



# **COSM 2018**

## **April 19-20, 2018**

**Gaylord National Resort & Convention Center  
National Harbor, MD**

*american-rhinologic.org*







Richard Orlandi, MD, FARS

## Presidential Welcome to the ARS at COSM 2018



It is my pleasure to welcome you to the 2018 American Rhinologic Society meeting at COSM. This meeting represents the latest installment in this year's world-class educational program schedule that the American Rhinologic Society offers to its membership. This year's Program Chair and President Elect, James Palmer, MD, has assembled another exciting and dynamic program that will feature leaders in our field discussing current topics and the latest developments in clinical Rhinology, along with updates on coding, the Rhinology Training Council, and the new ICAR Allergic Rhinitis document. The latest clinical and basic science research in Rhinology, Allergy, and Skull Base Surgery will be presented via the highest rated abstracts. I would like to thank and congratulate Dr. Palmer and the Program Committee for their hard work in developing a dynamic program. I would also like to congratulate and thank all the moderators, panelists, and presenters for their contributions, which will make this another hugely successful ARS meeting.

Thank you for being a member of the ARS and contributing to the growth and success of our society. For those of you that are not currently members, I encourage you to join. The benefits of ARS membership continue to expand, and include access to all the educational content of the ARS such as webcasts of previous meetings including Virtual Rhinology I through III and annual meetings, educational surgical videos, and patient and physician educational materials. Members also receive a subscription to the International Forum of Allergy and Rhinology (IFAR), the journal of the ARS. IFAR's expanded offerings now feature the "Scope it Out" podcasts and the new Case of the Month series. In addition, members of the ARS will receive free registration to the Summer Sinus Symposium. This year will be the 7th Summer Sinus Symposium and for the first time will be held in Seattle from July 12-14. The Summer Sinus Symposium provides great clinical content that is useful for all practitioners of Rhinology at every level. Membership information can be obtained on the ARS website, [american-rhinologic.org](http://american-rhinologic.org) or by speaking to one of the ARS staff. We look forward to welcoming you as a new member.

I would also like to acknowledge and thank all our corporate partners. Without their support this and all our meetings would not be possible. Please show your appreciation and support by taking the opportunity to visit with them in the exhibit hall and see the latest advances in technology and treatments.

I am honored and humbled to serve as president of this great society, and would like to thank the leadership, committee chairs and members, and staff for their hard work that makes the ARS such a vibrant and progressive society, and the worldwide leaders in Rhinologic care and education.

Welcome to the ARS at COSM—enjoy your time in National Harbor!

Richard R. Orlandi, MD, FARS  
*President, American Rhinologic Society*

## Welcome from the Program Chair



James Palmer, MD, FARS

Welcome to Washington D.C. for the American Rhinologic Society's Spring Meeting, part of the Combined Otolaryngology Spring Meetings (COSM). As your President-Elect, I'm honored to serve as the Program Chair for this 2018 meeting. This one and a half day conference will showcase the latest in Rhinologic and Skull Base discovery and innovation.

I'm confident that this year's Spring Meeting will provide all otolaryngologists interested in the field of Rhinology and Skull Base Surgery valuable content that will enhance our knowledge and will impact the care of our patients. If you happen to not be a member of the ARS, please join us to gain all of the advantages from membership that you can!

The Program Committee has reviewed over 200 abstract submissions for the meeting and we are very excited to share with you the very best of these competitive scientific presentations. We owe the Program Committee a huge debt of gratitude for their tireless work in ensuring the finest possible meeting content. Their names are listed below. Please join with me in thanking them for the fine work done on our behalf.

We are pleased to have over 70 oral abstract Podium presentations at this year's meeting – the most ever for an ARS COSM spring meeting. We intentionally have these abstract oral presentations as the core of our meeting. The top rated group of 13 have been placed on Thursday afternoon as a special highlight. Among the areas covered:

- basic science and clinical approaches to the pathophysiology of chronic rhinosinusitis,
- olfaction,
- role of microbes in rhinosinusitis,
- new and emerging treatments for rhinologic disease,
- skull base disease, and
- perspectives on pain control

In addition to these traditional areas of inquiry, we will hear from innovators who are examining how we learn and teach and investigators who are re-examining therapies we commonly employ in treating our patients.

A large number of high-quality posters will also provide rich and wide-ranging educational content. I encourage you to join with your colleagues on

Thursday night to view these posters and meet their authors during an evening reception.

Panels have been an important part of our past successful meetings. This year's panels will explore new knowledge, provide meaningful dialogue on controversial topics, share experience and wisdom, and put in context the latest advances in our field:

- How to Use the New Sinus Codes
- Women in Rhinology
- Regional variations in CRS
- ICAR Allergic Rhinitis
- Endoscopic Skull Base Challenges
- Residency Training Council

A special highlight is a Masters in Rhinology Lecture – "Basic Research in Rhinology: Perspectives from the Bedside and the Bench" by one of our own, Dr. Andrew Lane. Dr. Lane has been at the forefront of rhinologic research for almost two decades and has been a great leader, friend and colleague to all of us in the ARS. He will give highlights of his own NIH sponsored work and where we go to advance our specialty. The ARS Spring Meeting at COSM continues the exciting evolution of our society. I hope you will find it exceeds all of your expectations.

I look forward to seeing you at our meeting here in Washington, and later this year at our Summer Sinus Symposium in Seattle and our Fall Meeting in Atlanta!

*James Palmer, MD, FARS,  
Program Chair*

### ARS COSM 2018 Program Committee

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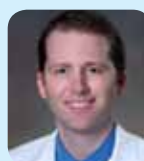
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## ARS Mission Statement

The American Rhinologic Society's mission is to serve, represent and advance the science and ethical practice of rhinology. The Society promotes excellence in patient care, research and education in Rhinology and Skull Base Disorders. The American Rhinologic Society is dedicated to providing communication and fellowship to the members of the Rhinologic community through on-going medical education, patient advocacy, and social programs. The ARS continuing medical education activities serve to improve professional competence, performance, and promote research.

## Business/ACCME

### Continuing Education

#### Accreditation Statement

American Rhinologic Society (ARS) is accredited by the Accreditation Council for **Continuing Medical Education** to provide **continuing medical education** for physicians.

#### Credit Designation Statement

ARS designates this live activity for a maximum of 10 *AMA PRA Category 1 Credit(s)*<sup>TM</sup>. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

## Learning Objectives from Practice Gaps

At the conclusion of this meeting participants will be able to:

1. Discuss the medical management of chronic rhinosinusitis (CRS) and appreciate advances in related basic science and translational research.
2. Gain an understanding of the advances in operative and in-office based procedures used in the management of conditions affecting the nose, sinuses and skull base.
3. Discuss the applications of new technologies in the treatment of sinus patients and demonstrate competence in their safe and effective use.

## How to obtain your CME certificate:

1. Go to ARS.  
*CmeCertificateOnline.com*
2. Click on the "ARS at COSM 2018" link
3. On the site, you will be asked to evaluate the overall conference. A certificate will be made available for you to print.

#### Questions? Email

*Certificate@AmedcoEmail.com*



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*\*As of 4/16/18*

# Women in Rhinology

is excited to announce our keynote speaker  
at COSM 2018



Sujana S.  
Chandrasekhar  
MD, FACS, FAAO-HNS  
Director  
New York Otology

## **Navigating the Labyrinth:**

### **How I Got From There to Here**

It's easy to look at people who've "achieved" from afar and imagine that a straight trajectory of success after success got them there. When I talk to people who have achieved some or great degrees of success, I find stories like mine: determination, setbacks, perseverance, tears and triumphs.

I will share my tales of the winding labyrinth, some turns with dead ends, some turns with danger, some turns with a helping hand. On the way, I've picked up some "pearls" and it is my privilege and honor to share them, and my story, with you.

# Podium/Oral Presentations *At-A-Glance*

## Thursday April 19, 2018

### PM Session

#### Maryland D

#### 1:00pm – 1:30pm

**How to Use the New Sinus Codes**  
Moderator: Seth Brown, MD, FARS  
Panelists: Peter Manes, MD, FARS,  
Trisha Crishock

#### TOP RATED ABSTRACTS

**Moderators: Spencer Payne, MD, FARS & Kevin Welch, MD, FARS**

#### 1:30pm – 1:38pm

**Budesonide Irrigation With Olfactory Training Significantly Increases Chances For Improvement In Patients With Olfactory Loss Over Olfactory Training Alone**  
Teresa Nguyen, BS  
Stanford, CA

#### 1:38pm – 1:46pm

**Productivity changes following medical and surgical treatment of chronic rhinosinusitis by symptom domain**  
Daniel Beswick, MD  
Portland, OR

#### 1:46pm – 1:54pm

**Glucocorticoid Receptor Isoform Expression In Peripheral Blood Mononuclear Leukocytes Of Patients With Chronic Rhinosinusitis**  
Robert Taylor, MD  
Charleston, SC

#### 1:54pm – 2:00pm

Q&A

**Moderators: Michael Kohanski, MD & Murray Ramanathan, MD**

#### 2:00pm – 2:08pm

**The Role Of Quinine-responsive T2rs In Airway Immune Defense And Chronic Rhinosinusitis**  
Alan Workman, BA  
Philadelphia, PA

#### 2:08pm – 2:16pm

**Red Ginseng Improves Markers Of Mucociliary Clearance And Reduces Pseudomonas Aeruginosa Biofilm Formation**  
Do-Yeon Cho, MD  
Birmingham, AL

#### 2:16pm – 2:24pm

**Nitric oxide releasing nanoparticles as a potent antimicrobial therapeutic against chronic rhinosinusitis bacterial isolates**  
Waleed Abuzeid, MD  
Bronx, NY

#### 2:24pm – 2:30pm

Discussion and Award Presentations

#### 2:30pm – 3:00pm

Break with Exhibitors

#### 3:00pm – 3:45pm

**Basic Research in Rhinology: Perspectives from the Bedside and the Bench**  
Andrew Lane, MD, FARS

#### 3:45pm – 3:50pm

Q&A

**Moderators: Stella Lee, MD & William Yao, MD**

#### 3:50pm – 3:58pm

**Solitary Chemosensory Cells Producing IL-25 And Group-2 Innate Lymphoid Cells Are Enriched In Chronic Rhinosinusitis With Nasal Polyps**  
Neil Patel, BS, BA  
Philadelphia, PA

#### 3:58pm – 4:06pm

**Highly Multiplexed Proteomic Analysis Reveals Significant Tissue And Exosomal Coagulation Pathway Derangement In Chronic Rhinosinusitis With Nasal Polyps**  
Sarina Mueller, MD  
Boston, MA

#### 4:06pm – 4:14pm

**Ivacaftor Reverses Airway Surface Liquid Depletion Caused By Pseudomonas Aeruginosa-induced Acquired Cftr Dysfunction In Rabbit Nasal Epithelia**  
Do-Yeon Cho, MD  
(Presented by Brad Woodworth, MD, FARS)  
Birmingham, AL

#### 4:14pm – 4:22pm

**Resveratrol And Ivacaftor Are Synergistic Cftr Channel Potentiators: Therapeutic Implications For Cf Sinus Disease**  
Do-Yeon Cho, MD  
(Presented by Jessica Grayson, MD)  
Birmingham, AL

#### 4:22pm-4:30pm

Q&A

**Moderators: Raymond Sacks, MD, FARS & Richard Lebowitz, MD**

#### 4:30pm – 4:38pm

**Exosome Swarming Mediates Innate Immunity In Nasal Mucosa Via No Associated Antimicrobial Activity And Passive Epithelial Immunoprotection**  
Angela Nocera, MS  
Boston, MA

#### 4:38pm – 4:46pm

**Total Intravenous Anesthesia Improves Intraoperative Visualization During Surgery For High-grade Chronic Rhinosinusitis: A Double-blind Randomized Controlled Trial**  
Jacob Brunner, MD  
New Orleans, LA

#### 4:46pm – 4:54pm

**Total intravenous anesthesia vs inhaled anesthetic for intraoperative visualization during endoscopic sinus surgery: a double blind randomized controlled trial**  
Michael Little, MD  
Edmonton, Alberta

#### 4:54pm – 5:00pm

Q&A and Adjour

**5:30pm – 7:00pm**  
Poster Presentation Reception  
Location: Prince George's Exhibit Hall A

**6:30pm – 8:00pm**  
ARS Welcome Reception  
Location: National Harbor 3

**Friday, April 20, 2018**  
**AM Session**  
**Scientific Room #1**  
**Maryland B 4-6**

*Moderators: Stephanie Joe, MD, FARS & Thomas Higgins, MD, FARS*

**8:00 am - 8:07am**  
Automated Classification Of Radiographic Osteomeatal Complex Inflammation Using Convolutional Neural Networks  
Naweed Chowdhury, MD  
Nashville, TN

**8:07am – 8:14am**  
Transorbital Neuroendoscopic Surgery Using The Superior Eyelid Approach – Trajectory Mapping And Outcomes  
Parth Shah, MD  
Chapel Hill, NC

**8:14am – 8:21am**  
Impact of high versus low risk genotype on sinonasal development and radiographic disease in cystic fibrosis  
Ashleigh Halderman, MD  
Dallas, TX

**8:21am – 8:28am**  
Sinus Surgery Is Associated With Less Frequent Antibiotic Use In Cystic Fibrosis Patients With Lung Transplant  
Tracy Cheng, AB  
Durham, NC

**8:28am – 8:32am**  
Q&A

*Moderators: Dana Crosby, MD & Anthony Del Signore, MD*

**8:32am – 8:39am**  
Relationship between specific atopic diseases and in-vitro allergen tests  
Kevin Grafmiller, MD  
Cleveland, Ohio

**8:39am – 8:46am**  
Association Between Allergic Rhinitis, Increased Sleep Latency And Obstructive Sleep Apnea In United States Adults  
Christopher Roxbury, MD  
Cleveland, OH

**8:46am – 8:53am**  
Understanding the propensity for chronic sinusitis in patients on immunosuppressive therapy  
Peter Papagiannopoulos, MD  
Chicago, IL

**8:53am – 9:00am**  
Comparison Of Outcomes Following The Use Of Culture-directed Versus Non-culture Directed Antibiotics In Treatment Of Chronic Rhinosinusitis  
Carol Yan, MD  
Stanford, CA

**9:00am – 9:07am**  
Efficacy Of Empiric Antimicrobial Prophylaxis After FESS  
Harrison Bartels, MD  
Charlottesville, VA

**9:07am – 9:15am**  
Q&A

**9:15am – 10:00am**  
Panel: Regional Variations in Chronic Rhinosinusitis  
Moderator: James Palmer, MD, FARS  
Panelists: Robert Kern, MD, FARS, Rodney Schlosser, MD, FARS, Martin Desrosiers, MD, Gretchen Oakley, MD, Alexander Chiu, MD, FARS

**10:00am – 10:30am**  
Break with Exhibitors

*Moderators: Andrew Goldberg, MD, FARS & Jivianne Lee, MD, FARS*

**10:30am – 10:37am**  
The sinonasal microbiota, neural signaling, and depression in chronic rhinosinusitis  
Michael Hoggard, BSc  
Auckland, NZ

**10:37am – 10:44am**  
Relative abundance of nasal microbiota in chronic rhinosinusitis by structured histopathology  
Hannah Kuhar, BA  
Chicago, IL

**10:44am – 10:51am**  
Analysis of the sinonasal microbiome in exacerbations of chronic rhinosinusitis subgroups  
Laura Vandelaar, MD  
Houston, TX

**10:51am – 10:58am**  
Predictive Measure Of Sellar Tumor Morphology For Transsphenoidal Surgery  
Andrew Heffernan, MD  
Norfolk, VA

**10:58am – 11:02am**  
Discussion

*Moderators: Jarrett Walsh, MD & Zachary Soler, MD*

**11:02am – 11:09am**  
Skills Transfer To Sinus Surgery Via A Low-cost Simulation-based Curriculum  
Richard Harbison, MD, MS  
Seattle, WA

**11:09am – 11:16am**  
Blinded Evaluation Of Endoscopic Skill And Instructability After Implementation Of An Endoscopic Simulation Experience  
Elizabeth Stephenson, BA  
Chapel Hill, NC

**11:16am – 11:23am**  
Double-blinded Randomized Controlled Trial To Evaluate A Novel Digital Platform To Improve Patient Satisfaction After Functional Endoscopic Sinus Surgery (FESS)  
Yue Ma, MD  
NYC, NY

**11:23am – 11:30am**  
Faculty attitudes towards rhinology training: a survey of rhinology fellowship programs  
Charles Riley, MD  
New York, NY

**11:30am – 11:32am**  
Discussion

*Moderators: Sammy Khalili, MD & Jordan Glicksman, MD*

**11:32am – 11:39am**  
Gender-related quality of life assessments in chronic rhinosinusitis  
Gretchen Oakley, MD  
Salt Lake City, UT

**11:39am – 11:46am**

Deviations From “Appropriateness Criteria” In The Management Of Chronic Rhinosinusitis And Effect On Outcomes

Andrew Thamboo, MD

(Presented by Zara Patel, MD, FARS)

Vancouver, BC

**11:46am – 11:53am**

Quality Indicators For The Management Of Chronic Rhinosinusitis

Justin Cottrell, MD

Toronto, Ontario

**11:53am – 12:00pm**

Analysis Of Absorbable Hemostatic Packing Compared To Physiologic Hemostasis In “Real World” Sinus Surgery

Brett Comer, MD

Lexington, KY

**12:00pm – 12:05pm**

Discussion

**12:05pm – 1:00pm**

Lunch with Exhibitors

## Friday, April 20, 2018

### AM Session

#### Scientific Room #2

#### Maryland D

*Moderators: Oswaldo Henriquez, MD & Monica Patadia, MD*

**8:00am – 8:07am**

A Multi-institutional Review Of Outcomes In Biopsy-proven Acute Invasive Fungal Sinusitis

Grace Wandell, MD, MS

Seattle, WA

**8:07am – 8:14am**

The Role Of Galactomannan Aspergillus Antigen In Diagnosing Acute Invasive Fungal Sinusitis

Clelie Melancon, MD

Winston Salem, NC

**8:14am – 8:21am**

Size Of Septectomy Does Not Affect Distribution Of Nasal Irrigation Following Endoscopic Modified Lothrop Procedure

Christopher Roxbury, MD

Cleveland, OH

**8:21am – 8:28am**

Draf lib With Superior Septectomy Vs Draf III: Comparison Of Irrigant Penetration

Vidur Bhalla, MD

Kansas City, KS

**8:28am – 8:32am**

Q&A

**8:32am – 9:04am**

Panel: ICAR: Allergic Rhinitis – What We Know and What We Don’t

Panelists: Sandra Lin, MD, FARS &

Elina Toskala, MD, FARS

*Moderators: Ian Humphreys, DO, FARS & Charles Ebert, MD, FARS*

**9:04am – 9:11am**

Activation of the Rat Olfactory Bulb by Direct Ventral Stimulation following Nerve Transection

Leandro Socolovsky, BS

Richmond, VA

**9:11am – 9:18am**

Establishing The Minimal Clinically Important Difference For The Questionnaire Of Olfactory Disorders

Jose Mattos, MD, MPH

Charlottesville, VA

**9:18am – 9:25am**

Olfactory Outcomes After Frontal Sinus Surgery And Stent Placement

Lauren Williams, BA

New York, NY

**9:25am – 9:32am**

Voxel Based Brain Perfusion Analysis For Olfactory Assessment In Patients With Dizziness And Dementia: Insights From Functional Spect Neuroimaging

Reza Nemati, MD

*Presented by Zaman Afrasiabi, MD, MSc Candidate*

Bushehr, Iran

**9:32am – 9:36am**

Q&A

*Moderators: Justin Turner, MD & Waleed Abuzeid, MD*

**9:36am – 9:43am**

Effects Of Sinupret On Mucociliary Clearance And Airway Surface Liquid Height Of Sinonasal Epithelial Cultures

Alan Workman, BA

Philadelphia, PA

**9:43am – 9:50am**

Ciliostimulatory Properties Of Broncho-vaxom® Soluble Components

Vasiliki Triantafillou, BS

Philadelphia, PA

**9:50am – 9:57am**

Cox-2 Overexpression In Schneiderian Papillomas

Kevin Hur, MD

Los Angeles, CA

**9:57am – 10:00am**

Q&A

**10:00am – 10:30am**

Break with Exhibitors

*Moderators: John Lee, MD & Troy Woodard, MD, FARS*

**10:30am – 10:37am**

The Benefits Of High Volume Pituitary Centers: An Analysis Of Socioeconomic And Morbidity Outcomes

Sean McKee, BS

New York, NY

**10:37am – 10:44am**

Nationwide Analysis Of Uplanned 30-day Readmissions After Transsphenoidal Pituitary Surgery

Zain Rizvi, MD

Los Angeles, CA

**10:44am – 10:51am**

Role of a laser sintered model to train endoscopic surgeons how to manage a catastrophic internal carotid artery injury.

Guillermo Maza, MD

Columbus, OH

**10:51am – 10:58am**

5-year outcomes of salvage endoscopic nasopharyngectomy for recurrent nasopharyngeal carcinoma

Andrew Thamboo, MD, MHS

Vancouver, BC

**10:58am – 11:05am**

Is There A Connection Between Endoscopic Endonasal Skull Base Surgery And Empty Nose Syndrome? A Pilot Cfd Study.

Guillermo Maza, MD  
Columbus, OH

**11:05am – 11:12am**

Impact Of Endoscopic Craniofacial Resection On Simulated Nasal Airflow And Heat Transport

Parth Shah, MD  
(Presented by Lauren Tracy, MD)  
Chapel Hill, NC

**11:12am – 11:15am**

Discussion

**11:15am – 12:00pm**

Panel: Endoscopic Skull Base Challenges

Moderator: Adam Zanation, MD  
Panelists: Nithin Adappa, MD, FARS, Brad Woodworth, MD, FARS, Dana Crosby, MD, Richard Harvey, MD, FARS

**12:00pm – 1:00pm**

Lunch with Exhibitors

## Friday, April 20, 2018

### PM Session

Maryland B 4-6

**Moderators: Erin O'Brien, MD, FARS & J. Pablo Stolovitzky, MD, FARS**

**1:00pm – 1:07pm**

The Price Of Pain In Chronic Rhinosinusitis

Kristine Smith, MD  
Salt Lake City, UT

**1:07pm – 1:14pm**

Postoperative Pain Management After Sinus Surgery: A Survey Of The American Rhinologic Society

Mingyang Gray, MD, MPH  
New York, NY

**1:14pm – 1:21pm**

Incidence and predictive factors for additional opiate prescription after endoscopic sinus surgery

Aria Jafari, MD  
San Diego, CA

**1:21pm – 1:28pm**

Predictive Value Of Baseline And Post-operative Snot-22 On Additional Opiate Prescriptions After Endoscopic Sinus Surgery

Sarek Shen, BS  
La Jolla, CA

**1:28pm – 1:32pm**

Q&A

**Moderators: Joshua Levy, MD & Charles Tong, MD**

**1:32pm – 1:39pm**

Early life risk factors for chronic sinusitis: a longitudinal birth cohort study

Eugene Chang, MD, FARS  
Tucson, AZ

**1:39pm – 1:46pm**

Impact Of Bitter Taste Phenotype Upon Clinical Presentation In Crs

Nicholas Rowan, MD  
Charleston, SC

**1:46pm – 1:53pm**

Mucus Th2 Biomarkers Predict Chronic Rhinosinusitis Disease Severity And Need For Revision Surgery

Justin Turner, MD PhD  
Nashville, TN

**1:53pm – 2:00pm**

Shortcomings In The Diagnosis Of Chronic Rhinosinusitis: Evaluating Accuracy By Otolaryngologists Versus Primary Care Physicians

Christopher Xiao, MD  
Oakland, CA

**2:00pm – 2:05pm**

Q&A

**2:05pm – 2:15pm**

Business Meeting

**Moderators: Edward Kuan, MD & Jose Gurrola, MD**

**2:15pm – 2:22pm**

Factors Associated With Revision Surgery After Balloon Sinuplasty

Matthew Cooper, MD

**2:22pm – 2:29pm**

Operative Time And Cost Variability In Endoscopic Sinus Surgery

Andrew Thomas, MD

**2:29pm – 2:36pm**

Randomized controlled trial comparing the laryngeal mask airway to use of an endotracheal tube in sinonasal surgery

Justin Turner, MD, PhD  
(Presented by Todd Wannemuehler, MD)

**2:39am – 2:46am**

The Endocannabinoid Receptor Cb2r Is Significantly Over-expressed In Aspirin Exacerbated Respiratory Disease

Joshua Levy, MD, MPH  
Atlanta, GA

**2:46pm – 2:53pm**

Alcohol-induced Respiratory Symptoms Improve After Aspirin Desensitization In Patients With Aspirin Exacerbated Respiratory Disease

Jordan Glicksman, MD, MPH  
Philadelphia, PA

**2:53pm – 3:00pm**

The presence of tissue eosinophil aggregates correlates with increased prednisone requirement after sinus surgery to control mucosal inflammation

Bobby Tajudeen, MD  
Chicago, IL

**3:00pm – 3:03pm**

Q&A

**3:03pm – 3:30pm**

Break with Exhibitors

**Moderators: Jonathan Ting, MD & Adam DeConde, MD**

**3:30pm – 3:37pm**

Cell culture alters the basal and progenitor cell populations of human sinonasal epithelium

Syed Khalil, MSPH, PhD  
Baltimore, MD

**3:37pm – 3:44pm**

Do mucin degrading microbes contribute to the pathogenesis of chronic rhinosinusitis?

Do-Yeon Cho, MD  
Birmingham, AL

**3:44pm – 3:51pm**

**Expression Of Iron-regulatory Hormone Hcpidin, And Iron Transporters Ferroportin And Zip8 In Sinus Mucosa Of Patients With And Without Chronic Rhinosinusitis**  
David Hsu, MD  
Los Angeles, CA

**3:51pm – 3:58pm**

**Nasal Transcriptome Analysis Reveals Nrf2 Pathway Associated Genes Are Down-regulated In Chronic Air Pollutant-induced Rhinosinusitis In Mice**  
Nyall London Jr, MD PhD  
Baltimore, MD

**3:58pm – 4:05pm**

**Fibroblast Wnt Signaling Influences Ciliary Differentiation In Chronic Rhinosinusitis With Nasal Polyps**  
Alex Dobzanski, BA  
Baltimore, MD

**4:05pm – 4:15pm**

**Q&A**

**4:15pm – 5:00pm**

**Panel: Residency Training Council**  
Moderator: David Poetker, MD, FARS  
Panelists: Michael Stewart, MD, FARS & Ara Chalian, MD

**Accreditation Statement**

*The American Rhinology Society (ARS) is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.*

**Credit Designation Statement**

*ARS designates this live activity for a maximum of 10.0 AMA PRA Category.*

# POSTERS

## #E001

**A Case Of Skull Base Erosion After Eight Years Of Frontal Sinus Stenting**  
Harry Ching, MD  
Las Vegas, NV

## #E002

**A Contemporary Qualitative Appraisal Of Otolaryngology-head & Neck Surgery Smartphone Applications**  
Julian Amin, MD  
Baltimore, MD

## #E003

**A Laterally-based Nasal Septal Mucosal Flap For Reconstruction Of The Anterior Frontal Table Following A Draf Iii Procedure: Initial Observations**  
Catherine Merna, MD  
Orange, CA

## #E004

**A Matched Pilot Cohort Study Of The Impact Of Zileuton On Aspirin-exacerbated Respiratory Disease**  
Saangyoung Lee, BS  
Chapel Hill, NC

## #E005

**Allergic fungal sinusitis imitating an aggressive skull base lesion in the setting of pembrolizumab immunotherapy**  
Natalie Krane, MD  
Portland, OR

## #E006

**Alterations in the sinonasal microbiome of patients with typical antibiotic therapy for acute rhinosinusitis**  
Brianna G. Smith, MD  
Tucson, AZ

## #E007

**Analysis Of A Cluster Of Acute Invasive Fungal Sinusitis Due To Hospital Maintenance**  
Tawfiq Khoury, MD  
Durham, NC

## #E008

**Baseline Patient Characteristics Predict Olfactory Outcomes After Frontal Sinus Surgery**  
Sarah Kidwai, MD  
New York, NY

## #E009

**Bilateral Inverted Papilloma Of The Frontal Sinus: A Case Report And Literature Review**  
Emily Johnson, DO  
Madison Heights, MI

## #E010

**Bilateral Nasal Mucormycosis, How We Managed It?**  
Evuru Rama gopal, MS(ENT)  
Guntur, Andhra Pradesh

## #E011

**Characteristics Of Young Adult Chronic Rhinosinusitis Patients Treated With Endoscopic Sinus Surgery**  
Amar Miglani, MD  
Phoenix, AZ

## #E012

**Clinical Implications Of Carcinoma In Situ In Inverted Papilloma**  
Ivy Maina, BA  
Philadelphia, PA

## #E013

**Clinical Outcomes Of Inverted Papilloma Management And Comparative Analysis Of Healthcare Utilization**  
Neil Patel, BS, BA  
Philadelphia, PA

## #E014

**Comparison between the sinus and gut microbiome in patients with chronic sinus disease**  
Sanjeev Balamohan, MD  
Gainesville, FL

## #E131

**Computational fluid dynamic modeling of maxillary sinus irrigation after maxillary antrostomy versus endoscopic medial maxillectomy**  
Zaahir Turfe, MD  
Kai Zhao, Ph.D  
James Palmer, MD  
John Craig, MD  
Detroit, MI

## #E015

**Correlations In Trends Of Sinusitis-related Online Google Search Queries In The United States**  
Dhruv Sharma, MD  
Indianapolis, IN

- #E016**  
**Cribriform Plate Width Is Highly Variable Within And Between Subjects**  
 Taylor Pence, BS  
 Richmond, VA
- #E017**  
**Dedifferentiated Acinic Cell Carcinoma In The Sinonasal Cavity: First Reported Case**  
 Varesh Patel, BA  
 Newark, NJ
- #E018**  
**Diagnosis And Management Of Nasal Pseudoaneurysms**  
 Daniel Faden, MD  
 Pittsburgh, PA
- #E019**  
**Diagnostic Criteria Of Recurrent Acute Rhinosinusitis (rars): A Systematic Review**  
 Thomas Higgins, MD, FARS  
 Louisville, Kentucky
- #E020**  
**Do You Use Cocaine? Decongestant Practices Of Canadian Otolaryngologists During Endoscopic Sinus Surgery**  
 Jonathan Reid, BSCh  
 LONDON, ON
- #E021**  
**Draf III And Single Layer Biomaterial Repair Of Frontal Sinus Encephalocele In A Pediatric Patient: First Reported Case in the Literature**  
 Brooke Su, MD, MPH  
 Los Angeles, California
- #E022**  
**Durability of improved healthy utility after frontal sinus surgery**  
 Ashton Lehmann, MD  
 Boston, MA
- #E023**  
**Eds-flu (exhalation Delivery System with Fluticasone) is Effective For Nasal Polyposis (np) Patients Either with or Without History of Prior Surgery: Integrated Results from Navigate I and II**  
 Joseph Han, MD, FARS  
 Norfolk, VA
- #E024**  
**Endoscopic And External Approaches For Orbital Decompression: An Analysis Of Trends From A Nationwide Perspective**  
 Peter Svider, MD  
 Detroit, MI
- #E025**  
**Endoscopic endonasal repair of a massive middle cranial fossa meningocele and cerebrospinal fluid leak**  
 Jenny Ma, BA  
 Philadelphia, PA
- #E026**  
**Endoscopic Endonasal Surgery For Sino-nasal Polyposis: General Versus Local Anesthesia.**  
 Ahmed El Batawi, MD  
 Giza, Outside U.S and Canada
- #E027**  
**Endoscopic Management Of Lateral Sphenoid Cerebrospinal Fluid Leaks: Creating A Surgical Algorithm**  
 Aaishah Raquib, MS  
 Boston, MA
- #E028**  
**Endoscopic Management Of The Orbital Tooth: Displaced Molars In The Maxillary Sinus Roof**  
 Jocelyn Kohn, MD  
 Boston, MA
- #E029**  
**Endoscopic Modified Medial Maxillectomy (emmm) For Orbital Floor Fractures**  
 Michiko Uchiyama, MD  
 Shibuya-ku, Tokyo
- #E030**  
**Endoscopic sinus surgery simulator to optimize surgical outcomes: a pilot study on conductive olfactory losses**  
 Chengyu Li, PhD  
 Columbus, Ohio
- #E031**  
**Endoscopic Transorbital Approach To The Infratemporal Fossa: A Cadaveric Study**  
 Devin Mistry, DO  
 Columbus, OH
- #E032**  
**Endoscopic transseptal approach with use of the vascular nasoseptal flap in transphenoidal pituitary adenoma surgery: preventing disease recurrence and reducing complications**  
 Taylor Burt, BS  
 Oklahoma City, Oklahoma
- #E033**  
**Epistaxis Health Disparities In The U.S. Pediatric Population**  
 Lindsay Yang, BA  
 Los Angeles, CA
- #E034**  
**Evaluating For Resolution Of Symptoms In Sinonasal Fibrous Dysplasia Based On Presentation And Management**  
 Aakanksha Rathor, MD  
 Stanford, CA
- #E035**  
**Evaluating the characteristics of central nasal polyposis**  
 Vidur Bhalla, MD  
 Kansas City, KS
- #E036**  
**Evaluation Of Intraoperative MRI For Endoscopic And Microscopic Transphenoidal Surgery**  
 Cyrus Rabbani, MD  
 Indianapolis, IN
- #E037**  
**Evidence Of Symptomatic And Radiographic Improvement Following Conjunctivodacryocystosinusotomy (cdcs) With Lacrimal Diversion Device (Ldd) Placement As A Novel Therapeutic Platform For Sinusitis**  
 Jayakar Nayak, MD, PhD  
 Stanford, CA
- #E038**  
**Evolution Of The Diagnosis And Management Of Allergy-mediated Disorders**  
 Khashayar Arianpour, BS  
 Rochester, MI
- #E039**  
**Examining The "July Effect" On Patients Undergoing Pituitary Surgery**  
 Shreya Patel, BS  
 Newark, NJ



#E040

**Exhalation Delivery System (eds) Provides Superior Deposition of Liquid in Post-surgical Cavities in Comparison to Conventional Spray or Irrigation Modalities**

Per Djupesland, MD, PhD  
701, Oslo

#E041

**Extent Of Skull Base Surgery As A Risk Stratifier For Surgical Complications In The Elderly**

Maheer Masood, BA  
Chapel Hill, North Carolina

#E042

**Feasibility Of Advanced Molecular Diagnostics For Sinonasal Specimens Compared To Standard Culture**

Michael Coulter, MD  
San Diego, CA

#E043

**Financial Implications Of Derivation From AAO-HNS Clinical Practice Guidelines For Adult Sinusitis**

Mark Gelpi, MD  
Cleveland, Ohio

#E044

**Follow-up Management Of Patients After Transsphenoidal Approach For Pituitary Adenoma Resection**

Allison Ikeda, BA  
Atlanta, GA

#E045

**Frontal Ostium Grade ( FOG ) - A New Classification System For A Safe Endoscopic Approach To The Frontal Sinus**

Heitham Gheriani, MB, ChB, MMsc, FRCSI  
Vancouver, BC

#E046

**Frontal sinus stent usage and safety: a systematic review**

Ahmed Hussein, MD  
Cairo, Cairo

#E047

**Gender Bias And Reporting In Basic Science/translational Rhinology Research**

Zainab Farzal, MD  
Chapel Hill, NC

#E048

**Gender Bias And Reporting: An Analysis Of Clinical Rhinology Research**

Elizabeth Stephenson, BA  
Chapel Hill, NC

#E049

**Health related quality of life is predictive of health utility in patients with nasal polyposis: Analysis of sinonasal outcomes test (SNOT-22) and SF-6DR2 in pooled randomized controlled trials with EDS-FLU**

Fulton Velez, MD  
Yardley, PA

#E050

**Immunologic Function In Adult Patients With Recurrent Acute Rhinosinusitis**

Christian Soneru, MD  
New York, NY

#E051

**Impact factor of using local steroid nasal spray in the prevention of recurrent nasal symptoms and adenoid regrowth after adenoidectomy**

Ahmed El Batawi, MD  
Giza, Outside U.S and Canada

#E052

**Impact of EDS-FLU On Work Productivity: Results from Two Phase III Trials, NAVIGATE 1 and 2**

Fulton Velez, MD  
Yardley, Pennsylvania

#E053

**Improving Efficiency In Epistaxis Management In A Large Health System: Analyzing Emergency Department Treatment Variability As Pretext For A Clinical Care Pathway**

Clare Richardson, MD  
Cleveland, OH

#E054

**Incidence of postoperative epistaxis after posterior septal branch injury during sphenoidotomy**

Joanna Kam, MD  
Detroit, MI

#E055

**Incorporation Of Antibiotics Into The Management Of Sinus Disorders: A Nationwide Perspective**

Khashayar Arianpour, BS  
Detroit, MI

#E056

**Increased Expression Of Bip/grp78 In Inverted Papilloma: An Immunohistochemical Study**

Houmeh Hojjat, MD  
Detroit, MI

#E057

**Indications For Endoscopic Sinus Surgery In The Geriatric Population**

Michael Marino, MD  
Phoenix, AZ

#E058

**Indications For Revision Endoscopic Sinus Surgery: A Systematic Review**

John Gettelfinger, MD  
Indianapolis, IN

#E059

**Intralesional bevacizumab for recurrent septal hemangioma**

Michael Kinzinger, MD  
Sacramento, CA

#E060

**Intraoperative Identification Of Internal Carotid Aneurysm During Transsphenoidal Pituitary Surgery**

Qasim Husain, MD  
New York, NY

#E061

**Intraseptal Fungal Ball After Septoplasty: An Unusual Cause Of Epistaxis**

Keven Ji, BA  
Durham, NC

#E062

**Introduction Of Topical Irrigants To Post-surgical Frontal Sinuses Using Mygind Positioning: Evaluation Of Delivery Patterns Using Contrast And Colorimetric Methods**

Jonathan Overvest, MD, PhD  
Stanford, CA

#E063

**Lack Of Sphenoid Pneumatization Does Not Affect Endoscopic Endonasal Pediatric Skull Base Surgery Outcomes**

Adam Kaufman, MD, PhD  
Philadelphia, PA

#E064

**Levels Of Evidence In Rhinology-Skull Base Surgery Research**Jennifer Silver  
Montreal, Quebec

#E065

**Long-term complication rates following septoplasty with inferior turbinate reduction: a modern look at an old procedure**Rina Joshi, MS  
New York, NY

#E066

**Management of chronic frontal sinusitis using the axillary flap approach**Ayman Megahed, MD  
Giza, Giza

#E067

**Management Of Epidermal Inclusion Cyst Within The Frontal Bone**Tran Le, MD  
Kansas City, KS

#E068

**Minimally Invasive Transorbital Approaches To The Anterior Skull Base: A 6-Year Update**Andrew Lee, MD  
Baltimore, MD

#E069

**Mobile Applications For Allergic Rhinitis**Albert Zhou, BS  
Newark, NJ

#E070

**Modulators of rhinovirus incidence and severity**Eugene Chang, MD, FARS  
Tucson, AZ

#E071

**Multicenter experience with acute invasive fungal sinusitis**Katherine Lees, MD  
Rochester, MN

#E072

**Multiple Bioabsorbable Corticosteroid-eluting Stent Placement With Associated Skull Base Injury – Too Much Of A Good Thing?**Dennis Tang, MD  
Cleveland, OH

#E073

**Myhre-laps Syndrome - A Case Report**Joseph Degruy, MD-Student  
Jackson, MS

#E074

**Nasal Manifestations Of Crohn's Disease: Literature Review And Case Report Of Nasal Septal Perforation**Christine Kim, MD  
Albany, New York

#E075

**Nasal myiasis in a patient with hemorrhagic shock from acute gastrointestinal bleeding**Matthew Kim, MD  
Bronx, NY

#E076

**Neutrophil Activation Pathway Is Suppressed In Human Nasal Polyps**Dawei Wu, MD  
Cambridge, Massachusetts

#E077

**Olfactory Neuroblastoma: The Suny Upstate Medical University Experience 1980-2016**Mark Arnold, MD  
Syracuse, NY

#E078

**Open Versus Endoscopic Approach For Sinonasal Melanoma: A Systematic Review And Meta-analysis**Kevin Hur, MD  
Los Angeles, CA

#E079

**Opioid Prescription Among Sinus Surgeons**Peter Svider, MD  
Detroit, MI

#E080

**Oropharyngeal squamous cell carcinoma with distant metastasis to clivus**Jose Ting, BS  
Houston, TX

#E081

**Outcomes And Complications Of Endoscopic Sinus Surgery Based On Age**Carol Yan, MD  
Stanford, CA

#E082

**Outcomes Of Endoscopic Surgical Treatment Of Sinonasal Hemangiopericytoma**Vasiliki Triantafillou, BS  
Philadelphia, PA

#E083

**Patient Satisfaction In A Multidisciplinary Rhinology And Allergy/immunology Clinic**Christina Fang, MD  
Bronx, NY

#E084

**Perioperative Analgesia For Patients Undergoing Endoscopic Sinus And Skull Base Surgery: An Evidence-based Review With Recommendations**Brandon Nguyen, BS  
Detroit, MI

#E085

**Physician variation in debridements after endoscopic sinus surgery**Caleb Fan, MD  
New York, NY

#E086

**Post-traumatic Organized Maxillary Sinus Hematoma Causing Proptosis In A Patient With Von Willebrand Disease**Levi Stevens, MD  
Morgantown, West Virginia

#E087

**Povidone-iodine: A Novel Treatment Option For Pilonidal Cyst**Warren Jennings, MD, FRCSC, FARS  
Vancouver, BC

#E088

**Primitive Neuroectodermal Tumors (pnet) Of The Nose: A Case Report And A Literature Review**Ahmed Hussein, MD  
Cairo, Cairo

#E089

**Rapid progression of odontogenic sinusitis leading to fulminant orbital infection**Brooke Su, MD, MPH  
Los Angeles, California

WITHDRAWN

#E090

**Recurrence Of Skull Base Lesions Attributed To Tumor Seeding: A Systematic Review Of The Literature**  
Michael Blasco, MD  
Detroit, MI

#E091

**Reliability Of The Supraorbital Ethmoid Cell Versus Keros Classification In Predicting The Course Of The Anterior Ethmoid Artery**  
Mingsi Li, MD  
Augusta, GA

#E092

**Replication Study Of Patient-specific Factors That Correlate With The Average Number Of Post-operative Sinonasal Debridements**  
Auddie Sweis, MD  
Chicago, IL

#E093

**Rhinotillexomania In The Cystic Fibrosis Patient Population- A Review Of The Literature**  
Mark Gelpi, MD  
Cleveland, Ohio

#E094

**Septoplasty And Rhinoplasty In The Pediatric Population: Epidemiology Using A Population Based Approach**  
Nour Bundogji, BA  
San Diego, CA

#E095

**Septoplasty With Inferior Turbinectomy, In-patient Or Out-patient?**  
Yung Yuan Chen, MD  
Taipei, Taiwan

#E096

**Severe refractory epistaxis in patient with a left ventricular assist device: a case report**  
Bharat Panuganti, MD  
San Diego, CA

#E097

**Should endoscopic technique be considered the preferred approach for pediatric septoplasty?**  
Jordan Teitelbaum, DO  
Columbus, OH

#E098

**Silent Sinus Syndrome Masquerading As Recurrent Graves' Orbitopathy**  
Jenna Devare, MD  
Ann Arbor, MI

#E099

**Silent Sinus Syndrome With Lateralized Middle Turbinates: A Case Report**  
Tom Zhou, MD  
Columbus, OH

#E100

**Silent Sinus Syndrome: 5% Criteria**  
Ronald Nowak, MS  
Columbus, Ohio

#E101

**Sinonasal Disease In Total Laryngectomy Patients**  
Vijay Patel, MD  
Hershey, PA

#E102

**Sinonasal Inflammation In Inverted Papilloma**  
Michael Kohanski, MD, PhD  
Philadelphia, PA

#E103

**Sinonasal quality of life and radiographic outcomes following endoscopic skull base surgery with nasoseptal flap reconstruction**  
Charles Riley, MD  
New York, NY

#E104

**Sinonasal Tract Mucoepidermoid Carcinoma: A Review Of The National Cancer Database**  
Neil Patel, BA BS  
Philadelphia, PA

#E105

**Sinus Surgery Online Information: A Systematic Analysis Of The Website And Videos That Our Patients See**  
Michael Nissan, B.S.  
Detroit, MI

#E106

**Skull base osteomyelitis secondary to pediatric radium exposure**  
Daniel Spielman, MD  
New York, NY

#E107

**Spindle Cell Lipomas Of The Respiratory Tract – Case Report And Literature Review.**  
Jonathan Reid, BSCh  
LONDON, ON

#E108

**Spontaneous CSF Otorrhea And Pneumocephalus From Multiple Skull Base Defects: Case Report And Literature Review**  
Oliver Gantz, MD  
Los Angeles, CA

#E109

**Stab wounds affecting the anterior skull base: trajectory analysis as a means of directing clinical decision-making**  
Tiffany Peng, MD  
New York, NY

#E110

**Sublabial Approach To Excision Of Paranasal Kimora Disease**  
Ryan Stephenson, MD  
Los Angeles, CA

#E111

**Technology and experience in functional endoscopic sinus surgery: role in surgical timing and complications management.**  
Stefano Millarelli, MD  
Rome, Lazio

#E112

**Telementoring In Endoscopic Sinus Surgery: A Feasibility Trial**  
Elizabeth Zambricki, MD  
Palo Alto, CA

#E113

**The association between symptom severity and quality of life in patients with chronic rhinosinusitis and cystic fibrosis**  
Eric Barbarite, MD  
Boston, MA

#E114

**The Effect Of Anti-il-5 Antibody Therapy On Chronic Sinusitis And Eosinophilic Otitis Media**  
Wakako Nakanishi, MD  
Shibuya-ku, Tokyo

#E115

**The Effect Of Mucosal Grafts On Rates Of Restenosis And Revision Surgery Following Draf III Procedures**

Sean McKee, BS  
New York, New York

#E116

**The Endoscopic Trans-pterygoid Approach To The Lateral Sphenoid Recess: A Review Of The Literature**

Brian Song, MD  
Tucson, AZ

#E117

**The Endoscopic Transpterygoid Versus Endoscopic Transorbital Approach To Meckel's Cave: A Comparison Of Surgical Freedom**

Devin Mistry, DO  
Columbus, OH

#E118

**The histopathologic features of chronic sinusitis precipitated by odontogenic infection**

Peter Papagiannopoulos, MD  
Chicago, IL

#E119

**The Impact Of Video Nasal Endoscopy On Patient Satisfaction**

Vidur Bhalla, MD  
Kansas City, KS

#E120

**The Prognosis Of Appropriately Managed Chronic Rhinosinusitis With Nasal Polyposis And Its Relation To Preoperative Eosinophil/basophil Levels**

Fahad Alasousi, MD  
Al-Farwaniyah, Al-Farwaniyah

#E121

**Topical Nasal Therapy In Hereditary Hemorrhagic Telangiectasia**

Jessica Clark, MD, MSc  
Edmonton, Alberta

#E122

**Unique Clinical And Prognostic Behavior Of Patients Diagnosed With Exophytic And Inverted Papillomas**

Apoorva Ramaswamy, MD  
New York, NY

#E123

**Unusual Anatomic Locations Of Inverted Papilloma: Management And Outcomes**

Vasiliki Triantafillou, BS  
Philadelphia, PA

#E124

**Utilization Of Prophylactic Antibiotics After Nasal Packing For Epistaxis**

Lizbeth Hu, BA  
New York, NY

#E125

**Vascular Endothelial Growth Factor Expression In Inverted Papilloma**

Kevin Hur, MD  
Los Angeles, CA

#E126

**Virtual Reality FESS With 3d-printed Instruments For High-fidelity Simulation**

Samuel Barber, MD  
Tucson, AZ

#E127

**When Is A Transoral Approach Necessary For Accessing Clivus And Craniocervical Junction Pathology?**

Edward Kuan, MD  
Philadelphia, Pennsylvania

#E128

**Yellow Nail Syndrome: Rhinologic Manifestations, Case Series And Review Of The Literature**

William Thomas, MD  
Philadelphia, PA

#E129

**Zoonotic Staphylococcus Pseudintermedius Sinonasal Infections: Risk Factors And Resistance Patterns**

Arman Danielian, MS  
Los Angeles, CA

# Oral Presentations

Thursday, April 19, 2018

PM Session

Maryland D

1:00pm

**Panel: How to Use the New Sinus Codes**

Moderator: Seth Brown, MD, FARS

Panelists: Peter Manes, MD, FARS, Trisha Crishock

## TOP RATED ABSTRACTS

**Moderators: Spencer Payne, MD, FARS & Kevin Welch, MD, FARS**

1:30pm

**Budesonide irrigation with olfactory training significantly increases chances for improvement in patients with olfactory loss over olfactory training alone**

Teresa P. Nguyen, BS

Zara M. Patel, MD, FARS

Stanford, CA

Introduction:

Olfactory training (OT) is a viable option for treating patients with olfactory loss, but unfortunately a significant percentage of patients remain without functioning sense of smell despite this therapy. Budesonide irrigations have been used widely to help patients with paranasal sinus inflammation. We sought to examine the effect of budesonide irrigation on patients with olfactory loss without any visible sign of sinonasal inflammation.

Methods:

Randomized controlled trial. After excluding patients with sinusitis, rhinitis, and sinonasal tumors, patients with anosmia were further filtered with peak nasal inspiratory flow (PNIF) and excluded if presentation <6 months from onset. Patients were randomized to either OT with saline irrigations or OT with budesonide irrigations. The UPSIT was used at the beginning of the study and at 6 months. Univariate and multivariate statistical analyses were utilized.

Results:

138 patients were enrolled, with 133 completing the study. The two groups were not significantly different at baseline across any demographic, etiology, or smoking status variables. On univariate analysis, budesonide irrigation + OT showed significant improvement over saline irrigations + OT ( $p=0.0394$ ), with age and duration of loss also significant factors ( $p < 0.0001$  for both). On multivariate analysis, patients who received budesonide irrigation had an increase in odds of clinically significant change, with a fully adjusted odds ratio (OR) of 3.926 (95% confidence interval [CI], 1.20-12.88;  $P = 0.0200$ ).

Conclusions:

Budesonide irrigation used along with OT is significantly associated with increased odds of having clinically signif-

icant improvement in olfactory ability compared with OT and saline irrigation alone.

1:38pm

**Productivity changes following medical and surgical treatment of chronic rhinosinusitis by symptom domain**

Daniel M. Beswick, MD

Luke R. Rudmik, MD, MSc, FARS

Jess C. Mace, MPH

Zachary M. Soler, MD, MSc

Adam S. DeConde, MD

Timothy L. Smith, MD, MPH, FARS

Portland, OR

Introduction:

Refractory chronic rhinosinusitis (CRS) is associated with substantial productivity losses. Prior study has identified risk factors and symptom subdomains contributing to baseline productivity loss. This study evaluates associations between post-treatment changes in symptom subdomain and productivity loss.

Methods:

Adult patients with CRS were prospectively enrolled into a multi-institutional cohort study between August 2012 and June 2015. Respondents provided pre-treatment and post-treatment SinoNasal Outcomes Test (SNOT-22) scores. Productivity losses were monetized using measures of absenteeism, presenteeism, lost leisure time, and United States government-estimated wage and labor rates.

Results:

202 patients met inclusion criteria, 39(19%) electing continued appropriate medical therapy (CAMT) and 163(81%) electing endoscopic sinus surgery (ESS). CAMT patients experienced improvement in SNOT-22 total and rhinologic subdomain scores (both  $p < 0.039$ ). ESS patients experienced improvements in SNOT-22 total scores and all subdomains ( $p < 0.001$ ). Average monetized productivity losses were nearly unchanged following CAMT ( $-\$200$ ,  $p=0.887$ ) but significantly reduced following ESS ( $-\$5,015$ ,  $p < 0.001$ ). Larger productivity losses were found in CAMT patients reporting worse post-treatment extra-rhinologic, psychological, and sleep symptom severity scores. No such differences in productivity losses were seen in patients electing ESS.

Conclusions:

Patients electing ESS experienced a considerable improvement in productivity postoperatively that is distributed across all SNOT-22 domains, suggesting productivity improvements associate with multiple symptom domains. Patients electing CAMT did not experience meaningful improvements in productivity following treatment, and greater productivity loss occurred in patients with worse scores in the extra-rhinologic, psychological, and sleep subdomains. Selection of surgical or medical therapy correlates with different post-treatment productivity changes.

**1:46pm****Glucocorticoid receptor isoform expression in peripheral blood mononuclear leukocytes of patients with chronic rhinosinusitis**

Robert J. Taylor, MD  
 Rodney J. Schlosser, MD, FARS  
 Zachary M. Soler, MD  
 Jose L. Mattos, MD  
 Jennifer K. Mulligan, PhD  
 Charleston, SC

**Background:**

In several inflammatory disorders, altered peripheral blood mononuclear leukocyte (PBML) glucocorticoid (GC) receptor isoform expression has been associated with GC resistance and disease severity. However, it is unclear if PBML GC receptor isoforms are expressed differentially and are associated with worsened disease severity in chronic rhinosinusitis (CRS).

**METHODS:** PBMLs were isolated from control (n = 8), CRS without nasal polyps (CRSsNP) (n = 8), atopic CRS with nasal polyps (CRSwNP) (n = 8), non-atopic CRSwNP (n = 8), and allergic fungal rhinosinusitis (AFRS) (n = 8) patients. Demographics, atopic status, asthmatic status, Sino-Nasal Outcomes Test (SNOT)-22 scores, Lund-Kennedy nasal endoscopy scores, Lund-Mackay sinus CT scores, Kennedy Osteitis scores, and GC utilization 6 months postoperatively were collected. Intracellular immunostaining was then performed for functional GC receptor  $\alpha$  (GCR $\alpha$ ) and non-functional GC receptor  $\beta$  (GCR $\beta$ ), followed by flow cytometry analysis of geometric mean fluorescent intensity (MFI) and the percent of cells expressing each GC receptor isoform.

**Results:**

Compared to controls, each CRS subtype had decreased PBML GCR $\alpha$  and GCR $\alpha$ :GCR $\beta$  MFI expression, but no difference in GCR $\beta$  expression. Decreasing PBML GCR $\alpha$  in AFRS was associated with increasing Lund-Mackay sinus CT scores ( $r = -0.880$ ,  $p = 0.004$ ). No significant associations were found between GC receptor isoform expression and other clinical measures.

**Conclusions:**

CRS patients have reduced functional PBML GCR $\alpha$  expression and decreased GCR $\alpha$ :GCR $\beta$  compared to controls. Reductions in GCR $\alpha$  in AFRS are associated with worsening Lund-Mackay sinus CT scores. The clinical implications of decreased functional GC receptor expression merits further investigation.

**1:54 pm****Q&A**

**Moderators: Michael Kohanski, MD & Murray Ramanathan, MD, FARS**

**2:00pm****The role of quinine-responsive T2rs in airway immune defense and chronic rhinosinusitis**

Alan D. Workman, BA  
 Ivy W. Maina, BS  
 David W. Kennedy, MD, FARS  
 James N. Palmer, MD, FARS  
 Nithin D. Adappa, MD, FARS  
 Noam A. Cohen, MD, PhD, FARS  
 Philadelphia, PA

**Background:**

Bitter (T2R) and sweet (T1R) taste receptors in the airway are important in innate immune defense, and variations in taste receptor functionality in one T2R (T2R38) correlate with disease status and disease severity in chronic rhinosinusitis (CRS). Quinine is a bitter compound that is an agonist for several T2Rs, but not T2R38. Because of this property, quinine may stimulate innate immune defense mechanisms in the airway, and functional differences in quinine perception may be reflective of disease status in CRS.

**Methods:**

Demographic and taste intensity data were collected prospectively from CRS patients and non-CRS controls. Sinonasal tissue from patients undergoing rhinologic surgery was also collected and grown at an air-liquid interface (ALI). Nitric oxide (NO) production and dynamic regulation of ciliary beat frequency in response to quinine stimulation were assessed.

**Results:**

Quinine reliably increased ciliary beat frequency and NO production in ALI cultures in a manner consistent with T2R activation ( $p < 0.01$ ). Quinine taste intensity rating was performed in 328 CRS patients and 287 control subjects demonstrating that CRS with nasal polyps (CRSwNP) patients rated quinine as significantly less intense than did control subjects.

**Conclusions:**

Quinine stimulates airway innate immune defenses by increasing ciliary beat frequency and stimulating NO production in a manner fitting with T2R activation. Patient variability in quinine sensitivity is observed in taste intensity ratings, and gustatory quinine "insensitivity" is associated with CRSwNP status. Thus, taste tests for quinine may be a biomarker for CRSwNP and topical quinine has therapeutic potential as a stimulant of innate defenses.

**2:08pm****Red ginseng improves markers of mucociliary clearance and reduces pseudomonas aeruginosa biofilm formation**

Do-Yeon Cho, MD  
 Dong Jin Lim, PhD  
 Daniel Skinner, BS  
 Shaoyan Zhang, PhD  
 Jessica W. Grayson, MD  
 Bradford A. Woodworth, MD, FARS  
 Birmingham, AL

**Background:**

Abnormal chloride (Cl<sup>-</sup>) transport has a detrimental impact on mucociliary clearance (MCC) in both cystic fibrosis (CF) and non-CF chronic rhinosinusitis (CRS). Ginseng is a medicinal plant noted to have a number of anti-inflammatory properties. The objectives of the present study are to assess the capability of red ginseng aqueous extract (RGAE) to promote transepithelial Cl<sup>-</sup> secretion in nasal epithelium and to inhibit *P. aeruginosa* biofilm formation.

**Methods:**

Wild type (WT) and transgenic CFTR<sup>-/-</sup> primary murine nasal septal epithelial (MNSE) cultures were pharmacologically manipulated in Ussing chambers to measure the impact of RGAE on vectorial Cl<sup>-</sup> secretion. Effects on ciliary beat frequency (CBF) were also measured. Biofilm formation of the PAO1 strain of *P. aeruginosa* incubated with and without RGAE was quantified by crystal violet staining.

**Results:**

RGAE (at 200 µg/ml Ginsenosides) significantly increased Cl<sup>-</sup> transport [measured as change in short-circuit current (ISC = µA/cm<sup>2</sup>)] when compared to vehicle control in WT MNSE (35.1±3.1 vs 0.1±0.2, p < 0.05) and CFTR<sup>-/-</sup> MNSE (32.6±2.0 vs 0.2±0.3, p < 0.05) indicating effects are independent of CFTR. CBF (fold-change/baseline) was significantly increased compared to control in WT MNSE (2.05±0.2 vs 1.25±0.0, respectively p < 0.05). RGAE markedly reduced PAO1 biofilm formation compared to controls (optical density at 590nm = 0.18±0.03 vs 0.28±0.02, p < 0.001).

**Conclusion:**

RGAE activates transepithelial Cl<sup>-</sup> secretion, while inhibiting PAO1 biofilm formation. These findings suggest RGAE has therapeutic potential for both CF and non-CF CRS with *P. aeruginosa*. Further in vivo studies are planned.

**2:16pm****Nitric oxide releasing nanoparticles as a potent antimicrobial therapeutic against chronic rhinosinusitis bacterial isolates**

Waleed M. Abuzeid, MD  
 Girish V. Mavelli, PhD  
 Judd H. Fastenberg, MD  
 Marvin P. Fried, MD, FARS  
 Joshua D. Nosanchuk, MD  
 Joel M. Friedman, MD, PhD  
 Bronx, NY

**Introduction:**

Bacterial biofilms may be implicated in the pathogenesis of chronic rhinosinusitis (CRS) and enhance antibiotic resistance. Nitric oxide (NO) is a gaseous immunomodulator with antimicrobial activity and a short half-life, complicating achievement of therapeutic concentrations. We hypothesize that a novel nanoparticle-based delivery platform, which allows for adjustable release of NO, will exhibit potent antibacterial effects.

**Methods:**

Porous organosilica nanoparticles (SNO-NP) containing nitrosylated thiol groups were formulated. Dissociation of the nitrosothiol groups generates NO at body temperature. The susceptibility of bacterial isolates from CRS patients to SNO-NP was evaluated through a colony forming unit (CFU) assay. Serial dilutions of SNO-NP were incubated with isolates in suspension for 6 hours followed by triplicate plating on tryptic soy agar and overnight incubation followed by CFU quantification. Statistical analysis was performed with SPSS using one-way ANOVA with Bonferroni correction.

**Results:**

SNO-NP displayed antibacterial activity against gram-positive (Methicillin-resistant and sensitive *S. aureus*) and gram-negative (*P. aeruginosa*, *E. aerogenes*, and *P. mirabilis*) isolates. SNO-NP induced dose-dependent reductions in CFU across all strains. Compared to controls and blank nanoparticles, SNO-NP (10 mg/mL) induced a 99.99% to 100% reduction in CFU across all isolates, equivalent to a 5 to 9 log kill (p<0.005). There was no statistically significant difference in CFU concentration between controls and blank nanoparticles.

**Conclusions:**

SNO-NP, which has been shown to be safe in a murine model and has been developed into an aerosolized form, demonstrates potent bactericidal effect against antibiotic-resistant CRS bacterial strains.

**2:24pm****Discussion and Award Presentations****2:30pm****Break with Exhibitors**

**3:00pm****Basic Research in Rhinology: Perspectives from the Bedside and the Bench**

Andrew Lane, MD, FARS

**3:45pm**

Q&amp;A

**Moderators: Stella Lee, MD & William Yao, MD****3:50pm****Solitary chemosensory cells producing IL-25 and group-2 innate lymphoid cells are enriched in chronic rhinosinusitis with nasal polyps**

Neil N. Patel, BA, BS

Michael A. Kohanski, MD, PhD

Li-Yin Hung, PhD

James N. Palmer, MD, FARS

De'Broski R. Herbert, PhD

Noam A. Cohen, MD, PhD

Philadelphia, PA

**Introduction:**

Chronic rhinosinusitis with nasal polyps (CRSwNP) is characterized by type-2 inflammation. It is established that group-2 innate lymphoid cells (ILC2s) are a subset of immune cells important in orchestrating mucosal type-2 response. IL-25 is an epithelial-derived cytokine that is a critical activator of ILC2s. Recent evidence demonstrates that rare taste epithelial cells, solitary chemosensory cells (SCCs), produce IL-25. Although SCCs are known to modulate innate sinonasal defense through taste-receptor-mediated antimicrobial peptide release, their role in type-2 inflammation is unknown. To elucidate the relationship between SCCs and ILC2s in CRSwNP, we sought to quantify ILC2s and SCCs to determine if these cell types are enriched in nasal polyps compared to healthy sinonasal mucosa.

**Methods:**

We quantified SCCs and ILC2s using multicolor flow cytometry. Single-cell suspensions were created from human nasal polyps and healthy middle turbinates (preliminary n=4). Samples contained >1.2 million live cells and were stained with antibody panels marking SCCs (EpCAM+CD45-GNAT3+DCLK1+IL-25+) and ILC2s (CD45+Lineage1-GATA3+KLRG1+). Kruskal-Wallis test compared pairwise cell population frequencies ( $\alpha < 0.05$ ).

**Results:**

Nasal polyps demonstrated higher populations of both SCCs (32.78% vs. 5.093%,  $p=0.021$ ) and ILC2s (1.24% vs. 0.245%,  $p=0.043$ ) compared to patient-matched controls. Mean fluorescence intensity of IL-25 in SCC subpopulations was higher in nasal polyps compared to controls.

**Conclusion:**

Nasal polyps contain higher populations of SCCs and ILC2s, and the polyp SCCs contain higher levels of IL-25. While the molecular mechanism linking SCCs to ILC2s remains to be elucidated, these data support SCC expansion and increased IL-25 production as early events in the pathogenesis of CRSwNP.

**3:58pm****Highly multiplexed proteomic analysis reveals significant tissue and exosomal coagulation pathway derangement in chronic rhinosinusitis with nasal polyps**

Sarina K. Mueller, MD

Angela L. Nocera, MS

Simon T. Dillon, PhD

Towia A. Libermann, PhD

Benjamin S. Bleier, MD, FARS

Boston, MA

**Introduction:**

The coagulation pathway has been previously implicated in the etiopathogenesis of chronic rhinosinusitis with nasal polyps (CRSwNP) through analysis of individual proteins within the cascade. The purpose of this study was to 1) Apply a large scale proteomic approach to explore these previous findings and 2) Correlate the protein aberrations between tissue and exosomes to identify novel non-invasive exosomal biomarkers for CRSwNP.

**Methods:**

IRB approved study in which matched tissue and mucus exosomal proteomes were compared between control and CRSwNP (n=10/group) using an aptamer based proteomic array. Protein expression and the correlation between samples were calculated using Student's t-test and Benjamini Hochberg procedures followed by the application of Ingenuity Pathway, MetaCore, and Genemania bioinformatics analyses.

**Results:**

Among all protein pathways, the coagulation cascade was the most significantly associated with CRSwNP ( $p=2.85e-8$ ). Among the 13 significantly altered coagulation related tissue proteins, Fibronectin and Fibrinogen gamma chain were the most overexpressed in CRSwNP relative to control (Fold change(FC) 2.59,  $p=0.006$ ; FC 2.38,  $p<0.001$ ; respectively) while von Willebrand Factor was the most underexpressed (FC-3.06,  $p < 0.001$ ). The aggregate correlation significance between the tissue and exosomal coagulation related proteome was  $5.19e-8$ .

**Conclusion:**

Our proteomic analysis confirmed that the coagulation pathway is highly significantly deranged within nasal polyp tissue. The correlation between tissue and mucus derived exosomal coagulation protein alterations was highly significant. This lends further support to the emerging concept of exosomal proteomic analysis as both a method to study chronic sinonasal inflammation as well as to establish non-invasive biomarkers of CRSwNP.



**4:06pm****Ivacaftor reverses airway surface liquid depletion caused by pseudomonas aeruginosa-induced acquired cftr dysfunction in rabbit nasal epithelia**

Do-Yeon Cho, MD

Presented by Brad Woodworth, MD, FARS

Jessica W. Grayson, MD

Shaoyan Zhang, PhD

Daniel Skinner, BS

Calvin S. Mackey, BS

Birmingham, AL

**Objectives:**

Abnormal chloride (Cl<sup>-</sup>) transport dehydrates airway surface liquid (ASL) in sinonasal epithelium leading to mucus stasis and chronic rhinosinusitis (CRS). As an experimental epithelium, rabbit tissue provides an excellent representation of human sinus disease, and the rabbit sinusitis model is established and well suited for therapeutic interventions in vivo. The objective of this study is to evaluate whether ivacaftor reverses the consequences of *P. aeruginosa*-induced acquired CFTR dysfunction.

**Methods:**

Rabbit nasal epithelia (RNE) cultures were incubated with an ultrafiltrate of *P. aeruginosa* (PAO1 strain) for 4 hours and tested for acquired CFTR dysfunction. Transepithelial Cl<sup>-</sup> transport in RNE was evaluated for responsiveness to ivacaftor in vitro (Ussing chamber) and in vivo (nasal potential difference assay). Airway surface liquid depth was measured by micro-optical coherence tomography ( $\mu$ OCT).

**Results:**

A 50% reduction in CFTR-mediated Cl<sup>-</sup> transport (change in short-circuit current,  $I_{SC} = \mu A/cm^2$ ) was detected following PAO1 exposure (PAO1,  $50.8 \pm 4.9$  vs. control,  $101.8 \pm 0.3$ ,  $p < 0.001$ ). RNE exhibited a robust response to ivacaftor both in vitro (ivacaftor,  $16.2 \pm 2.7$  vs. vehicle control,  $0.2 \pm 0.1$ ;  $p < 0.001$ ) and in vivo (in  $\mu V$ ; ivacaftor,  $12.9 \pm 2.1$  vs. control,  $0.4 \pm 0.3$ ;  $p < 0.001$ ). RNE cultures exposed to PAO1 inhibited ASL depth (in  $\mu m$ ), whereas ivacaftor enhanced ASL in both control and PAO1 filters (PAO1,  $3.53 \pm 0.13$  vs. PBS control,  $4.96 \pm 0.38$  vs. ivacaftor,  $17.94 \pm 3.86$  vs. ivacaftor+PAO1,  $6.67 \pm 0.46$ ;  $p < 0.05$ ) as measured by  $\mu$ OCT.

**Conclusion:**

Ivacaftor robustly stimulates CFTR-mediated Cl<sup>-</sup> secretion in RNE in vitro and in vivo, and normalized ASL in PAO1-induced acquired CFTR dysfunction. Testing CFTR potentiators in *P. aeruginosa* rabbit sinusitis are planned.

**4:14pm****Resveratrol and ivacaftor are synergistic cftr channel potentiators: Therapeutic implications for cf sinus disease**

Presented by Jessica Grayson, MD

Do-Yeon Cho, MD

Jaime A. Peña Garcia, BS

Sean S. Evans, MD

Daniel T. Skinner, BS

Dong Jin Lim, PhD

Bradford A. Woodworth, MD, FARS

Birmingham, AL

**Background:**

Mutations in the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) gene result in defective Cl<sup>-</sup> transport and causes chronic bacterial infections in the upper and lower airways of cystic fibrosis (CF) patients. Ivacaftor is a CFTR potentiator that improves Cl<sup>-</sup> transport in CF patients with at least one copy of the G551D mutation. Resveratrol is also a potent CFTR potentiator that increases mucociliary transport. The objective of this study is to evaluate whether resveratrol and ivacaftor improve Cl<sup>-</sup> secretion in G551D CFTR over either agent alone.

**Methods:**

Fisher rat thyroid cells (FRT) transfected with G551D CFTR and human sinonasal epithelial cells (HSNE) containing the CFTR G551D mutation were subjected to pharmacologic manipulation of transepithelial ion transport in Ussing chambers. Sequential administration of amiloride (sodium channel inhibitor), potentiators (10  $\mu M$  ivacaftor and/or 100  $\mu M$  resveratrol), and forskolin (maximal CFTR activator) was performed.

**Results:**

In FRT-G551D cells, resveratrol and ivacaftor acted synergistically to significantly increase Cl<sup>-</sup> transport (change in short-circuit current,  $I_{SC} = \mu A/cm^2$ ) compared to single agent and dimethyl sulfoxide (DMSO) vehicle controls (resveratrol+ivacaftor,  $4.97 \pm 0.57$  vs. ivacaftor,  $0.74 \pm 0.12$  vs. resveratrol,  $2.96 \pm 0.52$  vs. DMSO,  $0.74 \pm 0.12$ ;  $p < 0.05$ ). Maximal Cl<sup>-</sup> secretion was also significantly enhanced (resveratrol+ivacaftor,  $254.5 \pm 7.53$  vs. ivacaftor,  $217.61 \pm 8.27$  vs. resveratrol,  $148.2 \pm 8.28$  vs. DMSO,  $92.93 \pm 4.22$ ;  $p < 0.05$ ). In G551D HSNE cells, the synergy between resveratrol and ivacaftor was confirmed (resveratrol+ivacaftor,  $4.48 \pm 0.39$  vs. ivacaftor,  $1.05 \pm 0.11$  vs. resveratrol,  $0.84 \pm 0.3$  vs. DMSO,  $0.0 \pm 0.02$ ;  $p < 0.05$ ), and maximal Cl<sup>-</sup> secretion was augmented with both agents (resveratrol+ivacaftor,  $32.2 \pm 1.17$  vs. resveratrol,  $10.73 \pm 0.84$  vs. ivacaftor,  $21.29 \pm 0.85$  vs. DMSO,  $3.88 \pm 0.85$ ;  $p < 0.05$ ).

**Conclusion:**

Synergistic improvement in G551D CFTR-mediated Cl<sup>-</sup> secretion suggests that resveratrol could enhance ivacaftor therapy in these patients and improve CF-related rhinosinusitis.

**4:22pm**

Q&amp;A

**Moderators: Raymond Sacks, MD, FARS & Richard Lebowitz, MD, FARS****4:30pm****Exosome swarming mediates innate immunity in nasal mucosa via no associated antimicrobial activity and passive epithelial immunoprotection**

Angela L. Nocera, MS

Sarina K. Mueller, MD

Jules R. Stephan, BS

Philip Seifert, MS

Derrick T. Lin, MD

Benjamin S. Bleier, MD

Boston, MA

**Introduction:**

Exosomes are 30-150nm particles which participate in immune responses and are known to shuttle protein cargo between nasal mucosal epithelial cells. The purpose of this study was to examine whether exosomes mediate TLR4 dependent innate immunity within the human nose through both interepithelial transfer of immunoprotective proteins and direct microbiocidal effects.

**Methods:**

IRB approved study of mucus and culture derived exosomes. Exosome secretion was quantified following TLR4 stimulation by LPS(12.5 µg/mL) in the presence of TLR4 pathway specific inhibitors. Intrinsic and interepithelial transfer of exosomal NOS2 and NO were measured using ELISA and NO activity assays in the presence of NO inhibitors. Exosomal antimicrobial assays were performed using *P. aeruginosa*. Exosomal proteomic analyses were performed using SOMAscan.

**Results:**

LPS exposure more than doubled exosome secretion both in vitro(230.0+/-35.0%, mean+/-sem; p=0.002) and in vivo(212.0+/- 28.4%, p=0.03). LPS stimulation significantly increased intrinsic exosomal NOS2 and NO activity (177.1+/-16.3%, p=0.008 and 220.3+/-50.0%, p=0.003; respectively) which was subsequently transferred to naïve autologous epithelial cells. Finally, LPS stimulated exosomes induced a significant reduction in *P. aeruginosa* CFUs to 0.92%+/-0.48% of control (p<0.001).

**Conclusions:**

Our results reveal a novel arm of innate airway immunity characterized by a swarm-like release and transport of TLR4 stimulated exosomes which confer epithelial immunoprotection and exert direct antimicrobial effects via NO. Additional exosomal antimicrobial peptides were identified through our proteomic analysis and require further study. These findings provide important insights into human innate immunity and open the door for the development of exosome associated therapeutics for chronic airway inflammation.

**4:38pm****Total intravenous anesthesia improves intraoperative visualization during surgery for high-grade chronic rhinosinusitis: A double-blind randomized controlled trial**

Jacob P. Brunner, MD

Joshua M. Levy, MD, MPH

Melissa L. Ada, MS

Kiranya E. Tipirneni, MD

Bobby D. Nossaman, MD

Edward D. McCoul, MD, MPH

New Orleans, LA

**Introduction:**

Total intravenous anesthesia (TIVA) has been proposed as a method to reduce blood loss during endoscopic sinus surgery (ESS). Impaired sinonasal visualization due to mucosal bleeding may be burdensome in cases of chronic rhinosinusitis (CRS) with high-grade inflammatory disease, suggesting a particular benefit for use of TIVA in that population.

**Methods:**

A double-blind, randomized controlled trial was conducted of adults undergoing ESS at a tertiary medical center. All patients had high-grade CRS defined as either sinonasal polyposis on examination or a preoperative Lund-Mackay score of >12. Subjects were randomly assigned to receive either TIVA or inhaled anesthesia (IA). The primary outcome measure was intraoperative visibility as rated by three independent, blinded reviewers utilizing the 10-point Wormald Surgical Field Grading Scale. Secondary outcomes included operative blood loss, complications and change in quality-of-life evaluated by the Sino-Nasal Outcome Test (SNOT-22).

**Results:**

60 patients were randomized into TIVA (n=28) and IA (n=32) cohorts. Median Wormald scores were significantly lower in the TIVA group (reviewer 1: 4.0 vs 5.3, p=0.008; reviewer 2: 3.6 vs 5.3, p=0.005; reviewer 3: 2.4 vs 3.0, p=0.004), as was estimated blood loss (p=0.03). Baseline patient characteristics were comparable between cohorts with no significant postoperative complications. No significant changes were detected between postoperative SNOT-22 scores at 3 (p=0.25) and at 6 months (p=0.66) following ESS.

**Conclusions:**

TIVA contributes to improved intraoperative visualization and decreased blood loss in patients undergoing ESS for advanced inflammatory sinus disease.

**4:54pm**

Q&amp;A and Adjourn

**5:30pm-7:00pm****Poster Presentation Reception**

Location: Prince George's Exhibit Hall A

**6:30pm-8:00pm****ARS Welcome Reception**

Location: National Harbor 3

## Friday, April 20, 2018

### AM Session

### Scientific Room #1

### Maryland B 4-6

**Moderators: Stephanie Joe, MD, FARS & Thomas Higgins, MD, FARS**

#### 8:00am

#### **Automated classification of radiographic osteomeatal complex inflammation using convolutional neural networks**

Naweed Chowdhury, MD  
Rakesh Chandra, MD, FARS  
Timothy L. Smith, MD, MPH, FARS  
Justin Turner, MD, PhD  
Nashville, TN

#### Background:

Convolutional neural networks (CNNs) are advanced artificial intelligence algorithms well-suited to image classification tasks such as handwriting recognition, face detection, image search, and fraud prevention. Medical uses for CNNs are an emerging area of research. We sought to retrain a robust CNN with coronal computed tomography (CT) data to classify osteomeatal complex (OMC) occlusion and assess the performance of this technology with rhinologic data.

#### Methods:

The Google Inception-V3 CNN trained with 1.2 million images was used as the base model. Preoperative two-dimensional coronal CT slices through the OMC were obtained from 238 patients with chronic rhinosinusitis enrolled in two prospective studies. Images were labelled according to OMC status (open/closed) and mirrored to obtain a final set of 956 images. Inception-V3 was retrained in Python using a transfer-learning method for 30,000 iterations. Hyperparameters were adjusted for optimal accuracy.

#### Results:

Final test accuracy for the model for OMC classification on the test set was 85%. The 95% confidence interval for algorithm accuracy was 78-92%, significantly different than random guessing ( $p < 0.001$ ). Receiver operating curve analysis showed good classification ability of the CNN with an area-under-the-curve of 0.87 (95% confidence interval 0.794-0.947).

#### Conclusions:

Current state-of-the-art CNNs are capable of learning clinically-relevant information from sinonasal CT scans and accurately generalizing this information to unseen images. This potentially enables the discovery of new clinical phenotypes and imaging biomarkers using artificial intelligence. Future work will extend this approach to three-dimensional CT and endoscopic data to further investigate these relationships.

#### 8:07am

#### **Transorbital neuroendoscopic surgery using the superior eyelid approach – trajectory mapping and outcomes**

Parth V. Shah, MD  
Maheer M. Masood, BA  
Gregory Capra, MD  
Charles S. Ebert, Jr., MD, MPH, FARS  
Brian D. Thorp, MD, FARS  
Adam M. Zanation, MD  
Chapel Hill, NC

#### Introduction:

Transorbital neuroendoscopic surgery (TONES) is a novel approach to skull base lesions that prove challenging to access transnasally. In this study, we performed three-dimensional trajectory mapping for patients who underwent TONES via the superior eyelid crease (SLC) approach and investigated surgical outcomes.

#### Methods:

A retrospective review was performed for patients who underwent TONES at our institution. Demographic, intra-operative, and postoperative data were obtained. Pre-operative computed tomography scans were collected and using MIMICSTM software, three-dimensional reconstructions were created. Angulations between zygomaticofrontal (ZF) and nasofrontal (NF) sutures, and four points of lesion extent (superior, inferior, medial, lateral), were measured and compared.

#### Results:

Eight patients (50% female) underwent TONES via the SLC approach. Mean age was  $47.8 \pm 17.8$  years. Gross total resection (GTR) was achieved in five of six patients where GTR was the surgical plan. For one patient, craniotomy was required for GTR due to lack of visualization of lesion via SLC. For two patients, goal of surgery was biopsy. Postoperative complications included V1 numbness ( $n=1$ ) and diplopia ( $n=1$ ). For the GTR group, angles from NF to lateral, NF to superior, and NF to inferior ranged from  $24.43^\circ$ - $37.74^\circ$ ,  $39.38^\circ$ - $63.33^\circ$ ,  $24.67^\circ$ - $51.97^\circ$ , respectively. For the non-visualized lesion, these angles were  $22.09^\circ$ ,  $74.75^\circ$ ,  $65.84^\circ$ .

#### Conclusion:

At our institution, TONES led to GTR in most patients with no major complications. Decreased angulations from NF to lateral lesion extent, and increased angulations from NF to superior and inferior extents, may hinder visualization via the SLC. Thus, trajectory mapping can provide additional information in predicting success with TONES.

**8:14am****Impact of high versus low risk genotype on sinonasal development and radiographic disease in cystic fibrosis**

Ashleigh A. Halderman, MD  
 Nyall London, MD  
 John Moore, BS  
 Stella Lee, MD  
 Sandra Y. Lin, MD, FARS  
 Dallas, TX

**Introduction:**

Understanding of how specific mutations impact the cystic fibrosis transmembrane conductance regulator (CFTR) protein has given rise to the classification of CF patients into low-risk and high-risk genotypes. Few prior studies have investigated differences in sinonasal disease between low and high-risk CF genotypes. This multi-institutional review aimed to evaluate radiographic sinus disease severity based on genotype.

**Methods:**

A review was conducted on adult patients with CF evaluated between 2005-2017 at three academic institutions. Data including age, gender, CFTR mutation, and presence of a maxillofacial/sinus computed tomography scan was collected. A modified Lund-Mackay score (LMS) was assigned to each scan and the presence of sinus aplasia or hypoplasia was determined. Patients were further grouped depending on genotype into low or high risk for comparison.

**Results:**

102 patients were included with 91 patients in the high-risk and 11 in the low-risk groups. The high-risk group had significantly higher modified LMS than the low-risk group (mean 13.93 versus 10.6,  $p=0.04$ , 95%CI -6.629 to -0.156.) The rates of frontal aplasia/hypoplasia and sphenoid hypoplasia did not significantly differ between groups ( $p=0.07$ ,  $p=0.51$ , and  $p=0.148$  respectively). Patients with the most severe genotypes had significantly increased rates of frontal aplasia and sphenoid hypoplasia ( $p=0.0014$  and  $p=0.026$  respectively).

**Conclusions:**

This is one of the largest studies to date evaluating the impact of CF genotype on paranasal sinus development and disease. Genotype appears to impact sinonasal disease severity, and also paranasal sinus cavity development.

**8:21am****Sinus surgery is associated with less frequent antibiotic use in cystic fibrosis patients with lung transplant**

Tracy Z. Cheng, AB  
 Kevin Choi, MD  
 Adam Honeybrook, MD  
 Rasheedat Z. Zakare-Fagbamila, BA  
 Ralph Abi Hachem, MD  
 David W. Jang, MD  
 Durham, NC

**Introduction:**

Patients with cystic fibrosis (CF) who have undergone lung transplantation frequently require hospitalizations and antibiotic treatments for pulmonary issues. While endoscopic sinus surgery (ESS) improves sinonasal quality-of-life in CF patients, it is unclear if ESS offers additional benefit in terms of antibiotic utilization, hospitalization, and pulmonary function.

**Methods:**

This is a single-institution retrospective study of patients who underwent lung transplantation for cystic fibrosis from 2005 to 2017. Patients who underwent ESS at least one year after transplant were selected. Paired bivariate analyses were performed to determine whether there was a difference in the frequency and length of hospitalizations, number of antibiotic courses (intravenous and oral) for pulmonary exacerbations, and mean FEV1 in the 6 months before versus after ESS. Perioperative antibiotics or hospitalizations were not included in the analyses. Least means regression analysis was utilized to determine whether ESS affected FEV1 trends.

**Results:**

A total of 20 patients underwent a total of 36 ESS in the study period. There was significantly higher antibiotic utilization in the 6 months before ESS (0.89 +/- 1.02) compared to the 6 months after ESS (0.33 +/- 0.53) ( $p$ -value = 0.006). The frequency and length of hospitalizations, mean FEV1, and FEV1 trend were not significantly different.

**Conclusions:**

Our results suggest that ESS may help reduce the frequency of antibiotic utilization for pulmonary exacerbations in lung transplant patients with cystic fibrosis. A prospective study is needed to investigate these relationships further.

**8:28am****Q&A**

**Moderators: Dana Crosby, MD & Anthony Del Signore, MD**

**8:32am****Relationship between specific atopic diseases and in-vitro allergen tests**

Kevin T. Grafmiller, MD  
 Michael S. Benninger, MD, FARS  
 Thomas M. Daley, MD  
 Valeda L. Young, BA  
 Cleveland, OH

**Introduction:**

Multiple allergens may be associated with comorbid atopic disease. The purpose of this study was to examine the correlation of specific allergic sensitivities with four atopic conditions.

**Methods:**

Positive allergy tests obtained by in-vitro ImmunoCAP® at a Midwestern US reference laboratory were identified from September 2014 until September 2016. 6630 positive allergen tests from patients who were seen at one health care institution with full medical records were abstracted to determine whether they had a clinical diagnosis of allergic rhinitis (AR), asthma (AS), atopic dermatitis (AD) or allergic conjunctivitis (AC). Proportional relationships between positive tests and specific atopic diseases were made.

**Results:**

Of patients with positive allergy tests 42.7% had AS, 29.6% AR, 14.2% AD, and 3.4% AC. Positive allergen tests in men were more likely to be associated with all four comorbid conditions. Positive allergen tests in younger patients were stronger predictors of comorbid AS, AD, and AC, but not AR. There was a strong association with specific allergen for both AS and AD, a weaker association for AR and no association for AC. Higher in-vitro class of response predicted increased risk of comorbidity with all four diseases. When combining allergens into large categories there was a strong association between type of allergen and AS, AR and AD, but not AC. Molds followed by weeds and grasses appear to have the strongest association with AS and AR, and molds and animal dander with AD.

**Conclusions:**

There are strong associations between specific allergens and AS, AR and AD.

**8:39am****Association between allergic rhinitis, increased sleep latency and obstructive sleep apnea in United States adults**

Christopher R. Roxbury, MD  
Mary Qiu, MD  
Josef Shargorodsky, MD, MPH  
Sandra Y. Lin, MD, FARS  
Cleveland, OH

**Introduction:**

Increasing evidence suggests a relationship between allergic rhinitis (AR), sleep disturbances, and obstructive sleep apnea (OSA). However, population-based studies assessing these associations in the United States (US) are lacking and little is known about associations between sleep disturbances and sensitization to specific allergens. This study investigates the relationship between AR, allergen sensitization and sleep in a representative sample of US adults.

**Methods:**

Cross-sectional study of 6139 participants =16 years old from the 2005-2006 National Health and Nutrition Examination Survey (NHANES), who participated in the allergy and sleep surveys. Predictor variables were AR, defined as self-reported hay fever and/or nasal symptoms in the past 12 months and allergen sensitization,

defined as a positive response to any of 19 specific IgE antigens. Outcome variables were subjective difficulty falling asleep, sleep latency, sleep disturbances (snoring or apneic episodes) and OSA. Covariates included age, gender, race and obesity (body mass index =30).

**Results:**

The population-weighted prevalence of trouble falling asleep, sleep disturbances, and OSA was 57.2%, 66.6% and 4.7%, respectively. AR was self-reported in 28.0%. Adjusting for covariates, subjects with AR had 1.6 times higher odds of subjective difficulty falling asleep (OR 1.55, CI 1.32-1.81, p<0.0001), 1.3 times higher odds of sleep latency >20 minutes (OR 1.30, CI 1.07-1.59, p=0.01) and 1.8 times higher odds of OSA (OR: 1.80, CI: 1.13-2.88, p=0.02). There were no significant associations with specific allergen sensitization.

**Conclusions:**

This study revealed associations between AR and subjective difficulty falling asleep, increased sleep latency and OSA, reinforcing the need to assess sleep quality in patients with AR.

**8:46am****Understanding the propensity for chronic sinusitis in patients on immunosuppressive therapy**

Peter Papagiannopoulos, MD  
Hannah N. Kuhar, BA  
Anish Raman, BA  
Paolo Gattuso, MD  
Pete S. Batra, MD, FARS  
Bobby A. Tajudeen, MD  
Chicago, IL

**Introduction:**

Chronic rhinosinusitis (CRS) is a frequently observed condition in patients on immunosuppressive therapies. The histopathologic features of CRS among patients undergoing immunosuppressive treatment have yet to be determined and may have important implications on understanding pathophysiology of disease.

**Methods:**

A structured histopathology report was utilized to analyze sinus tissue removed during functional endoscopic sinus surgery (FESS). Histopathology variables, Lund-Mackay Score (LMS) and SNOT-22 scores were compared among patients with CRS on immunosuppressive therapy (CRSi), CRS without nasal polyps (CRSsNP) patients and CRS with nasal polyps (CRSwNP) patients.

**Results:**

15 CRSi, 36 CRSwNP, and 56 CRSsNP patients who underwent FESS were analyzed. Compared to CRSsNP, CRSi patients exhibited a trend towards increased moderate-severe inflammation (66.7% vs. 42.1%, p<0.080), increased neutrophil infiltrate (40.0% vs. 24.6%, p<0.192), and decreased fibrosis (26.7% vs. 43.9%, p<0.182). Compared to CRSwNP, CRSi patients demonstrated decreased fibrosis (26.7% vs. 66.7%, p<0.010), decreased

eosinophil aggregates (13.3% vs. 44.4%,  $p < 0.032$ ), and a trend towards fewer eosinophils per HPF (46.7% vs. 66.7%,  $p < 0.154$ ). CRSi cases had significantly lower mean LMS ( $8.20 \pm 4.30$  vs.  $12.78 \pm 6.56$ ,  $p < 0.017$ ) compared to CRSwNP.

#### Conclusions:

CRS patients on immunosuppressive therapy exhibit histopathology more similar to CRSsNP cases with increased neutrophilia and reduced eosinophilia. This study provides initial insight into understanding the propensity for chronic sinusitis in patients undergoing immunosuppressive treatment which may have implications on disease management.

#### 8:53am

##### **Comparison of outcomes following the use of culture-directed versus non-culture directed antibiotics in treatment of chronic rhinosinusitis**

Carol H. Yan, MD

Navarat Tangbumrungtham, MD

Ximena A. Maul, MD

Peter H. Hwang, MD, FARS

Jayakar V. Nayak, MD, PhD

Zara M. Patel, MD, FARS

Stanford, CA

#### Introduction:

Acute exacerbations in patients with chronic rhinosinusitis (CRS) are often treated with courses of systemic antibiotics. Poor correlation between microbiologic culture results and the sinus microbiome in CRS has caused increased debate as to the relevance of culture-directed antibiotics. There is currently sparse data comparing outcomes of culture directed antibiotics versus non-culture directed antibiotics for treatment of CRS.

#### Methods:

Retrospective review. 946 CRS patients treated with antibiotics were examined. 121 CRS patients with acute exacerbations were treated with culture-directed ( $n=61$ ) versus empiric ( $n=60$ ) antibiotics. Lund-Kennedy (LK) and 22-item Sinonasal Outcome Test (SNOT-22) scores were compared pre- and post-treatment, with short-term ( $< 1$  month) and long-term (1-6 months) follow-up. Patient demographics, co-morbidities, and prior surgical history were collected.

#### Results:

Both groups had similar pre-treatment SNOT-22 scores ( $p=0.245$ ) while the culture group had higher baseline LK endoscopy scores ( $p < 0.0001$ ). All data were adjusted for pertinent co-morbidities, surgical history, co-therapeutics, and baseline scores. There was no difference in improvement in culture-directed and empirically treated groups in the short-term ( $p=0.997$ ) and long-term ( $p=0.279$ ) for minimal clinically important difference (MCID) of SNOT-22 and no difference in the short-term for LK scores ( $p=0.108$ ), but there was significantly more improvement in long-term LK scores in the culture-directed group ( $p=0.005$ ).

#### Conclusion:

Culture-directed therapy improves long-term endoscopy scores but does not yield an advantage in improving short-term endoscopy scores, nor in improving short and long-term quality of life scores in CRS patients. A prospective study is necessary to examine the relevance of routine microbiologic cultures in CRS patients.

#### 9:00am

##### **Efficacy of empiric antimicrobial prophylaxis after fess**

Harrison G. Bartels, MD

Ellen C. Shaffrey, BS

Spencer C. Payne MD

Charlottesville, VA

#### Background:

Functional endoscopic sinus surgery (FESS) is the current standard of care for treatment of chronic rhinosinusitis refractory to medical management. The use of empiric post-operative antibiotics is common practice among otolaryngologists but the data supporting this use are mixed and limited.

#### Setting:

Tertiary Care University Hospital

#### Objectives:

To compare outcome differences between patients who did and did not receive post-operative prophylactic antimicrobial therapy after undergoing endoscopic sinus surgery with a single provider.

#### Methods:

A retrospective analysis was performed from 2012-2016 on all patients who underwent endoscopic sinus surgery by a single provider during this time period. This time period was selected as it represented the two years before and after the practice of prescribing empiric antibiotic therapy post-operatively changed from positive to negative. The primary outcomes were the number of antibiotic and systemic steroid prescriptions over a 6-month post-operative time period.

#### Results:

450 patients were identified over this period. There was no significant difference between the number of antibiotic courses or steroid courses between patients that did and did not receive post-operative antimicrobial prophylaxis.

#### Conclusions:

There is currently no standard of care for post-operative antimicrobial therapy in patients undergoing functional endoscopic sinus surgery. Our data may support a more conservative approach that does not subject patients to the comorbidity and resistance concerns associated with empiric antimicrobial therapy.

#### 9:07am

Q&A

**9:15am****Panel: Regional Variations in Chronic Rhinosinusitis**

Moderator: James Palmer, MD, FARS

Panelists: Robert Kern, MD, FARS, Rodney Schlosser, MD, FARS, Martin Desrosiers, MD, Gretchen Oakley, MD, Alexander Chiu, MD, FARS

**10:00am****Break with Exhibitors****Moderators: Andrew Goldberg, MD, FARS & Jivianne Lee, MD, FARS****10:30am****The sinonasal microbiota, neural signaling, and depression in chronic rhinosinusitis**

Michael Hoggard, BSc

Angela Nocera, MSc

Kristi Biswas, PhD

Michael W. Taylor, PhD

Richard G. Douglas, MD

Benjamin S. Bleier, MD, FARS

Auckland, Auckland

**Introduction:**

The complex relationships between the human microbiota, the immune system, and the brain play important roles in both health and disease and have been of increasing interest in the study of chronic inflammatory mucosal conditions. We hypothesized that the sinonasal microbiota may act as a modifier of inter-kingdom neural signaling, and subsequently mental health, in the upper respiratory inflammatory condition chronic rhinosinusitis (CRS). This study investigated associations between the sinonasal microbiota, local concentrations of the neurotransmitters serotonin, dopamine, and GABA, and depression severity, in a cohort of 14 CRS patients and 12 healthy controls.

**Methods:**

Subject demographics, clinical severity scores, depression index scores, and sinonasal swab and mucus samples were collected at the time of surgery. Bacterial communities were characterized from swabs by 16S rRNA gene-targeted sequencing and quantified by quantitative PCR. Mucus concentrations of the neurotransmitters serotonin, dopamine, and GABA were quantified by ELISA.

**Results:**

Several commonly 'health-associated' sinonasal bacterial taxa were positively associated with higher neurotransmitter concentrations and negatively associated with depression severity. In contrast, several taxa commonly associated with an imbalanced sinonasal microbiota negatively associated with neurotransmitters and positively with depression severity. Few significant differences were identified when comparing between control and CRS subject groups, including neurotransmitter concentrations, depression scores, or sinonasal microbiota composition or abundance.

**Conclusions:**

These data lend support to the potential for downstream effects of the sinonasal microbiota on neural signaling and subsequently brain function and behavior.

**10:37am****Relative abundance of nasal microbiota in chronic rhinosinusitis by structured histopathology**

Hannah N. Kuhar, BA

Bobby A. Tajudeen, MD

Mahboobeh Mahdavinia, MD, PhD

Ashley Heilingoetter, BA, MPH

Paolo Gattuso, MD

Pete S. Batra, MD, FARS

Chicago, IL

**Introduction:**

Chronic rhinosinusitis (CRS) is an infectious and inflammatory disease process with different phenotypes. Recent data has shown that CRS phenotypes maintain distinct nasal microbiota that may predict surgical outcomes. Nasal microbiota and structured histopathologic reporting have the potential to further differentiate subtypes and provide added insight into CRS pathophysiology.

**Methods:**

Sinus swabs for nasal microbiome assay were performed in the office and studied by polymerase chain reaction analysis of 16S ribosomal RNA. A structured histopathology report of 11 variables was utilized to analyze sinus tissue removed during functional endoscopic sinus surgery (FESS). Histopathology variables and relative abundance of nasal microbiota were compared among CRS patients.

**Results:**

51 CRS patients who underwent FESS were included. Relative abundance of Firmicutes phylum in nasal microbiota of CRS patients was associated with presence of neutrophilic infiltrate ( $27.47 \pm 44.75$  vs.  $9.21 \pm 11.84$ ,  $p < 0.029$ ), presence of mucosal ulceration ( $47.67 \pm 45.52$  vs.  $13.27 \pm 26.48$ ,  $p < 0.041$ ), presence of squamous metaplasia ( $5562.70 \pm 2715.66$  vs.  $3563.73 \pm 2580.84$ ,  $p < 0.035$ ), and absence of Charcot Leyden crystals ( $5423.00 \pm 3320.57$  vs.  $679.94 \pm 1653.66$ ,  $p < 0.001$ ). Relative abundance of Bacteroidetes phylum in nasal microbiota of CRS patients was associated with increased severity of inflammatory degree ( $p < 0.004$ ) and presence of mucosal ulceration ( $p < 0.004$ ).

**Conclusions:**

Distinct histopathologic features of CRS are associated with relative abundance of nasal microbiota phyla, specifically Firmicutes and Bacteroidetes. These findings contribute to the literature on microbiota in sinonasal disease and may have important implications for understanding pathophysiologic mechanisms of CRS subtypes and disease management.

**10:44am****Analysis of the sinonasal microbiome in exacerbations of chronic rhinosinusitis subgroups**

Laura J. Vandelaar, MD  
 Blake M. Hanson, MS, PhD  
 Michael J. Marino, MD  
 William C. Yao, MD  
 Amber U. Luong, MD, PhD, FARS  
 Martin J. Citardi MD, FARS  
 Houston, TX

**Introduction:**

Polymerase chain reaction (PCR) technology now allows precise determination of the sinus microbiota of patients with exacerbations of chronic rhinosinusitis (CRS). The aim of this report is to describe the sinus microbiota in CRS clinical subgroups (with nasal polyps [CRSwNP], without nasal polyps [CRSSNP] and allergic fungal rhinosinusitis [AFRS]).

**Methods:**

A retrospective review of all patients whose sinus microbiota were assayed via a commercially available PCR technology (MicroGen Diagnostics, Lubbock, TX) during an acute CRS exacerbation during the 2-year period ending December 31, 2016, was performed. All samples were collected under endoscopic visualization in a tertiary rhinology clinic.

**Results:**

A total of 91 patients (50 CRSSNP, 32 CRSsNP and 9 AFRS) were reviewed. The observed diversity (the number of taxa above 2%) ranged between 1 and 8 taxa, with most samples between 1 and 4 taxa. Only *Pseudomonas*, *Staphylococcus*, and *Streptococcus* were present above 50% across all clinical subgroups. *Staphylococcus aureus* had an increased prevalence in CRSSNP patients as compared to AFRS and CRSwNP samples, and *Streptococcal* species had a decreased prevalence in AFRS patients as compared to CRSSNP and CRSwNP samples. Otherwise the sinus microbiota were markedly similar among all 3 clinical subgroups.

**Conclusions:**

Many different bacterial types were identified during acute CRS exacerbation using PCR-based techniques. Bacterial diversity was remarkably low in all samples. Few differences in the patterns from clinical subgroups were observed. Further investigation is warranted to determine the clinical significance of these observations.

**10:51am****Predictive measure of sellar tumor morphology for transsphenoidal surgery**

Andrew T. Heffernan, MD  
 Joseph K. Han, MD, FARS  
 Kent Lam, MD  
 James Reese, MD  
 John Campbell, MD  
 William G. Day, MS2  
 Norfolk, VA

**Introduction:**

Endonasal transsphenoidal surgery is becoming the mainstay of treatment for sellar tumors. There are few studies that have evaluated the tumor size and extent on pre-operative imaging to predict the rate of post-operative complications, but there is little data on the relationship between sellar tumor morphology and surgical outcomes.

**Materials and Methods:**

Pre-operative MRI/CT scans from patients undergoing endoscopic sellar tumor resection from 2007 to 2017 were retrospectively evaluated. A neuroradiologist defined the sellar tumors by size, extension, and shape. The surgical difficulty, need for adjuvant treatment, rates of incomplete resection, and rates of post-operative complications were then stratified in relation to the pre-defined sellar tumor size, extension, and shape.

**Results:**

Sellar tumors of 138 patients were classified from pre-operative imaging into 6 characteristic morphologies: 1. Round, 2. Transverse oblong, 3. Vertical oblong, 4. Large lobulated, 5. Snowman, 6. Microadenoma. Specific tumor morphologies were significantly associated with incomplete tumor resections and the use of grafts for control of intra-operative cerebrospinal fluid leaks. Large lobulated (75%), snowman (35%), and transverse oblong (47%) tumors correlated with higher rates of residual tumor ( $p < 0.001$ ). Large lobulated (50%), snowman (33%), and vertical oblong (23.5%) tumors more commonly required use of a graft to repair CSF leaks ( $p < 0.012$ ).

**Conclusion:**

Sellar tumors can be classified into characteristic morphologies on pre-operative radiographic scans. Each characteristic morphology is associated with varying degrees of intra-operative surgical difficulty and complications. Utilizing tumor morphology may help aid surgeons in planning the extent of resection, need for complex closure, and patient counseling.

**10:58am****Discussion****Moderators: Jarrett Walsh, MD & Zachary Soler, MD****11:02****Skills transfer to sinus surgery via a low-cost simulation-based curriculum**

Richard A. Harbison, MD, MS  
 Jennifer Dunlap, BS  
 Ian M. Humphreys, DO, FARS  
 Greg E. Davis, MD, MPH  
 Seattle, WA

**Introduction:**

The purpose of this study was to evaluate the correlation between technical and cognitive skills with cadaveric endoscopic sinus surgery (ESS) and change in ESS performance before and after implementation of a dedicated ESS curriculum.



**Methods:**

A before-after study design was implemented among 10 medical students and 10 junior otolaryngology residents. Participants completed a knowledge-based, multiple-choice ESS pre-test and watched an ESS prosection video. Participants performed nine tasks on a previously validated, non-biologic ESS task trainer followed by cadaveric maxillary anastomy and anterior ethmoidectomy. Participants completed a simulation- and knowledge-based ESS curriculum followed by a repeat cadaveric ESS. Performance was graded with a global rating scale and ESS-specific checklist.

**Results:**

We observed a strong correlation between the multiple-choice, knowledge-based, ESS pre-test scores and cadaveric ESS performance ( $r = 0.73$ ). Pre- vs post-curriculum mean (SD) cadaveric ESS performance increased for both medical students (1.18 (0.25) vs 2.58 (0.57),  $p$ -value = 0.0002) and residents (2.09 (0.78) vs 2.88 (0.54),  $p$ -value = 0.023). The greatest improvements for residents were performance of uncinctomy, enlargement of the maxillary os, and identification of the bulla.

**Conclusions:**

Basic endoscopic skills can be taught, and learned outside the operating room in a safe, controlled manner leaving precious operating room time for mastery of more advanced skills. Endoscopic sinus surgery performance in cadavers improved in a clinically meaningful manner for both medical students and junior residents who were exposed to a cost- and time-efficient, cognitive and simulation-based training curriculum.

**11:09am****Blinded evaluation of endoscopic skill and instructability after implementation of an endoscopic simulation experience**

Elizabeth D. Stephenson, BA  
Douglas R. Farquhar, MD MPH  
Maheer M. Masood, BA  
Gregory Capra, MD  
Adam J. Kimple MD PhD  
Adam M. Zanation, MD  
Chapel Hill, NC

**Objective:**

Interest in endoscopic simulation is increasing. Past studies have used virtual reality or non-human models and residents with varying experience. Our aim was to evaluate the effect of simulation on procedural and psychomotor competence of medical students - surgical novices - performing endoscopic tasks on human cadavers.

**Methods:**

Students completed a baseline sinus model skill evaluation graded by two blinded Rhinology fellows. Intervention and control groups with equal baselines were assigned. Intervention students practiced endoscopic tasks on the model for 45 minutes minimum over two weeks. All students reviewed materials about sinus

anatomy/disease and sinus surgery. The final evaluation on cadavers was similar to the baseline. Fellows graded students on anatomy identification (sinuses, turbinates), psychomotor (navigation, camera alignment, instrument handling) and timed procedural (maxillary and sphenoid object retrieval) skills, confidence and instructability via fellow-guided frontal balloon placement.

**Results:**

Twenty-two students participated, 16 male (72.7%) and 6 female (27.3%). Intervention and control groups contained 10 (45.4%) and 12 (54.6%) students, respectively. Intervention group final "Total Psychomotor" scores were higher (10.1/15 vs 7.8/15,  $p=0.0231$ ). "Surgical confidence" was 3.3/5 vs 2.5/5; "Instructability" was 3.9/5 vs 3.4/5 in intervention vs controls, respectively ( $p<0.050$ ). Multivariate regression analysis demonstrated superior psychomotor skills, navigation and confidence in the intervention group (all  $p<0.036$ ). Instructability, camera alignment and overall performance approached significance (all  $p<0.060$ ).

**Conclusion:**

In surgical novices endoscopic simulation leads to superior subjective endoscopic navigation and task performance in cadaver sinuses. Furthermore, this simulation design presents a novel method for incorporating Otolaryngology simulation in medical student education.

**11:16am****Double-blinded randomized controlled trial to evaluate a novel digital platform to improve patient satisfaction after functional endoscopic sinus surgery (fess)**

Yue Ma, MD  
Joshua Zeiger, BS  
Anthony Yang, BS  
Alfred Iloreta, MD  
Satish Govindaraj, MD  
New York, NY

**Introduction:**

Current delivery of CRS education is done during the clinic visit, where physicians or nurses have limited time for each patient. One potential solution is to provide a personalized video-based patient education program delivered to patients through text messaging. Such enhanced patient-doctor communication may improve patient satisfaction.

**Methods:**

A double-blinded randomized controlled trial was initiated to study the efficacy of an automated digital platform to improve patient satisfaction measured by Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys. Patients in the experimental group received four educational videos and automated reminders to take medications and perform nasal irrigation. The control group received a sham platform. Patients were randomized and physicians, clinic staff, and patients were blinded. The chi-square test was used to assess differences in patient satisfaction between the two groups.

**Results:**

After receiving IRB approval, 108 patients were enrolled and a total of 60 CAHPS surveys were collected at post-op week one. Patients in the experimental group were more likely to answer "Yes, definitely" to "Did these pictures drawings models or videos help you better understand your condition and its treatment?" (97.1 % vs. 65%,  $p=0.0014$ ) and "Did anyone in this surgeon's office warn you about any signs or symptoms that would need immediate medical attention during your recovery period?" (97.3% vs. 82.6%,  $p=0.0453$ ). The mean physician rating in the experimental group was 9.84 and in the control group was 9.80.

**Conclusions:**

An automated digital platform was successfully developed and has promising effects on patient satisfaction after FESS.

**11:23am****Faculty attitudes towards rhinology training: a survey of rhinology fellowship programs**

Charles A. Riley, MD  
Christian P. Sonner, MD  
Qasim Husain, MD  
Stacey T. Gray, MD, FARS  
Brent A. Senior MD, FARS  
Abtin Tabaee, MD, FARS  
New York, NY

**Introduction:**

The number of rhinology fellowship programs has grown rapidly over the past decade. To date, no standardization or accreditation process exists, raising the potential for disparate programs. The attitudes of faculty regarding training are important to elucidate the educational experience of rhinology fellowship.

**Methods:**

An anonymous, web-based survey of rhinology faculty assessed the subjective attitudes towards various domains of fellowship training including surgery, office-based procedures, research, and career development. A 5-point Likert scale assessing importance was used (1-not at all important, 5-extremely important).

**Results:**

A total of 34 faculty (response rate 35.8%) completed the survey. The surgical procedures that received the highest mean importance scores were endoscopic surgery for advanced inflammatory disease (4.9), CSF leak closure (4.8), and extended endoscopic sinus surgery (4.8). The procedures with the lowest scores were nasal valve repair (2.6), inferior turbinate surgery (3.6) and open approaches to the sinuses (3.7). A wide range of responses was noted for the minimum number of fellow cases for surveyed procedures. Higher importance scores were noted for direct attending supervision (4.6) when compared to fellow autonomy (3.5,  $p<0.001$ ) or shadowing (3.5,  $p<0.001$ ) in the operating room. Higher

scores were noted for career preparation in academic (3.8) versus private practice (2.8,  $p<0.001$ ) and providing opportunities for clinical (4.2) versus basic science research (2.4,  $p<0.001$ ). The majority of faculty felt there were too many fellowship positions with respect to the market place for private practice (58.8%), academic jobs (85.3%), as well as overall societal need (61.8%).

**Conclusion:**

A range of faculty attitudes with respect to fellowship training was noted in this study. Continued assessment and refinement of the educational experience in rhinology fellowships is necessary.

**11:30am****Discussion**

**Moderators: Sammy Khalili, MD & Jordan Glicksman, MD**

**11:32am****Gender-related quality of life assessments in chronic rhinosinusitis**

Gretchen M. Oakley, MD  
Shaelene Ashby, PhD  
Jeremiah A. Alt, MD, PhD, FARS  
Salt Lake City, UT

**Background:**

The impact of chronic disease on quality of life (QOL) is different between males and females, due, in part, to differences in biopsychosocial variables. However, it is unclear if variables known to be correlated with poorer QOL, such as depression, pain, and sleep dysfunction, contribute to the known sex differences in QOL scores in patients with chronic rhinosinusitis (CRS).

**Methods:**

Adult patients with CRS were prospectively enrolled into a cross sectional cohort study. Baseline demographics, CRS-associated comorbidities, objective findings by Lund-Mackay computed tomography (CT) and Lund-Kennedy endoscopy scores were assessed. The Sino-Nasal Outcome Test-22 (SNOT-22) was used to measure QOL. Depression was evaluated with Patient Health Questionnaire-2 (PHQ-2), sleep dysfunction with the Pittsburgh Sleep Quality Index (PSQI), and pain with the Short Form McGill Pain Questionnaire (SF-MPQ) and Brief Pain Inventory Short Form (BPI-SF).

**Results:**

Females (n=58) reported significantly worse SNOT-22 scores than males (n=62) in all subdomains (total score  $66.4\pm 16.1$  vs  $53.3\pm 17.7$ ;  $p>0.01$ ) except the Rhinologic subdomain. Females had significantly more depression risk ( $2.3\pm 1.9$  vs  $1.6\pm 1.8$ ;  $p>0.05$ ), sleep dysfunction ( $12.1\pm 4.5$  vs  $9.7\pm 4.5$ ;  $p>0.01$ ), and higher pain scores by both the SF-MPQ ( $16.7\pm 10.0$  vs  $9.7\pm 8.7$ ;  $p>0.01$ ) and BPI-SF ( $4.3\pm 1.9$  vs  $3.0\pm 1.1$ ;  $p>0.01$ ). Interestingly, females had significantly lower CT ( $11.4\pm 6.7$  vs  $14.2\pm 6.0$ ;  $p>0.05$ ) and endoscopy scores ( $4.9\pm 3.2$  vs  $6.4\pm 3.2$ ;  $p>0.01$ ) compared to males.

**Conclusion:**

Females had significantly worse CRS-specific QOL scores compared to males. The cluster of depression, pain, and sleep dysfunction was significantly higher in female subjects with CRS despite lower objective CRS measures.

**11:39am****Deviations from “appropriateness criteria” in the management of chronic rhinosinusitis and effect on outcomes**

Andrew Thamboo, MD  
Aakanksha Rathor, MD  
Nicole Bouchard, BSc  
Jayakar Nayak, MD, PhD  
Peter Hwang, MD, FARS  
Zara Patel, MD, FARS  
Vancouver, BC

**Introduction:**

In uncomplicated chronic rhinosinusitis (CRS), a consensus regarding appropriate medical therapy (AMT) prior to surgical intervention has been published in the form of “appropriateness criteria” for endoscopic sinus surgery (ESS). We sought to determine reasons why tertiary surgeons may deviate from the suggested criteria for AMT and to evaluate if those deviations resulted in change in outcomes.

**Methods:**

Patients with uncomplicated CRS were prospectively enrolled over the course of one year. Sinonasal Outcomes Test-22 (SNOT-22), Euro-QoL 5 Dimensions (EQ5D) and a physician form indicating management pathway and decision making was completed at each visit over a 6-month follow-up period. Descriptive analysis was used to quantify reasons for veering from the “appropriateness criteria” and repeated linear regression modeling was used to measure whether compliancy impacted the SNOT-22, EQ5D, general health score (out of 100) and Lund-Kennedy (LK) scores over this time period.

**Results:**

155 patients were enrolled. 68% followed the appropriate management pathway based on their presentation and the suggested criteria. Disparate reasons were documented for deviation in the other 32%, and in spite of establishing several predictive categories, “other” was the most common reason, with various explanations well documented. The SNOT-22, EQ5D, general health score and LK scores were not statistically impacted by compliancy status ( $p > 0.05$ ).

**Conclusion:**

The suggested “appropriateness criteria” predict a management pathway for the majority of CRS patients. However, in a tertiary sinus center, surgeons may deviate from that model with a significant minority of their patients, for multiple reasons, without causing a change in outcomes.

**11:46am****Quality indicators for the management of chronic rhinosinusitis**

Justin Cottrell, MD  
Jonathan Yip, MD  
Doron Sommer, MD  
John Lee, MD  
Shaun Kilty, MD  
Eric Monteiro, MD  
Toronto, Ontario

**Introduction:**

The development of quality indicators (QIs) should be prioritized when a large burden of illness exists, where evidence suggests variable care, where opportunity for improvement exists, and where improving quality will lead to patient benefit. Chronic rhinosinusitis (CRS) has recently been identified as a high priority disease category for quality improvement. To this effect, this study aimed to develop QIs to evaluate management that relieves patient discomfort, improves quality of life, and prevents complications.

**Methods:**

A guideline-based approach, proposed by Kotter et al (2012) was used to develop QIs for CRS. Candidate Indicators (CIs) were extracted from existing guidelines on the diagnosis and management of CRS. Guidelines were evaluated using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool. Each CI and its supporting evidence was summarized and reviewed by an expert panel based on validity, reliability, and feasibility of measurement. Final QIs were selected from CIs utilizing the modified RAND/UCLA appropriateness methodology.

**Results:**

Thirty-nine CIs were identified after literature review and put forward to our panel for evaluation. Of these, nine CIs had consensus as being appropriate QIs, with four requiring additional discussion. After a second round of evaluations, the panel selected ten QIs as appropriate measures of high quality care.

**Conclusions:**

This study proposes ten QIs for the management of patients with CRS. These QIs can serve multiple purposes including documenting the quality of care; comparing institutions and providers; prioritizing quality improvement initiatives; supporting accountability, regulation, and accreditation; and pay for performance initiatives.

**11:53am****Analysis of absorbable hemostatic packing (ahp) compared to physiologic hemostasis in “real world” sinus surgery**

Brett T. Comer, MD  
 Kristan P. Alfonso, MD  
 Edward J. Doyle III, MD  
 James Gallogly, BS  
 Matthew C. Simpson, MPH  
 Justin L. Antisdell, MD, FARS  
 Lexington, KY

**Objective:**

To examine outcomes after FESS +/- septoplasty with the use of AHP vs. physiologic hemostasis.

**Study Design:**

Prospective double-blinded randomized control trial.

**Methods:**

Fifty-five patients receiving bilateral FESS +/- septoplasty from two academic surgeons were prospectively enrolled to receive randomly one of multiple types of AHP in one middle meatus and no packing contralaterally. Subjective outcomes (pain, bleeding, obstruction, discharge) on self-reported VAS questionnaires were tabulated on postoperative days 0, 1, 7, and 14. Endoscopic objective outcomes (synechia formation, edema, infection, granulation, debridement, crusting) were measured at 1 week, 2 weeks, and 6 weeks postoperatively.

**Results:**

Results show no overall difference in subjective or objective outcomes. There was a trend towards statistical significance with less synechia formation at POD#7 ( $P=0.06$ ) in the AHP group. Surgeon 1's patients experienced higher synechia scores at week 6 ( $p=0.03$ ) and higher granulation and debridement scores at week 1 ( $p<0.01$ ) on their treated side compared to surgeon 2, consistent with characteristics of the different AHPs reported elsewhere. Data also suggests concurrently performed septoplasty results in higher subjective patient scores (though not objective scores) ( $P<0.05$ ) at several points during the healing process, with analysis ongoing.

**Conclusion:**

This first ever prospective randomized study of non-selected patients with “real-world” choices of AHP found AHP makes no significant difference on subjective and objective postoperative outcomes as compared to physiologic hemostasis. Previous AHP-specific studies have shown differences in selected patient groups (i.e.: non-septoplasty). Generalizing study-proved benefits of specific AHP to all AHP is shown to be not appropriate.

**12:00pm****Discussion****12:05pm****Lunch with Exhibitors**

## Friday, April 20, 2018

### AM Session

### Scientific Room #2

### Maryland D

**Moderators: Oswaldo Henriquez, MD & Monica Patadia, MD**

**8:00am****A multi-institutional review of outcomes in biopsy-proven acute invasive fungal sinusitis**

Grace Wandell, MD  
 Craig Miller, MD  
 Greg E. Davis, MD, FARS  
 Justin H. Turner, MD, PhD  
 Peter H. Hwang, MD, FARS  
 Ian M. Humphreys, DO, FARS  
 Seattle, WA

**Introduction:**

Acute invasive fungal sinusitis (AIFS) is a rare, aggressive infection that typically occurs in immunocompromised patients. The aims of this study were to identify patient factors and whether immune stimulating medications (ISM) (e.g., granulocyte colony stimulating factor) impact survival in the largest cohort reported to date.

**Methods:**

Retrospective review of medical records were reviewed for biopsy-proven AIFS from three tertiary academic institutions from 1995-2016. Variables were analyzed using log rank survival analysis.

**Results:**

A total of 115 patients were included; 44 received ISM. Mean follow-up was 1.1 years. The overall mortality was 42%. Patients with hematologic malignancy had poor survival (RR 6.75,  $p<0.0001$ ). Recent bone marrow transplant (BMT) and chemotherapy within one month were significant risk factors (BMT RR 11.02,  $p<0.0001$ ; chemotherapy RR 3.51,  $p<0.0001$ ). Infection with non-zygomycetes fungal pathogens (RR 9.48,  $p<0.0001$ ) and extension into the cavernous sinus (RR 5.31  $p=0.002$ ) were associated with increased mortality. Both ANC  $<500$  and  $<1000$  were associated with worse survival ( $<500$  RR 3.40,  $p<0.0001$ ;  $<1000$  RR 4.47,  $p<0.0001$ ). Surprisingly, use of immune stimulating medications was associated with poorer survival (RR 2.04,  $p=0.013$ ).

**Conclusions:**

We present the largest case-series of AIFS and long-term survival follow-up from three tertiary academic institutions. A history of hematologic malignancy, BMT, and non-zygomycetes fungal species were strongly associated with poorer survival. ANC  $<1000$  may be a more appropriate prognostic marker (than  $<500$ ) for poorer survival. Use of ISM was associated with increased mortality in this cohort; however, this may be due to selection bias and warrants further investigation.

**8:07am****The role of galactomannan aspergillus antigen in diagnosing acute invasive fungal sinusitis**

Clelie C. Melancon, MD  
 Jennifer Lindsey, BS  
 John D. Clinger MD  
 Winston Salem, NC

**Introduction:**

Pathologic diagnosis remains the gold standard for final diagnosis of acute invasive fungal sinusitis (AIFS), however other less invasive tests could suggest the presence of AIFS in at risk populations where early diagnosis is crucial. The role of serum galactomannan aspergillus antigen (GAA) has been shown to correlate with a diagnosis of invasive pulmonary aspergillosis, however it has not adequately been evaluated in regard to AIFS in the literature. The objective of this study is to evaluate the statistical relevance of GAA in predicting diagnosis of AIFS.

**Methods:**

Retrospective review of pathologic records using Co-Path from 2007-2017, incorporating two searches with criteria identifying patients who received pathologic evaluation for AIFS. Electronic medical records were subsequently reviewed.

**Results:**

After exclusions isolating at risk populations, 78 cases were reviewed using the above search criteria. Of these, 38 met further criteria of having had both pathologic evaluation and GAA analysis. Statistical variables were assessed, as well as mortality. Overall, GAA had a sensitivity of 43%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 32%. Within one month of positive pathology result, mean peak positive GAA value was 4.17, and mean closest positive GAA value was 3.6.

**Conclusion:**

Positive serum GAA can be an indication of AIFS in patients with a high clinical suspicion. In our study, a positive GAA always correlated with a positive pathologic diagnosis. However, given its low sensitivity, one must use caution in relying on galactomannan as a screening tool in diagnosis of AIFS.

**8:14am****Size of septectomy does not affect distribution of nasal irrigation following endoscopic modified lothrop procedure**

Christopher R. Roxbury, MD  
 Dennis Tang, MD  
 Janki Shah, MD  
 Jennifer McBride, PhD  
 Troy D. Woodard, MD, FARS  
 Raj Sindwani, MD, FARS  
 Cleveland, OH

**Background:**

The endoscopic modified Lothrop procedure (EMLP) is

commonly performed in recalcitrant frontal sinusitis to achieve better penetration of medicated irrigations post-operatively. While EMLP requires a septectomy for exposure, it is unknown if septectomy size affects delivery of irrigations. This study evaluates the role of septectomy in delivery of irrigations to the EMLP cavity.

**Methods:**

EMLP was performed on fresh human cadavers with sequentially increasing septectomy (minimal septectomy: drilling across septum to combine frontal sinuses; standard septectomy: 1cm anterior to middle turbinate and inferiorly to the mid-level of the turbinate; large septectomy: extension to nasal floor). Irrigation with fluorescein-labeled free water was performed with a 240ml irrigation bottle in the vertex position and recorded with a 30-degree endoscope fixed in a 4mm trephine in the paramedian EMLP cavity. Two blinded reviewers scored irrigation distribution (0: nasal cavity only; 1: frontal recess; 2: medial distribution; 3: lateral distribution; 4: entire sinus lavage). Ordinal distribution scores were assessed using Kendall's tau-b.

**Results:**

Six specimens (mean age 75.2±2.4, 50% female) were assessed. There were no significant differences in lavage distribution with standard septectomy or large septectomy compared to minimal septectomy (10.9% vs 13.0%, p=0.10; 12.5% vs 13.0%, p=0.24). Inter-observer scores were highly concordant (Kendall's W: 0.83, p<0.01).

**Conclusions:**

Septectomy size does not affect irrigation delivery in patients undergoing EMLP. These results suggest that a limited septectomy for access to the bilateral frontal sinuses is all that is required for effective drug delivery. This strategy may reduce morbidity and complications associated with larger septectomies.

**8:21am****Draf IIB with superior septectomy vs Draf Iii: Comparison of irrigant penetration**

Vidur Bhalla, MD  
 Tran B Le, MD  
 Jennifer A. Villwock, MD  
 Stanley W. McClurg, MD, FARS  
 Donald D. Beahm, MD  
 Alexander G. Chiu, MD, FARS  
 Kansas City, KS

**Introduction:**

Previous studies have demonstrated a high failure rate of Draf 2b in patients with chronic rhinosinusitis with nasal polyposis, particularly in patients with comorbidities such as asthma or aspirin exacerbated respiratory disease. A high percentage of these patients eventually require a Draf 3. This study seeks to compare the distribution of sinus irrigations in Draf 2b with a superior septectomy (Draf 2b+SS) vs Draf 3.

**Methods:**

Endoscopic sinus surgery with Draf2b+SS was performed on 6 cadaver heads. Fluorescein-dyed irrigations were performed on each head and penetration was recorded using video endoscopy. Draf 3 was subsequently performed on each head with repeat dye-irrigation and video endoscopy. The videos were reviewed by four, blinded fellowship-trained rhinologists and penetration of the olfactory cleft and maxillary, ethmoid, frontal, and sphenoid sinuses were graded 0 to 3 (3 implying complete staining).

#### Results:

The mean scores when comparing Draf2b+SS to Draf 3 were as follows: Overall 1.99 vs 2.03 ( $p=0.717$ ), maxillary sinus 2.69 vs 2.48 ( $p=0.120$ ), ethmoid sinus 1.85 vs 1.96 ( $p=0.502$ ), sphenoid sinus 2.67 vs 2.75 ( $p=0.531$ ), frontal sinus 1.08 vs 1.35 ( $p=0.063$ ), olfactory cleft 1.69 vs 1.63 ( $p=0.674$ ), respectively. There was no significant difference overall or between subsites. Interrater reliability (Cronbach's  $\alpha=0.81$ ) was good.

#### Conclusion:

In patient populations that are high risk to fail Draf 2b, adding a superior septectomy provides similar drug delivery benefits to Draf 3, without the need for altering natural sinus outflow and creating circumferential scarring. Further studies evaluating its use in these patients are needed.

#### 8:28am Q&A

#### 8:32am

##### Panel: ICAR: Allergic Rhinitis – What we Know and What we Don't

Panelists: Sandra Lin, MD, FARS & Elina Toskala, MD, FARS

##### Moderators: Ian Humphreys, DO, FARS & Charles Ebert, MD, FARS

#### 9:04am

##### Activation of the rat olfactory bulb by direct ventral stimulation following nerve transection

Leandro Socolovsky, BS  
Daniel H. Coelho, MD  
Richard M. Costanzo, PhD  
Richmond, VA

#### Introduction:

To demonstrate direct electrical stimulation can activate the olfactory bulb after denervation of the olfactory nerve input.

#### Methods:

Sprague-Dawley rats ( $n=5$ ) were anesthetized and olfactory bulbs exposed. Olfactory nerves were transected by passing a Teflon blade between the cribriform plate and ventral surface of the bulb. A cochlear implant electrode array was used to stimulate 6 different positions along the ventral surface of the olfactory bulb. Biphasic con-

stant-current pulses were used (50-1000uA, 50-1000 us) to stimulate the bulb, and a 16-electrode paddle array was used to record localized negative field potential responses at the dorsal surface of the bulb.

#### Results:

Localized negative field potentials were reliably obtained using biphasic, 500  $\mu$ A, 200  $\mu$ s pulses. A shift in stimulating position by 1mm resulted in a significant change in the dorsal field potential.

#### Conclusions:

Direct stimulation of the de-afferented olfactory bulb was effective in generating localized field potential responses. These findings support the potential use of direct electrical stimulation for the treatment of anosmia.

#### 9:11am

##### Establishing the minimal clinically important difference for the questionnaire of olfactory disorders

Jose L. Mattos, MD, MPH  
Rodney J. Schlosser, MD, FARS  
Jess C. Mace, MPH  
Timothy L. Smith, MD, MPH  
Zachary M. Soler, MD, Msc  
Charlottesville, VA

#### Introduction:

Olfactory-specific quality of life (QOL) can be measured using the Questionnaire of Olfactory Disorders Negative Statements (QOD-NS). Changes in the QOD-NS after treatment can be difficult to interpret since there is no standardized definition of clinically meaningful improvement. ?

#### Methods:

Patients with chronic rhinosinusitis (CRS) completed the QOD-NS. Four distribution-based methods were used to calculate the minimal clinically important difference (MCID): 1) one-half standard deviation (SD), 2) standard error of the mean (SEM), 3) Cohen's effect size (d) of the smallest unit of change, and 4) minimal detectable change (MDC). We also averaged all four of the scores together. Finally, the likelihood of achieving a MCID after sinus surgery using these methods, as well as average QOD-NS scores, was stratified by normal vs. abnormal baseline QOD-NS scores. ?

#### Results:

Outcomes were examined on 128 patients. The mean improvement in QOD-NS score after surgery was 4.3 [ $SD\pm 11.0$ ] for the entire cohort and 9.6 [ $SD\pm 12.9$ ] for those with abnormal baseline scores ( $p<0.001$ ). The MCID values using the different techniques were: 1)  $SD = 6.5$ ; 2)  $SEM = 3.1$ ; 3)  $d = 2.6$ ; 4)  $MDC = 8.6$ . The MCID score was 5.2 on average. For the total cohort analysis, the likelihood of reporting a MCID ranged 26%–51%, and 49%–70% for patients reporting preoperative abnormal olfaction. ?

#### Conclusions:

Distribution-based MCID values of the QOD-NS range between 2.6 to 8.6 points, with an average of 5.2. When stratified by preoperative QOD-NS scores the majority of patients reporting abnormal preoperative QOD-NS scores achieved a MCID.

#### 9:18am

##### **Olfactory outcomes after frontal sinus surgery and stent placement**

Lauren C. Williams, BA  
Sarah M. Kidwai, MD  
Alfred-Marc Iloreta, MD  
Satish Govindaraj, MD  
New York, NY

#### Introduction:

Endoscopic sinus surgery improves olfaction in patients with chronic rhinosinusitis. Frontal sinusotomy decreases obstruction and improves nasal airflow, thereby allowing flow of molecules to olfactory epithelium. On the other hand, the proximity of the olfactory epithelium to the frontal sinus renders the area vulnerable to damage. There is limited data on olfactory outcomes after frontal sinus surgery. We hypothesized that subjective olfaction improves after frontal sinus surgery and stent placement.

#### Methods:

Retrospective review of patients that underwent Draf IIa, IIb, or III frontal sinusotomy with or without frontal sinus stent placements with review of data from pre- and post-operative Sino-Nasal Outcome Tests.

#### Results:

A total of 79 patients were reviewed. There was a mean overall increase in olfaction of 2.10 +/- 2.12 points ( $p < 0.001$ ) with no significant difference in mean change between each group. Patients who had steroid-eluting frontal sinus stents had an increase in olfaction of 3.20 points, whereas patients who had silastic stents had an improvement of 1.49 points ( $p = 0.009$ ). There was a slight worsening of olfaction in the long term ( $> 3$  months post-op,  $p = 0.03$ ).

#### Conclusions:

There was no difference in olfaction between patients who underwent Draf IIa or IIb and Draf III procedures. On the other hand, patients with steroid-eluting frontal sinus stents had a significantly greater improvement in olfaction compared to those with silastic stents. While the extent of frontal sinusotomy may not have an effect on olfaction, steroid-eluting stents in the frontal sinus may have a positive impact on olfaction.

#### 9:25am

##### **Voxel based brain perfusion analysis for olfactory assessment in patients with dizziness and dementia: Insights from functional spect neuroimaging**

Reza Nemati, MD

*Presented by Zaman Afrasiabi, MD, MSc Candidate*  
Negar Chabi, MSc

Zahra Akbari, MD

Mohammad-Ali Nayyeri, MD

Iraj Nabipour, Professor

Majid Assadi, Professor

Bushehr, Bushehr

#### Introduction:

To compare regional cerebral blood flow for patients with olfactory dysfunction and patients with normal olfaction in patients with Dizziness and Dementia as well as performing correlation analysis between olfactory test scores and brain SPECT perfusion.

#### Methods:

21 (5 men, 16 women) with dizziness (mean age = 54.04 ± 26.04) and 8 (3 men, 5 women) with dementia (mean age = 59.12 ± 12.12) participated. All subjects underwent 99mTc-ECD SPECT imaging and olfactory testing. Statistical analysis including between group and correlation analysis were performed by SPM1 program.

#### Results:

Statistical analysis on Dementia and Dizziness group data revealed lower perfusion in (Right Cerebrum, Frontal Lobe) and (Right Cerebrum, Temporal Lobe, parietal lobe) in the "patients with olfactory dysfunction" compared by "the same group with normal olfactory function" ( $p < 0.001$  uncorrected for multiple comparisons) respectively. Furthermore, correlation analysis between brain perfusion and olfactory test scores was done for both groups ( $p < 0.005$  uncorrected for multiple comparisons). In Dizziness, positive correlation was seen mostly in Right Cerebrum, Temporal Lobe, Middle and superior Temporal Gyrus. In Dementia, positive correlation occurs in Right Cerebrum, Frontal Lobe, Inferior Frontal Gyrus and Right Cerebrum, Parietal Lobe, Postcentral Gyrus.

#### Conclusions:

Our findings reveal that voxel-based analysis on brain perfusion SPECT and olfactory test scores are effective in finding the relationship between perfusion and olfactory test response. To our knowledge, this analysis has not been performed previously.

#### Keywords

1Statistical Parametric Mapping (SPM), 99mTc-ECD SPECT, Olfactory test, Olfactory impairment, Dizziness, Dementia

#### 9:32am

##### **Q&A**

#### 9:36am

##### **Effects of sinupret on mucociliary clearance and airway surface liquid height of sinonasal epithelial cultures**

Alan D. Workman, BA

Vasiliki Triantafyllou, BS

David W. Kennedy, MD, FARS

James N. Palmer, MD, FARS

Nithin D. Adappa, MD, FARS

Noam A. Cohen, MD, PhD, FARS

Philadelphia, PA

**Background:**

Sinupret extract is an ethanolic extract of a mixture of five herbs that has been sold in different formulations for decades in the European market and more recently, in the United States market as an over-the-counter treatment for rhinosinusitis. Previous studies indicated activation of chloride secretion via CFTR and increase in ciliary beat frequency by Sinupret extract, but the functional consequences on mucociliary transport velocity and airway surface liquid homeostasis are unknown.

**Methods:**

Human sinonasal epithelial cells were grown at an air-liquid interface (ALI), with addition of Sinupret extract basolaterally in each experiment. Mucociliary transport velocity was assessed using live imaging of polystyrene fluorescent microspheres. Additionally, airway surface liquid (ASL) height changes were recorded.

**Results:**

Sinupret extract concentrations of 50 µg/ml, 150 µg/ml, and 500 µg/ml were tested. Basolateral application of compound resulted in a non-dose-dependent increase in ASL height compared to controls at 15 minutes, and this effect persisted through the one-hour duration of the experiment ( $p < 0.01$ ). Basolateral application of Sinupret extract also resulted in a non-dose-dependent increase in mucociliary clearance at 45 and 60 minutes following compound application ( $p < 0.01$ ).

**Conclusions:**

Basolateral application of Sinupret extract appears to elicit increases in mucociliary clearance and airway surface liquid height. These properties can potentially be leveraged for therapeutic efficacy in diseases affecting mucus production and mucociliary transport.

**9:43am**

**Ciliostimulatory properties of Broncho-vaxom® Soluble Components**

Vasiliki Triantafyllou, BS  
 Alan D. Workman, BA  
 David W. Kennedy, MD, FARS  
 James N. Palmer, MD, FARS  
 Nithin D. Adappa, MD, FARS  
 Noam A. Cohen, MD, PhD, FARS  
 Philadelphia, PA

**Introduction:**

Broncho-Vaxom® is an extract of infectious respiratory bacteria that is used as an immunostimulant outside of the United States for the prevention and treatment of bronchitis and rhinosinusitis. Prior studies have demonstrated that use of Broncho-Vaxom® is associated with reduction in frequency of respiratory infection and decreased duration of antibiotic usage. However, effects on mucociliary clearance are unknown.

**Methods:**

Human sinonasal epithelial cells were grown at an air-liquid interface (ALI). Broncho-Vaxom® was suspended at 1mg/ml in saline and centrifuged, with extraction of the soluble supernatant. This supernatant was added apically to ALI cultures from tissue of five unique patients, and ciliary beat frequency (CBF) changes were recorded.

**Results:**

Apical application of Broncho-Vaxom® resulted in an increase in CBF over a period of 5 minutes, significantly greater than changes observed in saline-stimulated control cultures ( $p < 0.05$ ). ALI pretreatment with L-Nitroarginine methyl ester (L-NAME), a nitric oxide synthase inhibitor, partially blocked Broncho-Vaxom®-induced increases in CBF.

**Conclusions:**

Broncho-Vaxom® has ciliostimulatory properties that may be partially responsible for its observed efficacy as a respiratory therapeutic. Nitric oxide dependence of the CBF increase is suggestive of a possible taste receptor (T2R)-mediated mechanism of action. Further work is necessary to elucidate specific component-receptor signaling relationships.

**9:50am**

**Cox-2 overexpression in schneiderian papillomas**

Kevin Hur, MD  
 Jeffrey D. Suh, MD  
 Elisabeth H Ference, MD, MPH  
 Bozena Wrobel, MD, FARS  
 Los Angeles, CA

**Background:**

Schneiderian papillomas (SP) are aggressive benign sinonasal tumors where the standard treatment is surgical resection. However, SP occasionally extend into areas that are unresectable. Cyclo-oxygenase-2 (COX-2) has been reported as a possible therapeutic target. Our objective was to evaluate COX-2 expression in SP.

**Methods:**

Immunohistochemistry for COX-2 was performed on SP samples and middle turbinates from chronic rhinosinusitis controls obtained during surgical resection between 2009-2017. A positive stain was defined as having 10% or more cells exhibiting diffuse immunoreactivity. Comparisons were performed using Fisher Exact tests, t-tests, and ANOVA.

**Results:**

The study included 67 tumor samples and 9 controls from two academic institutions. The mean age of the SP group was 55.4 years. Thirty-nine (58.2%) SP patients had previous surgery compared to 1 (11.1%) in the control group ( $p = 0.01$ ). The most common tumor attachment sites were the maxillary (47.8%) and ethmoid (25.4%) sinuses. Fifteen (22.4%) SP samples stained strongly positive for COX-2 and 24 (35.8%) stained weakly positive compared to no positive stains in the control group ( $p < 0.01$ ). When stratified by COX-2 intensity, there were



no statistically significant differences in gender, smoking history, history of previous sinus surgery, site of attachment, papilloma subtype, or future recurrence between SP samples.

#### Conclusion:

COX-2 was overexpressed in 58.2% of SP cases, and strongly positive in 22.4% of cases, compared to controls. No significant differences in COX-2 expression were observed between subtypes or recurrent tumors. Further studies are warranted to evaluate COX-2 as a possible therapeutic target in tumors that overexpress the enzyme.

#### 9:57am

##### Q&A

#### 10:00am

##### Break with Exhibitors

#### Moderators: John Lee, MD &

#### Troy Woodard, MD, FARS

#### 10:30am

##### The benefits of high volume pituitary centers: An analysis of socioeconomic and morbidity outcomes

Sean McKee, BS  
Anthony M. Yang, BS  
Sarah M. Kidwai, MD  
Joshua M. Zeiger, BA  
Raj M. Shrivastava, MD  
Alfred Iloreta, MD  
New York, NY

#### Introduction:

In this study we investigated the effect of hospital volume on readmission rates, complications, and prolonged length of stay (pLOS) following transsphenoidal resection of pituitary adenomas.

#### Methods:

Statewide Planning and Research Cooperative System (SPARCS) database was queried to investigate 30-day readmissions, pLOS (5+ days), and complications of transsphenoidal pituitary resections in New York State from 1995–2015. Hospitals were classified by volume. Multivariate logistic regression, adjusting for patient and hospital characteristics, was performed to assess the effect of volume on outcomes.

#### Results:

9,950 patients were identified. 7,122 (71.6%) were treated at high-volume (76-100th percentile), 2,394 (24.1%) at medium-volume (26-75th percentile), and 434 (4.4%) at low-volume centers (0-25th percentile). 30-day readmission rates for high, medium, and low-volume hospitals were 6.66%, 7.52%, and 8.99%, respectively ( $p=0.0853$ ). Multivariate analysis showed no statistically significant difference in 30-day readmissions for high (OR=0.821, 95% CI 0.572-1.179,  $p=0.2856$ ) or medium (OR=0.861, 95% CI 0.594-1.248,  $p=0.429$ ) compared to low-volume centers.

The proportion of patients with pLOS at high, medium, and low-volume centers was 19.21%, 37.30%, and 45.54%, respectively ( $p<0.001$ ). Multivariate analysis further demonstrated that patients treated at high-volume (OR=0.34, 95% CI 0.27-0.42,  $p=0.007$ ) and medium-volume (OR=0.738, 95% CI 0.59-0.92,  $p<0.001$ ) centers were less likely to have pLOS.

Complications showing statistically significant differences based on hospital volume included fluid and electrolyte abnormalities ( $p<0.001$ ) but not CSF leaks ( $p=0.071$ ) or diabetes insipidus ( $p=0.236$ ).

#### Conclusions:

This analysis suggests that patients undergoing transsphenoidal pituitary surgery at higher volume centers have better outcomes with lower rates of postoperative electrolyte abnormalities and pLOS.

#### 10:37am

##### Nationwide analysis of unplanned 30-day readmissions after transsphenoidal pituitary surgery

Zain H. Rizvi, MD  
Rocco Ferrandino, BS  
Marvin Bergsneider, MD  
Jeffrey Suh, MD  
Marilene Wang, MD, FARS  
Los Angeles, CA

#### Introduction:

Transsphenoidal pituitary surgery has evolved into an increasingly safe procedure with shorter hospitalizations, yet unplanned readmissions remain a quality measure with a paucity of data. We sought to examine rates, timing, etiologic factors, and costs surrounding readmission after transsphenoidal pituitary surgery.

#### Study Design:

Retrospective cohort study

#### Methods:

The Nationwide Readmissions Database (NRD) was queried for patients who underwent transsphenoidal partial or total excision of the pituitary gland between 1/2013 - 11/2013. Patient, procedure, admission, and hospital-level characteristics were compared for patients with and without unplanned thirty-day readmission. Multivariate logistic regression was used to identify predictors of readmission.

#### Results:

A total of 8546 patients, with a median age of 54 and female predominance who underwent pituitary surgery were identified, with 742 patients experiencing at least one unplanned readmission within thirty days of the index admission. Readmission was most frequently due to neurohypophyseal or electrolyte disorders followed by cerebrospinal fluid leak, hemorrhage, and meningitis. Median length and cost of stay of index admission and was greater in the readmission group ( $P<.001$ ). Fluid and

electrolyte disorders as well as neurologic disease (most commonly epilepsy or convulsions) present on initial admission were predictive of length of initial stay and readmission ( $p < .001$ ). Median cost of readmission was \$7723 and most frequently occurred within 7 days of discharge.

#### Conclusions:

Approximately 8.7% of patients undergoing transsphenoidal pituitary surgery experience an unplanned readmission within 30 days of discharge. Mitigation of risks factors identified should be considered, to reduce preventable readmissions, minimize adverse events, and lower healthcare costs.

#### 10:44am

##### **Role of a laser sintered model to train endoscopic surgeons how to manage a catastrophic internal carotid artery injury**

Guillermo Maza, MD  
 Kyle K. VanKoeveering, MD  
 Juan C. Yanez-Siller, MD  
 Tekin Baglam, MD  
 Bradley A. Otto, MD  
 Daniel M. Prevedello, MD  
 Ricardo L Carrau, MD  
 Columbus, OH

#### Introduction:

The catastrophic nature of internal carotid artery (ICA) injuries limits training opportunities. Cadaveric and animal models have been proposed but they are expensive and their complicated logistics have limited wider adoption. 3D printed models have proved to be advantageous at improving surgical skills and psychomotor behavior. Therefore, this study evaluates the role of a laser-sintered model combined with a standardized training, in improving expertise needed to manage an ICA injury.

#### Methods:

A laser-sintered model made of polyamide nylon and glass beads was designed with a 3-mm defect in the paraclival carotid canal. Artificial blood was directed by gravity (replacing the use of a specialized pump required by previous models). Surgeons with varying training and experience levels were asked to stop the "ICA bleeding" as they would in a clinical scenario. This was followed by individualized formative training, and a second simulation. Self-confidence assessment questionnaires, volume-of-blood-loss and time-to-hemostasis were compared through paired t-test.

#### Results:

The cohort comprised 20 otolaryngologists and 26 neurosurgeons. Following instructions, average parameters changed as follows:

- Confidence level increased from 3 to 8 ( $P < 0.01$ ).
- Time to hemostasis was reduced from 135 seconds to 42 seconds ( $P < 0.01$ )
- Blood loss was reduced from 690 ml to 272ml ( $P < 0.01$ )

#### Conclusion:

This ICA injury training model, along with a formalized training algorithm, appears to be valuable and cost-effective. Significant improvement in all measurements suggests the acquisition of psychomotor skills required to control an ICA injury.

#### 10:51am

##### **5-year outcomes of salvage endoscopic nasopharyngectomy for recurrent nasopharyngeal carcinoma**

Andrew Thamboo, MD, MHSc  
 Vishal S. Patel, BS  
 Peter H. Hwang, MD, FARS  
 Vancouver, BC

#### Background:

Recurrent nasopharyngeal carcinoma (rNPC) can be salvaged with re-irradiation, open nasopharyngectomy, and more recently endoscopic nasopharyngectomy. However, long-term outcomes of endoscopic approaches are lacking. Thus, we report 5-year outcomes following endoscopic nasopharyngectomy for rNPC.

#### Methods:

Patients who underwent endoscopic nasopharyngectomy for rNPC between November 2000 and November 2012 were retrospectively reviewed. Inclusion criteria included a minimum 5-year follow-up time after surgery. Presenting (pTNM) status and recurrent (rTNM) status for each recurrence was determined. Outcomes included margin status, disease recurrence, death, and complication rates.

#### Results:

Thirteen patients were included. Mean time follow-up was 74.3 months (range = 56.4 – 96 months). Negative margins were achieved in 77% of initial cases. Positive margins were associated with higher rT stages. Re-recurrence was seen in 6 patients, which was also associated with a higher pStage and rStage. All patients with positive margins had re-recurrence. Four patients required repeat endoscopic nasopharyngectomy and two received chemoradiation. All four with a second endoscopic procedure had further disease recurrence. Five-year local disease-free and overall survival rates were 53.9% and 84.6%, respectively. The minor complication rate was 52.6%, major operative complication rate was 0.0%, and late complication rate was 23.1%.

#### Conclusion:

Endoscopic nasopharyngectomy demonstrates promising 5-year overall survival rate for rT1-2 and select rT3 cases of rNPC with favorable complication rates. Lower rStages were associated with a higher disease-free rate, and lower pStages were associated with improved overall prognosis. Close surveillance and prompt management of recurrences can be associated with favorable long-term tumor control.

**10:58am****Is there a connection between endoscopic endonasal skull base surgery and empty nose syndrome? A pilot Cfd study**

Guillermo Maza, MD  
 Chengyu Li, PhD  
 Bradley A. Otto, MD  
 Alexander A. Farag, MD, FARS  
 Ricardo L. Carrau, MD  
 Kai Zhao, PhD  
 Columbus, OH

**Introduction:**

Empty nose syndrome (ENS) is a rare and debilitating disease that despite medical advancements remains controversial. One puzzling fact is that patients who undergo endoscopic endonasal approaches (EEA) often receive resection of the turbinates and posterior septum, yet seldom develop ENS symptoms. In this pilot study, we analyzed and compared the computational fluid dynamics (CFD) and symptom differences among EEA patients and against confirmed ENS and healthy cohorts.

**Methods :**

CT scans of 4 EEA patients were collected and analyzed utilizing CFD techniques. All of them had undergone unilateral middle turbinectomy and posterior septectomy. Two of them had confirmed ENS symptoms based on ENSQ6 questionnaire (score >11), while the other two were asymptomatic. Previously published data of 27 non-EEA ENS patients and 42 healthy controls served as reference.

**Results :**

Post-EEA patients with ENS had very similar nasal airflow patterns as non-EEA ENS patients. The patterns significantly differed from that of EEA without ENS patients and healthy controls. The ENS groups exhibited airflow dominant in the middle meatus region and significantly less flow in the inferior turbinate region (EEAwENS: 17.74%±4.00% vs EEAw/oENS: 51.25%±3.33%, p<0.0001; non-EEA ENS: 25.8±17.6%; healthy: 36.5±15.9%) as well as lower peak wall-shear-stress (EEAwENS: 0.30±0.13 vs EEAw/oENS: 0.61±0.03, p=0.003; non-EEA ENS: 0.58±0.24; healthy: 1.18±0.81 Pa).

**Conclusion:**

These results suggest that turbinectomy and/or posterior septectomy may have varying functional impact and that ENS symptoms go beyond anatomy, but rather correlate with aerodynamic changes. The findings open the door for CFD as potential objective diagnosis as well as prevention of ENS.

**11:05am****Impact of endoscopic craniofacial resection on simulated nasal airflow and heat transport**

Parth V. Shah, MD  
 (Presented by Lauren F. Tracy, MD)  
 Saikat Basu, PhD  
 Adam M. Zanation, MD  
 Julia S. Kimbell, PhD  
 Chapel Hill, NC

**Introduction:**

Craniofacial resections (CFR) are performed for extensive anterior skull base lesions. This surgery involves removal of multiple intranasal structures, potentially leading to empty nose syndrome (ENS). However, many patients remain asymptomatic postoperatively. Our objective was to analyze the impact of CFR on nasal physiology and airflow using computational fluid dynamics (CFD). This is the first CFD analysis of post-CFR patients.

**Methods:**

Three-dimensional sinonasal models were constructed from postoperative imaging using Mimics™. Hybrid computational meshes were created. Steady inspiratory airflow and heat transport were simulated at patient-specific flow rates using shear stress transport k-omega turbulent flow modeling in Fluent™. Simulated average heat flux (HF) and surface area where HF exceeded 50 W/m<sup>2</sup> (SAHF50) were compared with laminar simulations in nine non-operated adults.

**Results:**

Three adults underwent CFR without developing ENS. Average HF (W/m<sup>2</sup>) were 132.70, 134.84, 142.60 in the CFR group, ranging from 156.24 to 234.95 in the non-operative cohort. SAHF50 (m<sup>2</sup>) values were 0.0087, 0.0120, 0.0110 in the CFR group, ranging from 0.0082 to 0.0114 in the non-operative cohort. SAHF50 was distributed throughout the CFR cavities, with increased HF at the roof and walls compared to the non-operative cohort.

**Conclusion:**

Average HF was low in the CFR group compared to the non-operative cohort. However, absence of ENS in most CFR patients may be due to their large stimulated mucosal surface area, commensurate with the non-operative cohort. Diffuse distribution of stimulated area may result from turbulent mixing after CFR. To better understand heat transport post-CFR, a larger cohort is necessary.

**11:12am****Discussion**

**11:15am****Panel: Skull Base**

Moderator: Adam Zanation, MD  
 Panelists: Nithin Adappa, MD, FARS, Bradford Woodworth, MD, FARS, Sarah Wise, MD, FARS, Richard Harvey, MD, FARS

## Friday, April 20, 2018

### PM Session

### Maryland B 4-6

**Moderators: Erin O'Brien, MD, FARS & J. Pablo Stolovitsky, MD, FARS**

**1:00pm****The price of pain in chronic rhinosinusitis**

Kristine A. Smith, MD  
 Shaelene Ashby, PhD  
 Richard R. Orlandi, MD, FARS  
 Gretchen Oakley, MD  
 Jeremiah A. Alt, MD, PhD, FARS  
 Salt Lake City, UT

**Background:**

Chronic rhinosinusitis (CRS) is associated with productivity losses exceeding \$13 billion US annually. Although pain is well known to significantly affect patient productivity in other diseases, its economic impact on CRS-related lost productivity has not been examined. The objective of this study was to determine whether CRS-related facial pain correlates with lost productivity in patients with CRS.

**Methods:**

Seventy patients with CRS were enrolled in a cross-sectional investigation. Patients with a history of systemic inflammatory disease, ciliary dysfunction, chronic pain syndromes, migraines, and fibromyalgia were excluded. Pain was measured using the Brief Pain Inventory Short Form (BPI-SF) and the Short-Form McGill Pain Questionnaire (SF-MPQ). Presenteeism, absenteeism and lost work, household, and overall productivity were assessed. Regression analysis was performed to assess potential confounders, including depression.

**Results:**

Pain as measured with BPI-SF and SF-MPQ total scores correlated with all domains of productivity losses. Overall, lost productivity was significantly correlated with pain (R range =0.354 to 0.485,  $p<0.001$ ). Presenteeism (reduced work efficiency) had the largest correlation with all of the overall pain scores (R range =-0.366 to -0.515,  $p<0.001$ ). Lost household productivity time was the least affected by pain (R range =0.267-0.389,  $p<0.05$ ). These correlations remained statistically significant following regression analysis, which accounted for depression ( $p<0.05$ ).

**Conclusion:**

A significant correlation exists between CRS-related facial pain and productivity losses in patients with CRS that is independent of depression. Facial pain has the strongest correlation with presenteeism, which is the main driver of productivity losses and indirect costs associated with CRS.

**1:07pm****Postoperative pain management after sinus surgery: A survey of the American Rhinologic Society**

Mingyang L. Gray, MD, MPH  
 Caleb Fan, MD  
 Sarah Kidwai, MD  
 Patrick Colley, MD  
 Alfred Illoreta, MD  
 Satish Govindaraj, MD  
 New York, NY

**Introduction:**

Postoperative pain management is controversial as there are no current guidelines to direct clinical practice. The purpose of this study is to demonstrate prescribing patterns for pain management after functional endoscopic sinus surgery (FESS).

**Methods:**

A 15-item web-based survey was electronically distributed to the American Rhinologic Society (ARS) membership. Linear regression analysis was used to determine associations between providers and prescribing patterns.

**Results:**

The survey was completed by 169 members, representing all regions of the United States with a majority practicing in an urban and/or suburban setting. The most commonly prescribed medications were opioid/non-opioid combination pills. 156 of 169 members (92.3%) prescribed at least one kind of opioid after FESS, with an average of 27.4 pills. After aggregating 138 members' practice settings, 54.9% were in private practice, 22.1% were in academic setting, and 7% were in public institutions. Private practice physicians were more likely to prescribe ibuprofen ( $p=0.032$ ) whereas academic physicians were less likely to prescribe ibuprofen ( $p=0.038$ ). Physicians in private practice were less likely to refer patients to pain management ( $p=0.002$ ) but more likely to refer patients to nontraditional forms of pain management ( $p=0.008$ ). Academic physicians were more likely to refer patients to pain management ( $p<0.001$ ) and less likely to refer patients to nontraditional forms of pain management ( $p=0.048$ ).

**Conclusions:**

Most providers prescribe opioids after FESS. There was no significant difference in the number of opioids prescribed based on geography or practice setting. There is significant heterogeneity in the adjuvant pain management strategy between academic and private practitioners.

**1:14pm****Incidence and predictive factors for additional opiate prescription after endoscopic sinus surgery**

Aria Jafari, MD  
Sarek Shen, BS  
John Pang, MD  
David J. Bracken, MD  
Adam S. DeConde, MD  
San Diego, CA

**Introduction:**

Excessive post-operative opiate prescription is a source of prescription diversion in the US opiate crisis and may contribute to chronic opiate use. Efficient prescription by the surgeon can mitigate opiate abuse and improve post-operative pain control. This study seeks to better characterize the incidence and predictive baseline characteristics associated with need for additional opiate prescription after endoscopic sinus surgery (ESS) for chronic rhinosinusitis.

**Methods:**

A retrospective review of subjects undergoing ambulatory ESS between 11/2016 and 8/2017 was performed. The medical and Controlled Substance Utilization Review and Evaluation System (CURES) records were reviewed. Univariable and multivariable logistic regression were performed to evaluate factors associated with additional opiate prescription within 60 days of surgery.

**Results:**

A total of 121 patients were included. Additional prescriptions were seen in 22 patients (18.2%). There were no significant differences in surgical factors (sinuses operated, septoplasty, revision, or extended procedure [Draf IIB/III]). Pre-operative SNOT-22 overall score ( $58.7 \pm 16.0$  vs.  $46.1 \pm 22.5$ ) and ear/facial ( $11.4 \pm 4.8$  vs.  $8.5 \pm 5.4$ ), sleep ( $15.1 \pm 6.5$  vs.  $11.5 \pm 7.2$ ) sub-scores were higher in the group requiring additional prescription ( $p < .05$ ). On multivariate logistic regression, pre-operative opiate use (odds ratio [OR] 57.7; 95% CI 1.6-2027.4), initial opiate quantity (12.6; 1.4-112.5), and lower pre-operative health status (ASA score) (1.1; 1.0-1.3), were associated with additional prescription ( $p < .05$ ).

**Conclusion:**

Need for extended post-operative opiate pain control is common after ESS. Patient characteristics are predictive of need for re-prescription of opiates. Surgical extent is not associated with need for prolonged post-operative opiate pain management.

**1:21pm****Predictive value of baseline and post-operative snot-22 on additional opiate prescriptions after endoscopic sinus surgery**

Sarek A. Shen BS  
Aria Jafari, MD  
John Pang, MD  
David Bracken, MD  
Adam S. DeConde, MD  
La Jolla, CA

**Background:**

Endoscopic sinus surgery (ESS) is generally well tolerated, yet a subset of patients requires an additional of opiate prescription in the post-operative period. The purpose of this study was to quantify differences in both pre- and immediate post-operative Sino-Nasal Outcome Test-22 (SNOT-22) scores between patients with a single prescription and those requiring additional opiate prescription (AOP).

**Methods:**

Patients undergoing ESS between 11/2016 and 8/2017 were reviewed retrospectively. The Medical and Controlled Substance Utilization Review and Evaluation System (CURES) records were reviewed; patients requiring additional opiate prescription (AOP) within 60 days after surgery were identified. The primary and secondary outcomes of interest were the association of baseline and first post-operative visit SNOT-22 total and domain scores with AOP.

**Results:**

121 patients were reviewed, 22 (18.2%) required AOP. Baseline SNOT-22 scores were higher in aggregate ( $58.7 \pm 16.0$  vs.  $46.1 \pm 22.5$ ) and ear/facial domain ( $11.4 \pm 4.8$  vs.  $8.5 \pm 5.4$ ) in the AOP group ( $p < .01$ ). AOP patients also demonstrated higher scores across all SNOT-22 domains ( $p < .001$ ) at the immediate pre-operative visit. There was no difference in the absolute improvement between groups ( $15.5 \pm 18.30$  vs.  $12.3 \pm 23.9$ ,  $p = 0.54$ ). AOP patients experienced less relative improvement (20.2% vs. 34.8%,  $p < 0.05$ ) and smaller mean effect size (0.57 vs. 0.70,  $p < .001$ ) after ESS.

**Conclusion:**

Patients reporting increased ear and facial symptoms at baseline have an increased risk of additional opiate prescription after surgery; pre-operative SNOT-22 scores may provide utility in identifying these patients. Subjects in both cohorts report symptomatic improvement after ESS; however, relative, not absolute, improvement in SNOT-22 scores is more predictive of AOP.

**1:28pm****Q&A**

**Moderators: Joshua Levy, MD & Charles Tong, MD**

**1:32pm****Early life risk factors for chronic sinusitis: a longitudinal birth cohort study**

Eugene H. Chang, MD, FARS  
Tucson, AZ

**Background:**

Chronic sinusitis is a commonly diagnosed condition in adults who frequently present with late-stage disease and irreversible changes to the sinus mucosa. Understanding the natural history of chronic sinusitis is critical in developing therapies designed to prevent or

slow the progression of disease.

Objective: to determine early-life risk factors for adult sinusitis in a longitudinal cohort study (Tucson Children's Respiratory Study).

#### Methods:

Physician-diagnosed sinusitis was reported at age 6. Adult sinusitis between 22 and 32 years was defined as self-reported sinusitis plus physician-ordered sinus radiologic films. Atopy was assessed by skin prick test. Individuals were grouped into four phenotypes: no sinusitis (n=621), transient childhood sinusitis only (n=57), late-onset adult sinusitis only (n=68), and early-onset chronic sinusitis (childhood and adult sinusitis, n=26).

#### Results:

Sinusitis was present in 10.8% of children and 12.2% of adults. Childhood sinusitis was the strongest independent risk factor for adult sinusitis (OR=4.2, 95%CI:2.5, 7.1, p<0.0001, n=772). Early-onset chronic sinusitis was associated with increased serum IgE levels as early as at 9 months of age, atopy (assessed by skin test reactivity), childhood eczema and allergic rhinitis, frequent childhood colds, maternal asthma, and with increased prevalence of concurrent asthma. No association was found between late-onset adult sinusitis and any of the early life risk factors studied.

#### Discussion:

We identified an early-onset chronic sinusitis phenotype associated with a predisposition to viral infections/colds in early life, allergies, and asthma. Elucidation of the molecular mechanisms for this phenotype may lead to future therapies to prevent the progression of chronic sinusitis.

#### 1:39pm

##### **Impact of bitter taste phenotype upon clinical presentation in crs**

Nicholas R. Rowan, MD  
Zachary M. Soler, MD, MSc  
Florence Othieno, MD  
Kristina A. Storck, MSPH  
Timothy L. Smith, MD, MPH, FARS  
Rodney J. Schlosser, MD, FARS  
Charleston, SC

#### Introduction:

Genetic variation of the bitter taste receptor T2R38 has been associated with recalcitrant chronic rhinosinusitis (CRS). Specific T2R38 polymorphisms, correlating with bitter taste sensitivity to phenylthiocarbamide (PTC), have been identified as an independent risk factor for CRS disease severity; however, these studies were conducted in patients of European descent, in northern latitudes. This investigation characterizes bitter taste sensitivity to PTC in a population not previously described and correlates these findings with clinical demographics, disease severity, and measures of smell and taste.

#### Methods:

Prospective, cross-sectional enrollment of adult CRS patients was performed. All patients were assessed for their ability to taste the compound PTC and categorized as nontasters, tasters or supertasters. Correlation was performed between PTC "tasting status" and patient demographics, endoscopy scores, validated quality of life (QOL) measures, subjective and objective measures of taste and olfaction. Taste was assessed with strips for bitter, sweet, sour and salty, while olfactory testing utilized Sniffin' Sticks.

#### Results:

Sixty-seven patients were enrolled. Fifty-two percent were identified as nontasters, 34% tasters and 13% supertasters. Nontasters were more likely to be Caucasian (p=0.047), without nasal polyposis (p=0.006) and non-asthmatics (p=0.014). There were no other statistical differences in patient demographics, QOL measures, subjective or objective olfactory and taste scores when compared against the patient's oral PTC-sensing ability.

#### Conclusions:

Functional expression of T2R38, measured by oral PTC-sensing ability, may vary amongst regional CRS populations. Despite differences in ability to orally detect PTC, CRS patients did not demonstrate differences in subjective or objective measures of smell and taste.

#### 1:46pm

##### **Mucus Th2 biomarkers predict chronic rhinosinusitis disease severity and need for revision surgery**

Justin H. Turner, MD PhD  
Ping Li, MD  
Rakesh K. Chandra, MD, FARS  
Nashville, TN

#### Introduction:

Chronic rhinosinusitis (CRS) is a diverse clinical syndrome with a heterogeneous pathophysiology. Early attempts to identify CRS endotypes and biomarkers have largely relied on analysis of surgically obtained tissue, thus limiting their practical utility. This study examined the ability of mucus Th2 biomarkers to predict CRS disease severity, clinical characteristics, and outcomes.

#### Methods:

CRS (n=90) and healthy control subjects (n=17) were prospectively enrolled prior to surgical intervention and mucus levels of IL-4, IL-5, and IL-13 were determined using a multiplex cytometric bead assay. Data for relevant cytokines was then scaled, normalized, and later combined to develop standardized metrics indicative of Th2-associated inflammation. Th2-high and Th2-low subgroups were consequently identified and validated against factors associated with disease severity and clinical outcomes.

#### Results:

Mucus levels of IL-5, and IL-13 were elevated in CRS subjects compared to controls, while no significant differ-

ence was noted for IL-4. IL-5 and IL-13 high CRS were associated with worse objective measures of disease severity and greater rates of revision surgery. Similar relationships were noted for both cytokines when CRSwNP patients were analyzed separately. Th2-high CRS and Th2-low CRS were then categorized using a scaled IL-5/IL-13 metric. Th2-high CRS was characterized by an increased number of subjects with nasal polyps and comorbid asthma, and worse symptom and CT scores.

#### Conclusions:

The Th2-associated cytokines, IL-5 and IL-13, are detectable in sinonasal mucus and their levels can be used to define Th2-high and Th2-low CRS. Minimally invasive identification of Th2-high and Th2-low disease using mucus-based biomarkers could facilitate stratification of CRS subgroups and guide personalized therapies.

#### 1:53pm

##### **Shortcomings in the diagnosis of chronic rhinosinusitis: Evaluating accuracy by otolaryngologists versus primary care physicians**

Christopher C. Xiao, MD  
Mitchell Anderson, BA, MS  
Lucas D. Harless, MD  
Jonathan Liang, MD, FARS  
Oakland, CA

#### Introduction:

Chronic rhinosinusitis (CRS) is a prevalent illness in the US that accounts for 18-22 million physician visits annually. The American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) has defined diagnostic criteria, but a recent study demonstrated that nearly all patients diagnosed by primary care physicians didn't meet diagnostic criteria. We aim to evaluate the diagnostic accuracy of CRS by primary care physicians and otolaryngologists.

#### Methods:

We retrospectively reviewed a random-sample of adult patients diagnosed with CRS in 2016 based on ICD-10 codes from primary care and otolaryngology departments. Patients with prior CRS diagnosis, previous sinus surgery, and related comorbidities were excluded.

#### Results:

A total of 502 patients with new CRS diagnosis were analyzed (308 from primary care, 194 from otolaryngology). The percentage of correct diagnosis was significantly higher from otolaryngology (28.9% vs 1.0%, p-value <0.0001), but was low in both fields. Misdiagnosis due to symptom duration was higher in primary care (81.6% vs 53.6%, p-value <0.0001), as was misdiagnosis due to evidence of inflammation (97.4% vs 50.0%, p-value <0.0001). Misdiagnosis due to number of symptoms was significantly higher in otolaryngology (63.8% vs 50.8%, p-value 0.013). The most commonly undocumented symptom was decreased sense of smell (97.7% in primary care and 69.1% in otolaryngology encounters).

#### Conclusions:

CRS is commonly misdiagnosed per the diagnostic criteria outlined by AAO-HNS in both primary care and otolaryngology. As a specialty, we should aim to improve our diagnostic acumen and educate our primary care colleagues because misdiagnosis can lead to overtreatment and increased costs.

#### 2:00pm

##### **Q&A**

#### 2:05pm

##### **Business Meeting**

**Moderators: Edward Kuan, MD & Jose Gurrola, MD**

#### 2:15pm

##### **Factors associated with revision surgery after balloon sinuplasty**

Matthew Cooper, MD  
Tracy Cheng, BS  
Tracy Truong, BS  
Ralph Abi Hachem, MD  
David Jang, MD  
Durham, NC

#### Introduction:

Balloon sinuplasty (BSP) for chronic rhinosinusitis (CRS) has increased in popularity in the last decade. However, little is known about factors associated with the need for revision endoscopic sinus surgery (rESS) after BSP.

#### Methods:

This is a six-year (2011-2017) retrospective review of all adult patients who underwent BSP within a single tertiary care institution or underwent rESS with the senior author after BSP at an outside institution. Information pertaining to demographics, clinical findings, and radiographic findings was compared using univariate analyses. Wilcoxon rank sum test was performed for continuous variables and Fisher's exact test for categorical variables.

#### Results:

154 patients were identified with a median age of 53 years. Mean follow-up was 12.8 +/- 16.6 months. 146 patients underwent BSP at a single tertiary care institution with 16 (11%) undergoing rESS. 8 patients underwent BSP at an outside institution and underwent rESS with the senior author. A prior history of ESS (p=0.006), polyps (p=0.009), and allergic rhinitis (p=0.028) were significantly associated with rESS. Purulence on endoscopy (p=0.004) and presence of staphylococcus aureus (p=0.011) or gram negative infection (p<0.0001) were also significantly associated with rESS. In terms of radiographic findings, a higher Lund-Mackay score (p=0.005), neo-osteogenesis (p=0.003), moderate or complete opacification (p=0.012), and hyperdensities within the dilated sinus (p=0.003) were associated with rESS.

**Conclusions:**

This study identifies several clinical and radiographic factors that may be associated with the need for rESS after BSP. These factors can be taken into consideration when deciding whether a patient should undergo BSP versus conventional FESS.

**2:22pm****Operative time and cost variability in endoscopic sinus surgery**

Andrew Thomas, MD  
 Kristine A. Smith, MD  
 Christopher I. Newberry, MD  
 Brandon Cardon, MD  
 Jeremy D Meier, MD  
 Jeremiah A Alt, MD, PhD, FARS  
 Salt Lake City, UT

**Introduction:**

Understanding the variation in costs of endoscopic sinus surgery (ESS) is critical to defining value. Current published costs of ESS have not accounted for or identified potential sources of variation. The objective of this study was to perform a systematic, microcosting evaluation of true ESS costs and identify sources of variance which may guide value-based decisions.

**Methods:**

ESS cases performed between 2008 and 2016 were identified from a database comprised of 22 rural to tertiary facilities (n=1739 cases). Cost and time data were extracted from the database. Medical records were reviewed to confirm procedures. Three bilateral groupings were examined: 1) Full ESS (all sinuses); 2) Intermediate ESS (total ethmoid, maxillary); 3) Anterior ESS (anterior ethmoid, maxillary). Regression coefficients were determined by multivariable gamma regression modeling.

**Results:**

Median costs for full, intermediate, and anterior ESS were \$4276, \$3674, and \$2523 (p<0.001). Median durations were 87, 58, and 54 minutes (p<0.001). Full ESS duration and costs are 1.6 times greater than anterior ESS, while supply costs were 2.2 times greater (p<0.001). ESS performed at community rural, community urban, and tertiary centers differed most in duration and total cost, with no significant supply cost differences: Intermediate ESS duration at community urban facilities was 1.9 times that of community rural facilities (p<0.001).

**Conclusions:**

Duration of surgery, extent of surgery and location of surgery are sources of significant variation in the overall cost of ESS. Defining these variations will assist healthcare policy makers in targeting unwarranted variation and optimizing the value of ESS.

**2:29pm****Randomized controlled trial comparing the laryngeal mask airway to use of an endotracheal tube in sinonasal surgery**

Justin Turner, MD, PhD

(Presented by Todd Wannemuehler, MD)

Austin S. Adams, MD  
 Jeffanie Wu, BS  
 Rakesh K. Chandra, MD, FARS  
 Stephen T. Harvey, MD  
 Kelly A. McQueen, MD, MPH  
 Birmingham, AL

**Introduction:**

The laryngeal mask airway(LMA) has gained acceptance as an alternative to endotracheal intubation(ETT) in many types of ambulatory surgery. However, adoption has progressed slowly in sinonasal surgery, due in part to concerns over adequacy of airway protection and lack of clarity regarding perceived benefits. The purpose of this study was to compare perioperative quality of life measures and indices of airway protection between patients undergoing sinonasal surgery who were ventilated via an LMA or ETT.

**Methods:**

Patients undergoing outpatient sinonasal surgery from 2015-2016 were enrolled into a single-blind randomized study in which patients received either an LMA or ETT for ventilation. Patients completed a questionnaire assessing peri-operative symptom severity and quality of life metrics and additional objective metrics were extracted from the anesthesia record.

**Results:**

102 patients were enrolled (49 in LMA group, 53 in ETT group). No significant differences in swallowing function or presence of cough were identified between the groups. There was a trend toward a reduction in throat pain(p=0.07) and improved voice function(p=0.06) in the LMA group. No significant difference in oxygen desaturations, emesis, or recovery time were identified, and no significant difference in blood penetration into the airway was identified between the groups.

**Conclusions:**

Use of the LMA may be associated with a reduction in throat pain and dysphonia, but has no appreciable effect on post-anesthesia recovery times, oxygen desaturations, or emesis. Use of the LMA in sinonasal surgery appears to be a safe and reliable option for airway management in the ambulatory setting.



**2:36pm****The endocannabinoid receptor b2r is significantly over-expressed in aspirin exacerbated respiratory disease**

Joshua M. Levy, MD, MPH  
 Alessia Corrado, PhD  
 Samuel A. Molina, PhD  
 Sarah K. Wise, MD, MSCR, FARS  
 F. Eun-Hyung Lee, MD  
 David M. Guidot, MD  
 Atlanta, GA

**Background:**

The endocannabinoid system represents a highly-conserved, innate signaling network with direct and indirect control of eicosanoid-mediated inflammation. Activation of the type-2 cannabinoid receptor (CB2R) leads to decreased Th2 inflammation and reduced production of arachidonic acid (AA). Given that altered AA metabolism is associated with aspirin exacerbated respiratory disease (AERD), we hypothesize that CB2R expression is increased in AERD.

**Methods:**

Prospective polyp collection of consecutive patients with AERD and allergic fungal rhinosinusitis (AFRS) undergoing endoscopic sinus surgery. Control sphenoid mucosa was collected from patients undergoing endoscopic skull base procedures. Expression and localization of endocannabinoid receptors were evaluated by quantitative RT-PCR and immunohistochemistry. A two-group unpaired t-test with unequal variances was used to evaluate group differences.

**Results:**

Eleven subjects were included in this pilot study, including 5 controls, 3 AFRS and 3 AERD. Upregulated expression of CB2R was detected in subjects with AERD versus both AFRS and controls ( $p=0.047$ ), with a mean increase of 5.6-fold. No significant differences in CB2R expression was detected between control and AFRS groups. Immunohistochemistry demonstrated increased CB2R expression in AERD subjects, with a discrete epithelial localization that was less abundant than AFRS and control tissues.

**Conclusion:**

The endocannabinoid system is an emerging immunomodulatory network that may be involved in AERD. This is the first study of CB2R expression in sinonasal disease, showing significantly increased epithelial expression in nasal polyps from subjects with AERD. Additional study is warranted to further evaluate the contribution and therapeutic potential of this novel finding in chronic rhinosinusitis.

**2:43pm****Alcohol-induced respiratory symptoms improve after aspirin desensitization in patients with aspirin exacerbated respiratory disease**

Jordan T. Glicksman, MD, MPH  
 Andrew A. White, MD  
 James N. Palmer, MD, FARS  
 Nithin D. Adappa, MD, FARS  
 Jeff Bulva, MD, MS  
 John V. Bosso, MD  
 Philadelphia, PA

**Rationale:**

Aspirin exacerbated respiratory disease (AERD) is characterized by chronic sinusitis, asthma and respiratory sensitivity to aspirin (ASA) and Non-Steroidal Anti-inflammatory Drugs (NSAIDs). In addition to sensitivity to ASA and NSAIDs, the vast majority of patients with AERD have been reported to be intolerant of alcohol, developing respiratory symptoms with the consumption of alcohol.

**Methods:**

A multicenter prospective cohort study was performed. Patients with AERD confirmed by ASA challenge were eligible to participate. Patients who described themselves as able to tolerate alcohol consumption were excluded. Patients underwent ASA desensitization following endoscopic sinus surgery. A questionnaire was distributed to patients before and after desensitization to determine pre- and post- desensitization symptoms associated with alcohol exposure.

**Results:**

25 patients have completed the study. The most common pre-desensitization symptoms were nasal congestion (92%), wheezing (44%) and rhinorrhea (36%). Improvement in the ability to tolerate alcohol was noted in 76% of participants (95% confidence interval, CI 59.26% - 92.74%). 68% of participants (95% CI 49.71% - 86.29%) described ASA-desensitization to be "Very Helpful" or "Extremely Helpful" for their ability to tolerate alcohol.

**Conclusions:**

The majority of patients with AERD who experience respiratory symptoms with alcohol consumption describe improvement in this domain following ASA-desensitization.

**2:50pm****The presence of tissue eosinophil aggregates correlates with increased prednisone requirement after sinus surgery to control mucosal inflammation**

Bobby A. Tajudeen, MD  
 Hannah N. Kuhar, BA  
 Ashwin Ganti, BA  
 Ashley Heilingoetter, BA, MPH  
 Paolo Gattuso, MD  
 Pete S. Batra, MD, FARS  
 Chicago, IL

**Introduction:**

Failure after sinus surgery is often due to recurrence of inflammatory disease. Postoperative steroid requirements for control of mucosal inflammation may provide insight into predicting which patients require more aggressive medical therapy to prevent disease relapse.

**Methods:**

A retrospective chart review was performed of patients who underwent functional endoscopic sinus surgery (FESS) for refractory chronic rhinosinusitis (CRS). SNOT-22 scores and cumulative prednisone dose (mg) requirements at 1, 3, and 6-month post-operative intervals were reviewed. A structured histopathology report of 11 variables was accessed to correlate histopathology with postoperative steroid requirements.

**Results:**

101 patients were reviewed including 42 CRS with nasal polyps (CRSwNP) and 59 CRS without nasal polyps (CRSsNP) patients. CRS patients with eosinophilia required greater cumulative steroids to control disease at 1, 3 and 6-month post-operative intervals ( $p < 0.026$ ,  $p < 0.007$ ,  $p < 0.013$ , respectively) compared to patients with no eosinophilia. Patients with eosinophil aggregates required the highest cumulative steroids at 1, 3, and 6-month post-operative intervals ( $p < 0.003$ ,  $p < 0.001$ ,  $p < 0.001$ , respectively). When removing patients with eosinophil aggregates from the eosinophilia group, no difference persisted between patients with eosinophilia and those without eosinophilia at all time intervals ( $p = 0.664$ ,  $p = 0.735$ ,  $p = 0.800$ , respectively). No other histopathology variable correlated with postoperative steroid requirement.

**Conclusions:**

Tissue eosinophil aggregates appears to be the largest driving factor for increased prednisone requirements after surgery to control mucosal disease than mere presence of eosinophils alone. This key finding may identify patients at high risk for failure after sinus surgery and guide more proactive postoperative management.

**2:57pm****Q&A****3:00pm****Break with Exhibitors****Moderators: Jonathan Ting, MD & Adam DeConde, MD****3:30pm****Cell culture alters the basal and progenitor cell populations of human sinonasal epithelium**

Syed M. Khalil, MSPH, PhD  
 Alex Dobzanski, BS  
 Naina Gour, PhD  
 Stephane Lajoie, PhD  
 Andrew P. Lane, MD, PhD, FARS  
 Baltimore, MD

**Introduction:**

Respiratory epithelial basal cells (BC) are considered stem cells crucial for tissue regeneration and innate immunity in the airway epithelium. BC can differentiate into luminal progenitor (LP) cells that in turn differentiate into secretory and ciliated cells. The properties and roles of BC and LP in the sinonasal epithelium are incompletely understood, as are their characteristics in commonly utilized sinonasal epithelial cell (SNEC) culture models.

**Methods:**

Submerged and air-liquid interface (ALI) SNEC cultures were created from tissue derived from CRSwNP subjects. Flow cytometry was performed on whole tissue as well as submerged and ALI cells. SNEC BCs were identified by absent lymphoid, myeloid, endothelial, and differentiated epithelial cell markers, with the presence of CD104. LP were distinguished from BC by the expression of EpCAM. CD200+ and Lgr5+ expression was also determined by flow.

**Results:**

In submerged SNEC culture, the BC population is greatly reduced relative to native tissue, and the proportion of LP is highly significantly increased. In ALI culture the BC population is only slightly reduced relative to tissue, but a significantly increased LP population is again observed. CD200+ BC and LP are reduced in both submerged and ALI cells compared to tissue. However, Lgr5+ BC and LP populations are relatively stable among tissue, submerged, and ALI cells.

**Conclusions:**

This study is among the first to define the basal stem cell populations of SNEC as identified by surface markers expression, suggesting significant alterations of BC and LP populations in culture model systems.

**3:37pm****Do mucin degrading microbes contribute to the pathogenesis of chronic rhinosinusitis?**

Do-Yeon Cho, MD  
 AL Justin McCormick, MD  
 Calvin Mackey, BS  
 Daniel Skinner, BS  
 Ryan C. Hunter, PhD  
 Bradford A. Woodworth, MD, FARS  
 Birmingham, AL

**Background:**

Chronic rhinosinusitis (CRS) is characterized by complex bacterial communities that incite persistent inflammation and airway damage. Mucin-degrading microbes (MDM) are predominant during the early phase of acute rhinosinusitis in a rabbit model and may provide sustaining nutrients to bacterial pathogens observed after 12 weeks of chronic infection. The objective of this study is to evaluate the capability of MDM to contribute to the growth of *Pseudomonas aeruginosa*.

**Methods:**

Rabbit acute rhinosinusitis was induced by blocking the middle meati for two weeks to create an anaerobic environment for MDM. Healthy and sinusitis mucus were collected and co-cultured with PAO1 strain of *P. aeruginosa* for 72 hours and colony forming units were determined. Targeted quantification of short-chain fatty acids (SCFAs) in healthy and sinusitis mucus was performed via high performance liquid chromatography.

**Results:**

MDM (Bacteroidales, Lactobacillales) were dominant in the mucus at 2 weeks after blocking the middle meati ( $p=0.03$ ). Only co-cultures containing MDM enabled robust PAO1 growth ( $p<0.0001$ ) and the production of blue-green pigment characteristic of *P. aeruginosa* after 72 hours. SCFAs (acetate, butyrate) were abundant in the mucus from sinusitis (acetate (mM) =  $4.7\pm 0.6$  vs  $2.6\pm 0.5$ ,  $p=0.037$ ).

**Conclusions:**

Given that SCFAs are exclusively derived from bacterial fermentation, our evidence suggests a critical role for mucin-fermenting bacteria in generating carbon-source nutrients for pathogenic bacteria. Organisms typically defined as commensals may contribute to airway disease by degrading mucins, thus providing nutrients for pathogens like *P. aeruginosa*.

**3:44pm****Expression of iron-regulatory hormone hepcidin, and iron transporters ferroportin and zip8 in sinus mucosa of patients with and without chronic rhinosinusitis**

David Hsu, MD  
 Airie Kim, MD, PhD  
 Tomas Ganz, MD, PhD  
 Jeffrey Suh, MD  
 Marilene Wang, MD, FARS  
 Jivianne Lee, MD, FARS  
 Los Angeles, CA

**Background:**

Airway epithelia express intrinsic antimicrobials and nutrient-sequestering factors which contribute to the innate host defense of the respiratory tract. Hepcidin is an endogenous peptide hormone that serves as a key regulator of iron metabolism and exhibits innate antimicrobial activity. The purpose of this study is to determine if hepcidin and other molecules involved in iron regulation (i.e. iron transporters ferroportin and ZIP8) are expressed within sinus epithelia and to compare levels of expression between patients with and without CRS.

**Methods:**

Sinus mucosa was obtained from subjects with (19) and without (14) CRS. Eleven CRS patients had nasal polyposis. RT-PCR following RNA extraction was used to quantify the expression of hepcidin, ferroportin, and ZIP8 mRNA; with HPRT and the ribosomal protein (RP)L32 used as comparator housekeeping genes.

**Results:**

HPRT and RPL32 were expressed and their mRNA concentrations correlated closely ( $R^2=0.95$ ). Compared to HPRT mRNA, hepcidin mRNA was expressed in healthy mucosa at an 8-fold lower level ( $?Ct=3.0\pm 12.5$ , mean  $\pm$  SD), ferroportin at a 3-fold higher level ( $?Ct=-1.7\pm 0.6$ ), and ZIP8 at a similar level ( $?Ct=-0.1\pm 0.9$ ). Only ZIP8 was significantly changed in CRS, with a 2.5-fold mean increase in mRNA ( $?Ct=1.3\pm 1.1$ ,  $p=0.001$ ). There were no significant differences in mRNA expression of any of the iron-related proteins between CRS groups with and without polyposis.

**Conclusions:**

Hepcidin, ferroportin, and ZIP8 were detected in the sinus epithelia of CRS and healthy patients at moderate levels, but only ZIP8 was increased in CRS patients relative to controls. These findings suggest that ZIP8 may play a role in the innate mucosal defense of the paranasal sinuses.

**3:51pm****Nasal transcriptome analysis reveals nrf2 pathway associated genes are down-regulated in chronic air pollutant-induced rhinosinusitis in mice**

Nyall London, Jr., MD, PhD  
 Bongsoo Park, PhD  
 Anuj Tharakan, MS  
 Sanjay Rajagopalan, MD  
 Shyam Biswal, PhD  
 Murugappan Ramanathan Jr., MD, FARS  
 Baltimore, MD

**Background:**

Exposure to airborne environmental pollutants including fine 2.5µm particulate matter (PM2.5) has been linked to the aggravation of respiratory symptoms and increased risk of cardiovascular disease. It has recently been reported that chronic PM2.5 exposure induces sinonasal epithelial barrier dysfunction and non-allergic eosinophilic chronic rhinosinusitis in mice. However, the molecular mechanistic pathways underlying these findings are unknown.

**Methods:**

A genome-wide approach was utilized to identify sinonasal pathways dysregulated in mice exposed to PM2.5. Adolescent male C57BL/6 mice were exposed to either PM2.5 or filtered air 6 hours per day, 5 days per week for 14 weeks. The concentration of PM2.5 was between 70-100µg/m<sup>3</sup>, a similar level to several major global cities. Nasal tissue samples were collected from four PM2.5 and two filtered air control mice and RNA-seq was performed.

**Results:**

Analysis of the murine nasal transcriptome identified 64 differentially expressed genes in PM2.5 treated mice compared to controls. Of these, 53 were down-regulated and 11 were up-regulated. Interestingly, of the down-regulated genes, 9 are associated with the nuclear erythroid 2-related factor 2 (Nrf2) oxidative stress response pathway including HMOX1 (61%), GCLC (61%), AKR1B8 (55%), GPX2 (46%), CAT (46%), GSTP1 (43%), SRXN1 (40%), GCLM (38%), PPARGC1A (34%).

**Conclusions:**

These findings demonstrate a down-regulation of the Nrf2 oxidative stress pathway in airborne PM2.5 exposed mice. Interestingly, small molecule activation of the Nrf2 pathway has been demonstrated to reduce PM-induced sinonasal epithelial barrier dysfunction in vitro. Thus, the Nrf2 pathway represents a potential clinical target to ameliorate pollutant mediated sinonasal inflammatory disease.

**3:58pm****Fibroblast wnt signaling influences ciliary differentiation in chronic rhinosinusitis with nasal polyps**

Alex Dobzanski, BA  
 Nitya Surya, BA  
 Andrew P. Lane, MD, FARS  
 Baltimore, MD

**Introduction:**

While essential to the normal differentiation of ciliated airway epithelial cells, upregulated Wnt signaling in chronic rhinosinusitis with nasal polyps (CRSwNP) has been proposed to result in an abnormal epithelial morphology and dysfunctional mucociliary clearance. The mechanism of epithelial Wnt signaling dysregulation in CRSwNP is not known, and importantly the cellular source of Wnt ligands in CRSwNP has not yet been investigated.

**Methods:**

Human sinonasal epithelial cells (HSNECs) and fibroblasts (HSFs) from tissue of patients with CRSwNP and control subjects were collected and grown in differentiated as ALI primary co-culture. HSNECs were isolated to the apical compartment of the transwell and HSFs were isolated to the basolateral compartment of the transwell insert. After 21 days in ALI, changes in ciliary expression of sinonasal epithelium were examined by immunohistochemistry and quantitative real-time polymerase chain reaction.

**Results:**

Relative to co-culture with control HSFs, control HSNEC co-culture with CRSwNP HSFs revealed significantly decreased ciliary differentiation by quantified immunofluorescence for B-tubulin IV (1.000±.041 vs 0.459±.023; P<.01). HSFs derived from CRSwNP patients showed significantly higher gene expression of Wnt5A compared to control subjects (4.284±0.316 vs 1.000±.509; P<.05).

**Conclusions:**

Fibroblasts from CRSwNP patients decrease the ciliary differentiation of epithelial cells relative to co-culture with control fibroblasts. Furthermore, CRSwNP fibroblasts display significantly higher gene expression of Wnt5A relative to controls. These results suggest that abnormal interactions between epithelial cells and fibroblasts may underlie nasal polyposis and supports the concept that dysregulated Wnt signaling contributes to impairment of epithelial function in CRSwNP.

**4:05pm****Q&A****4:15pm****Panel: Residency Training Council**

Moderator: David Poetker, MD, FARS

Panelists: Michael Stewart, MD, FARS & Ara Chalian, MD

## #E001

**A case of skull base erosion after eight years of frontal sinus stenting**

Harry H. Ching, MD  
Walter W. Schroeder, MD  
Las Vegas, NV

**Introduction:**

Frontal sinus stenting after functional endoscopic sinus surgery (FESS) may reduce the incidence of restenosis. Multiple authors have endorsed the safety of long-term stenting up to 6 years with minimal major complications. We describe a previously unreported complication of long-term frontal sinus stenting causing posterior table and skull base erosion.

**Methods:** Case report**Results:**

A 57-year-old female presented with chronic sinusitis and nasal obstruction. An outside physician performed FESS 8 years prior, but she was lost to follow-up. CT scan of the sinuses revealed extensive pansinusitis with a retained stent in each frontal sinus. On the right, there was a 5 mm x 4 mm (H x W) erosion of the skull base at the tip of the frontal sinus stent. Preoperative CT scan from 8 years prior showed an intact skull base. After consultation with neurosurgery, the patient was taken to the operating theatre for removal. Polyps encasing the frontal sinus stent were cleared and the stent was carefully removed, a Rains Frontal Sinus Stent. In the nasofrontal duct, there were pulsations at the region of skull base erosion. The sinus mucosa appeared intact, and the duct was observed for several minutes with no sign of CSF leak. At 2-month follow-up, there were no signs or symptoms of CSF leak or other complications.

**Conclusions:**

Skull base erosion is a previously unreported complication of long-term frontal sinus stenting. Previous studies show very few major complications with long-term stenting, but skull base erosion can occur within eight years.

## #E002

**A contemporary qualitative appraisal of otolaryngology-head & neck surgery smartphone applications**

Julian D. Amin, MD  
Steven G. Brooks, MPH  
Bobby A. Tajudeen, MD  
James N. Palmer, MD, FARS  
Nithin D. Adappa, MD, FARS  
Joseph S. Schwartz, MD  
Baltimore, MD

**Introduction:**

The use of smartphone applications (apps) is increasingly prevalent within the healthcare field. A number of recent publications have investigated the current database of medical applications; however, data pertaining to otolaryngology-related apps is extremely limited. The purpose of this paper is to provide an updated review of smartphone apps that relate to otolaryngology, and to assess the reliability and quality of these apps.

**Methods:**

The app stores of Apple, Microsoft, Google, and BlackBerry were searched using search terms relevant to otolaryngology. App specific data were collected, including app type (clinical, journal/conference, education, patient), price, rating, MD involvement in development, and presence of referenced content.

**Results:**

A total of 383 apps were identified which were further subdivided by subspecialty (facial plastics, n= 57; general, n=6; H&N, n=51; laryngology, n=14; otology, n=161; pediatrics, n= 5; and rhinology, n=33). A minority of apps reported MD involvement (37%) or referenced their content (17%). No association was noted between app cost and MD involvement, nor whether in-app content was referenced. More recently created apps were also found to have the same degree of MD involvement and referenced content as older applications.

**Conclusions:**

As mobile apps become more accessible to the otolaryngology practitioner, trainee, and patient, it becomes increasingly important to assure the reliability and accuracy of the information they provide. Our contemporary appraisal of otolaryngology smartphone applications suggests that a majority are of questionable reliability and quality with no apparent growth trend observed in so far as the quality of applications.

## #E003

**A laterally-based nasal septal mucosal flap for reconstruction of the anterior frontal table following a Draf III procedure: Initial observations**

Catherine Merna, MD  
 Yarah Haidar, MD  
 Naveen Bhandarkar, MD, FARS  
 Orange, CA

**Introduction:**

Stenosis is a commonly reported sequela of the Draf III procedure, reported in 4-33% of cases and requiring revision surgery in 7-23% cases. Previous studies have discussed the use of free mucosal grafts and pedicled flap posterior frontal table reconstruction to minimize stenosis. We demonstrate a novel technique for reconstruction of the anterior frontal table (AFT) following Draf III procedures.

**Methods:**

This is a retrospective review of patients who had a laterally-based NSMF for reconstruction of the AFT following Draf III procedure. Incisions for the NSMF are placed along the nasal septum in locations approximately similar to those necessary for the septectomy part of the Draf III procedure. Rather than truncate the mucosa in the nasal cavity at the frontal cavity floor, the incisions are extended superolaterally to the lateral nasal wall and the flap is subsequently elevated and rotated inferiorly out of the dissection field. Once the Draf 3 procedure is concluded, the flap is rotated superiorly to cover the AFT and secured in place.

**Results:**

A total of seventeen patients were included. Patients had a minimum follow up of 30 days, with an average follow up of 484 days. Clinically significant restenosis requiring revision surgery occurred in one case (5.8%). This case demonstrated improved frontal sinus patency after one revision surgery.

**Conclusion:**

The laterally-based NSMF can be an easily harvested and viable flap for reconstructing the AFT to minimize risk of stenosis following Draf III procedures.

## #E004

**A matched pilot cohort study of the impact of zileuton on aspirin-exacerbated respiratory disease**

Saangyoung E. Lee, BS  
 Douglas R. Farquhar, MD  
 Brent A. Senior, MD, FARS  
 Brian D. Thorp, MD, FARS  
 Adam M. Zanation, MD  
 Charles S. Ebert, Jr., MD, FARS  
 Chapel Hill, NC

**Objective:**

Aspirin-exacerbated respiratory disease (AERD) is a chronic disease that is typically refractory to medical management and surgery. Patients with AERD are known to produce excessive amounts of leukotrienes. Zileuton inhibits 5-lipoxygenase on the arachidonic acid pathway, thereby limiting the production of leukotrienes. Our hypothesis was that medical therapy with Zileuton would improve quality-of-life in AERD patients without hepatotoxicity.

**Methods:**

Charts of patients with AERD were retrospectively analyzed. Patients who underwent functional endoscopic sinus surgery (FESS) were included in the study. The Zileuton cohort (n=12) included those who started medical therapy within 90 days of initial surgery. Non-Zileuton controls (n=13) were matched on having first FESS, with 6+ months of follow-up. Outcomes measured were rhinosinusitis disability index (RSDI) scores, antibiotics use, corticosteroid use, physician visits, and liver function test scores.

**Results:**

The present data showed no statistically significant changes between the two cohorts for RSDI scores, oral steroid use, antibiotics use, or clinic visits for CRS exacerbations. Interestingly, although statistically insignificant, only 8% of patients in the Zileuton cohort required revision FESS during follow-up, whereas 23% of the control cohort did. The Zileuton dosage prescribed for AERD shows no evidence of hepatotoxicity over two-year follow-up.

**Conclusions:**

In this small pilot study, the potential benefit in Zileuton therapy may be in reduced number of surgeries instead of improved quality-of-life scores. Further research into the long-term benefits and complications of the treatment are needed.

#E005

**Allergic fungal sinusitis imitating an aggressive skull base lesion in the setting of pembrolizumab immunotherapy**

Natalie A. Krane, MD  
Daniel M. Beswick, MD  
Kara Y. Detwiller, MD, MPH  
Maisie Shindo, MD  
Portland, OR

**Objective:**

To discuss the presentation of acutely worsening allergic fungal sinusitis in a patient receiving immunotherapy with pembrolizumab, an anti-programmed death-1 (PD-1) antibody.

**Study Design:** Case Report**Methods:**

A 53-year-old man with a history of metastatic cutaneous melanoma and recent initiation of pembrolizumab therapy presented with acutely worsening headaches, left abducens nerve palsy, and neuroimaging demonstrating an erosive skull base lesion with bilateral cavernous sinus involvement.

**Results:**

Intraoperative findings were consistent with non-invasive inflammatory fungal sinus disease. Microbiology and histopathologic data ruled out malignancy and demonstrated aspergillus fumigatus without angioinvasion. After postoperative treatment with systemic steroids and antifungal therapy, the patient's symptoms and abducens nerve palsy resolved. Symptoms were well-controlled four months after his initial presentation.

**Conclusions:**

Immunotherapy with anti-PD-1 agents has been associated with various immune-related adverse events related to T-cell infiltration, including colitis and hepatitis, which are commonly treated with systemic steroid therapy. This is the first known report of worsening or rapid progression of allergic fungal sinusitis in the setting of anti-PD-1 therapy. Worsening sinusitis in this patient population may be secondary to T-cell infiltration, a similar pathophysiology as other common adverse events, and warrants additional investigation. While no causality is implied by this report, clinicians should be aware of the possibility of such an association with this class of immunotherapy.

#E006

**Alterations in the sinonasal microbiome after topical antibiotic therapy for chronic sinusitis**

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Alexander S. Kim, BSE  
Amanda L. Willis, MS  
Erin O. Romero, BFA  
Christopher H. Le, MD  
Eugene H. Chang, MD, FARS  
Tucson, AZ

**Introduction:**

Topical antibiotics have potential therapeutic benefits in the treatment of recalcitrant chronic rhinosinusitis (CRS) while having advantages of direct contact with diseased epithelia, higher concentration delivery, and lack of systemic side effects. The impact of this therapy on the sinonasal microbiota is not fully understood. The goal of this study is to describe the changes to the sinonasal microbiome after topical antibiotic treatment along with associated clinical findings and subjective symptoms.

**Methods:**

Prospective clinical trial of refractory CRS patients with symptoms and signs of mucopurulent disease on endoscopy were instructed to use topical antibiotics (tobramycin and/or mupirocin) for a duration of a minimum of 4 weeks. Those with cystic fibrosis, autoimmune deficiency, and prior 6-week history of oral antibiotic use were excluded. Pre- and post-therapy symptoms (SNOT-20), endoscopy scores (Modified Lund-Kennedy score), and microbial swabs were collected. Total DNA contact was extracted from the microbial swabs and quantitative 16S PCR performed.

**Results:**

To date, all patients in the trial (n=3) showed significant symptom (SNOT: -12) and endoscopic (-2.3) improvement. Total bacterial load decreased by 20-fold in post-therapeutic patients. Enrollment is continuing and complete microbial analysis pending.

**Conclusions:**

Our preliminary data suggests that topical antibiotics effectively improve symptoms and endoscopic scores, while markedly decreasing bacterial load. However, additional patients are needed to reach statistical significance.

**#E007****Analysis of a cluster of acute invasive fungal sinusitis due to hospital maintenance**

Tawfiq Khoury, MD  
Clifford Brown, MD  
David Jang, MD  
Ralph Abi-Hachem, MD  
Durham, NC

**Introduction:**

Acute invasive fungal sinusitis (AIFS) remains a significant cause of morbidity and mortality in immunocompromised patients. Recently three cases of AIFS arose within a ten-day timeframe. This report discusses the presentation, treatment, and presumed etiology of this cluster.

**Methods:**

All cases of AIFS were reviewed over a 10-year-period at our tertiary care center. Patient characteristics and frequency of case diagnosis were compared to our recent cluster of 3 patients in order to identify a source for this recent cluster.

**Results:**

Over a 10-year period 35 biopsy proven cases of AIFS were diagnosed. Recently 3 cases of AIFS within 10 days were diagnosed. This represents a statistically significant increase over our baseline incidence on chi squared analysis ( $P < 0.01$ ). All patients in this recent cluster had acute myeloid leukemia. The primary site of necrosis involved the middle turbinate in 2 cases and the septum, nasal floor and inferior turbinate in 1 case. All patients were in rooms in a single inpatient unit that had recently undergone maintenance. The unit is near an active construction site. These rooms were not fitted with high efficiency particulate air (HEPA) filters initially. Portable HEPA filters were implemented during room maintenance after these cases and there have been no additional diagnoses of AIFS.

**Conclusion:**

We suspect that this cluster was related to the release of fungal spores from disrupted soil during construction combined with the room maintenance without air filtration. We advocate for the use of HEPA filters to avoid AIFS in immunocompromised patients.

**#E008****Baseline patient characteristics predict olfactory outcomes after frontal sinus surgery**

Sarah M. Kidwai, MD  
Lauren C. Williams, BA  
Alfred-Marc Iloreta, MD  
Satish Govindaraj, MD  
New York, NY

**Introduction:**

Olfactory dysfunction is common in patients with sinonasal disease. Previous studies have shown that endoscopic sinus surgery can improve olfaction, especially in patients with nasal polyps. Patient characteristics that can predict olfactory outcomes after frontal sinusotomy have not been studied. We identify pre-operative characteristics that are associated with an improvement in olfaction after frontal sinusotomy.

**Methods:**

Retrospective review of patients that underwent Draf II or III frontal sinusotomy from 2008 to 2017. Data from pre- and post-operative Sino-Nasal Outcome Tests was collected.

**Results:**

Seventy-nine patients were reviewed. There was a significant improvement in olfaction in patients with nasal polyps compared to those without ( $p < 0.001$ ). There was also a significant improvement in olfaction in patients with asthma and Samter's triad ( $p < 0.001$ ). Previous sinus surgery was not associated with an improvement ( $p = 0.376$ ). In patients that had Draf II frontal sinusotomy, nasal polyps, asthma, and Samter's triad were associated with an improvement in olfaction ( $p = 0.006$ ,  $p = 0.003$ ,  $p = 0.002$ , respectively). This same trend was present in patients that had Draf III frontal sinusotomy, although patients with Samter's triad showed an improvement that was close to significant ( $p = 0.063$ ). When examining patients with allergy, there was a trend toward a significant improvement in olfaction ( $p = 0.027$ ); however, this trend disappeared when examining Draf II and Draf III patients separately ( $p = 0.120$  and  $p = 0.105$ ).

**Conclusion:**

Nasal polyps, asthma, and Samter's triad may predict improvement in olfaction after frontal sinus surgery. History of allergy may not be predictive of olfactory outcomes.



## #E009

**Bilateral inverted papilloma of the frontal sinus: A case report and literature review**

Emily Johnson, DO  
Adam Folbe, MD, FARS  
Madison Heights, MI

## Introduction:

Inverted Papilloma is a benign tumor found in the nasal cavity. This uncommon tumor typically originates from the lateral wall of the nasal cavity. The high recurrence rate associated with incomplete resection has led surgeons to do more aggressive surgery. While most of these tumors are unilateral, there are some reports in the literature of bilateral nasal cavity involvement. We present a case of inverted papilloma involving bilateral frontal sinuses.

## Methods: Case Report:

A 52-year-old male presents status post recent sinus surgery at an outside institution with pathology revealing inverted papilloma in the frontal sinuses. Our practice is a tertiary level rhinology practice where the patient underwent subsequent endoscopic revision surgery including a Draf III.

## Results:

Pathology status post revision surgery revealed inverted papilloma of both frontal sinuses and negative margins were obtained using a purely endoscopic approach. Currently the patient is seven months postop and on examination has no evidence of recurrence.

## Conclusions:

This case presentation describes a unique finding of bilateral inverted papilloma treated completely endoscopically.

## #E010

**Bilateral nasal mucormycosis, how we managed it?**

Evuru Maruti Rama Gopal, MS (ENT)  
Suneel Kumar Pentyala, MS (ophth)  
Tata E. Chuakravarti, MD  
Prasad KLS, MS (ENT)  
Rammohan Adepu, MD  
Chudamani Padamata, MD  
Guntur, Andhra Pradesh, India

## Introduction:

Bilateral nasal mucor mycosis management in elderly uncontrolled diabetic patient.  
Materials and methods: 50 years female came with complaining of nasal obstruction, discharge, headache on examination blood sugar levels at 420 milligrams admitted and biopsy taken from the nasal tissue physician controlled the sugar levels surgical debridement is done extensively on both sides of nose with removal of septum, turbinates, all sinuses are opened.

## Results:

Surgical debridement was done multiple Times in a span of 3 months including the removal of skull base, nasal bones, hard palate, removal of sphenoid sinus anterior wall and both lamina papyracea. there is nasal fistula in between the medial canthai of both eyes through which we can inspect the nose. Obturator provided to hard palate fistula.

## Summary:

Multiple surgical debridement along with antifungal treatment with liposomal amphotericin b and posaconazole along with control of the diabetes is the mainstay in the management of mucormycosis.

## Conclusion:

Multiple surgical debridement with saline Douche and improving the immunity controlling diabetes with antifungal treatment is the mainstay for treating mucormycosis. in our study we observed that once the immunity is improved the disease will respond to the treatment of debridement and antifungal therapy.

## #E011

**Characteristics of young adult chronic rhinosinusitis patients treated with endoscopic sinus surgery**

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**Introduction:**

With the exception of heritable disorders such as cystic fibrosis (CF) and primary ciliary dyskinesia (PCD), chronic rhinosinusitis (CRS) in young adult subjects is poorly characterized. We have noted recalcitrant CRS (non-CF, non-PCD) in young adult patients in our practice. This study details characteristics and outcomes of young adult CRS subjects undergoing ESS.

**Methods:**

Adult CRS patients undergoing ESS (2010-2015) were retrospectively studied. Characteristics were compared between young adults (defined as those aged 18-25 years) and others (aged  $\geq$ 26 years).

**Results:**

Of 424 patients meeting inclusion criteria, 22 young adults were identified. None had CF or PCD. The young adult cohort, when compared to older adults, showed significantly higher prevalence of nasal polyposis (67%vs.44%;  $p=0.04$ ) and asthma (74%vs.47%;  $p=0.02$ ). Preoperative median SNOT-22 scores were significantly worse in young adults (57; Interquartile range(IQR) 42.0-70.5; vs. 40.0; IQR 23.0-57.0;  $p=0.007$ ). Tissue eosinophilia = 10/high power field (HPF) was more prevalent in young adults (69%vs.50%;  $p=0.01$ ). While both cohorts demonstrated significant, clinically meaningful improvement, young adults demonstrated significantly greater reduction in SNOT-22 scores 6 months postoperatively (magnitude of reduction: 36.5; IQR 23.0-54.8vs.20.0; IQR 8.5-34.0;  $p=0.004$ ).

**Conclusions:**

Young adult CRS patients (aged 18-25 years) presented with higher SNOT-22 scores compared to older adults. They also had a higher prevalence of nasal polyposis, asthma and tissue eosinophilia =10/HPF. ESS was effective in all subjects, with a larger magnitude of improvement in postoperative SNOT-22 scores in young adults. Awareness of recalcitrant characteristics in young CRS patients undergoing ESS may help modulate management.

## #E012

**Clinical implications of carcinoma in situ in inverted papilloma**

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**Introduction:**

Inverted papilloma (IP) is a benign sinonasal tumor with a tendency to recur and potential for malignant transformation. Varying degrees of dysplasia may be present, of which carcinoma in situ (CIS) is the most ominous. We hereby present the largest series of IP with CIS and describe its biological and clinical behavior.

**Methods:**

A retrospective chart review was performed from 2008 to 2017 of IP cases treated at a tertiary referral center. Pertinent clinical data was obtained, and all cases with IP with CIS were re-reviewed by a single pathologist with head and neck subspecialty training.

**Results:**

Eighteen patients were identified with specimen available for review. Median follow up was 23.9 months (range 1.9-110). Eight patients (44.4%) had initial resection at an outside institution and were referred for further management. The maxillary sinus was the most common primary site (38.8%) and 7 cases (38.8%) demonstrated multifocal disease involvement. Only one patient (5.6%) developed invasive disease after definitive surgery, with a time interval of 22 months. Seven patients required additional surgical management due to recurrent disease that remained CIS (38.8%). The majority of patients were treated with surgery alone (83.3%) and three patients received adjuvant radiotherapy (16.7%).

**Conclusions:**

CIS represents the most severe degree of dysplasia prior to invasion and is associated with higher recurrence rate and multifocal involvement in our study. Remarkably, only one case recurred in an invasive state. The need for adjuvant therapy remains controversial and further research in the etiology of the disease is warranted.

## #E013

**Clinical outcomes of inverted papilloma management and comparative analysis of healthcare utilization**

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**Introduction:**

Inverted papilloma (IP) is a locally aggressive tumor of the sinonasal cavity. Complete extirpation of the tumor is the standard treatment, yet a subgroup of tumors recur and undergo malignant degeneration. These challenges lead to revision surgery and increase healthcare utilization. The goal of this study is to describe the clinical outcomes for patients referred to our institution after initial surgery compared to primary presentation.

**Methods:**

A retrospective chart review and hospital billing software was performed between 2006-2017. Pertinent clinical outcomes were collected. Patients were considered referred if the tumor was found after an incidental finding on routine sinus surgery or tumor recurrence after definitive resection. Parametric statistics were used to compare results from each group.

**Results:**

282 patients were included in the analysis, with median follow up of 29 months. Preliminary analysis revealed 35.9% of patients had undergone initial resection at an outside institution. The overall recurrence rate was 12.8%. When compared to the primary cohort, the referred cohort had a higher incidence of recurrence (16.7% vs 3.5%,  $p=0.012$ ), multifocal disease (61.1% vs 26.7%,  $p<0.001$ ), frontal sinus primary (16.6% vs. 3.5%,  $p=0.001$ ), need for combined or open approach (33.3% vs. 20.0%,  $p=0.002$ ), and a longer length of hospital stay (1.5 vs 0.81 days,  $p=0.021$ ). The pathologic grading (degree of dysplasia) did not differ between the cohorts ( $p=0.27$ ).

**Conclusion:**

Secondary resection of inverted papilloma is associated with higher recurrence, revision rates, and resource utilization. Primary resection with curative intent should be attempted when possible.

## #E014

**Comparison between the sinus and gut microbiome in patients with chronic sinus disease**

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**Background:**

Associations between the gut microbiome and various non-GI related diseases have been detailed in recent studies. This investigation aims to directly compare the gut and sinus microbes in patients with chronic sinus disease and in control patients to determine if any link exists between the sinus and gut microbiota.

**Methods:**

This was a prospective study conducted from February 2016 to August 2017. It was conducted at a tertiary care academic rhinology practice on 16 patients undergoing rhinologic surgery. The primary outcome measure was to determine if any overlap exists between the gut and sinus microbiome in a given subject. A secondary outcome was to assess the effect of prior antibiotic therapy on the diversity of the gut microbiome.

**Results:**

There were 7 patients with chronic rhinosinusitis (CRS) with polyps, 6 patients with CRS without polyps, and 3 control patients. Only one patient demonstrated an overlap of sinus and gut microbiota. In patients receiving a reduced number of antibiotic courses over the past 24 months (0 or 1 course), there was a mean of 7.7 (SD 2.2) gut bacteria isolated from stool samples. In patients receiving more antibiotic courses (2+ courses), there was a mean of 5.1 (SD 2.3) gut bacteria isolated. This difference reached statistical significance ( $p = .043$ ).

**Conclusion:**

Minimal overlap between the sinus and gut microbiome was demonstrated, but further studies are needed to elucidate this potential association. This study supports the theory that antibiotics tend to reduce microbial diversity in the gastrointestinal tract.

## #E015

**Correlations in trends of sinusitis-related online Google search queries in the United States**

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**Introduction:**

Online search query trends have been shown to correlate with real-life epidemiologic phenomena. The aim of this study was to analyze correlations in trends in Google online search volumes of sinusitis-related terms.

**Methods:**

Google Trends, an online tool for extracting relative frequencies of search queries from a public database, was used to query normalized monthly volumes in the United States from January 2004 to September 2017 of sinusitis-related search terms decided upon by consensus. Query terminology was divided into the categories of related symptomatology and disease states, as derived from the SNOT-22 quality of life measure and terminology of the authors' clinical experience. SPSS was used to obtain bivariate Pearson correlation coefficients to compare the search queries.

**Results:**

Online search volumes of "sinusitis" have a distinct seasonal variation, with consistent peaks in December and troughs in July. Symptomatology most highly correlated with "sinusitis" were: "postnasal drip" ( $r = 0.889$ ,  $p < 0.001$ ), "nasal congestion" ( $r = 0.882$ ,  $p < 0.001$ ), "cough" ( $r = 0.863$ ,  $p < 0.001$ ), and "rhinorrhea" ( $r = 0.843$ ,  $p < 0.001$ ). "Sinusitis" had a higher positive correlation with "common cold" ( $r = 0.902$ ,  $p < 0.001$ ) and "acute sinusitis" ( $r = 0.836$ ,  $p < 0.001$ ) than "chronic sinusitis" ( $r = 0.639$ ,  $p < 0.001$ ).

**Conclusions:**

Trends in Google online search volumes provide insight into how the general population correlates symptomatology and disease state. "Sinusitis" searches have seasonal variation and high positive correlations to rhinogenic symptomatology. "Sinusitis" has higher correlations with acute than chronic disease states.

## #E016

**Cribriform plate width is highly variable within and between subjects**

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**Introduction:**

All successful endonasal surgery, including functional endoscopic sinus surgery (FESS), depends on knowledge of both anatomy and the specific variations that can occur between and within patients. Familiarity with these structures is a critical component in preventing complications from these procedures, and failure to understand subtle variation can have disastrous results. The aim of this study was to characterize the anatomical variations (if any) of the cribriform plate using a large cadaveric sample set. Better understanding of the disparities within and between patients may have important implications for surgical planning.

**Methods:**

Whole human skull specimens (31 specimens, 62 sides) were examined to obtain dimensional measurements of the cribriform plate on the right and left sides.

**Results:**

The average length of the cribriform plate was 21.28mm (range 15.25 - 27.73mm, SD 3.30mm). The average width of the cribriform plate (including the crista galli) was 4.53mm (range 1.75 - 8.03mm, SD 1.20mm). When comparing side differences in individual specimens, there was more variability between widths, relative standard deviation 26.4%, than between lengths, relative standard deviation 15.5%.

**Conclusions:**

There is a range of both length and width of the cribriform plate, between and within individuals. This is particularly true for width. In practice, this emphasizes the importance of pre-operative imaging and recognition of anatomic variability for sinus or anterior skull base procedure.

## #E017

**Dedifferentiated acinic cell carcinoma in the sinonasal cavity: First reported case**

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## Introduction:

This report discusses a unique presentation of sinonasal de-differentiated acinic cell carcinoma (AciCC) and offers a review of the current literature.

## Methods:

Chart review of a 48-year-old male with de-differentiated sinonasal AciCC, followed by a review of the literature.

## Results:

Initial imaging demonstrated a large enhancing anterior skull base mass that appeared to be of intracranial origin, extending into the ethmoid and sphenoid sinuses. A modified one-piece extended transbasal approach with endoscopic assistance was performed to resect the tumor. On histology the tumor was found to be a sinonasal de-differentiated AciCC with intracranial extension, an extremely rare presentation.

## Conclusions:

This is the first reported case of de-differentiated sinonasal AciCC in the English literature. De-differentiated AciCC is rare and extremely aggressive with poor prognosis. Although standard guidelines are not established, they require surgical resection, radiotherapy and close monitoring for recurrence and metastasis.

## #E018

**Diagnosis and management of non-traumatic pseudoaneurysms of the cranial base**

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## Background:

Non-traumatic (no history of blunt trauma and no history of surgery near the internal carotid artery (ICA)) pseudoaneurysms of the cranial base are rare and present unique diagnostic and treatment dilemmas compared to both true aneurysms and pseudoaneurysms outside of the cranial base. There is a dearth of knowledge regarding the management of these complicated lesions.

## Methods:

Non-traumatic pseudoaneurysms of the cranial base ICA were retrospectively identified at a single high volume academic institution through key word search of all cases from 2010-2017.

## Results:

Three cases were identified, demonstrating pseudoaneurysms of the paraclival, cavernous and petrous carotid. Presentation, diagnostic workup and management are discussed in detail and an algorithm for management is presented, which includes formal angiography for diagnostic confirmation and treatment planning, endovascular occlusion and endoscopic intervention.

## Conclusions:

Cranial base pseudoaneurysms are particularly prone to growth and rupture and intervention is warranted. First, formal angiography is necessary for accurate diagnosis and treatment planning. Next, endovascular occlusion is performed, with a preference for coiling or endoluminal reconstruction with a flow diverter. Lastly, endoscopic intervention follows in cases where: 1) decompression of vital structures is needed, 2) diagnosis of the pseudoaneurysm cannot be definitively confirmed with angiography or 3) the etiology of the confirmed pseudoaneurysm needs further investigation.

**#E019****Diagnostic criteria of recurrent acute rhinosinusitis (rars): A systematic review**

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**Objective:**

To examine diagnostic criteria of RARS

**Study Design:**

Systematic review

**Methods:**

Cochrane, PubMed, clinicaltrials.gov, EMBASE, Google Scholar, and Web of Science databases were queried for articles related to RARS dating from 1990 to present, according to PRISMA statement guidelines. Full text articles pertinent to RARS diagnostic criteria were included in this review. Inclusion criteria included articles specifically addressing RARS in adults and not single-episode acute rhinosinusitis (ARS) or solely chronic rhinosinusitis (CRS); studies with  $\geq 3$  patients; and articles written in English.

**Results:**

Systematic review found 979 abstracts potentially related to RARS. Sixty-nine full text articles related to RARS were found, with 32 of these relevant specifically to the diagnostic criteria of RARS. The level of evidence was generally low. Past studies and guidelines have used many different definitions for RARS diagnosis based on symptomatology, physical examination, nasal endoscopy, imaging, and laboratory domains. Clinically important RARS has been defined most commonly as  $\geq 4$  discrete episodes of ARS per year, but this frequency is based on level 5 evidence (expert opinion). Additionally, radiologic anatomic associations such as concha bullosa, accessory maxillary os, and narrowed infundibular distance may be associated with RARS.

**Conclusion:**

Systematic review demonstrates that the diagnostic definition for RARS has developed over time and is currently based on low level 4 and 5 evidence. Because of the migratory definition of RARS, comparing inter-study results of RARS remains difficult and further study is needed to better define RARS and the number of episodes per year that represent clinically-relevant disease.

**#E020****Do you use cocaine? Decongestant practices of Canadian otolaryngologists during endoscopic sinus surgery**

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**Background:**

Endoscopic Sinus Surgery (ESS) is a common procedure for chronic rhinosinusitis. A topical decongestant is used to improve visualization of the surgical field. Several different preparations are available, including cocaine, phenylephrine, oxymetazoline, and epinephrine. The understanding of the safety of each agent is changing, as are the practices of Otolaryngologists-Head & Neck Surgeons. Canadian practices have never been investigated.

**Objective:**

To determine decongestant use practices in ESS across Canada.

**Methods:**

An explorative survey design using a 24-item questionnaire hosted on the web-based survey platform Qualtrics will be distributed to current members of the Canadian Society of Otolaryngology-Head and Neck Surgery via email. A French translated version of the survey will be available to respondents. A single reminder will be sent. Questions will survey the respondents' demographics and decongestion practices for ESS.

**Results:**

The survey response rate will be reported. Data will be analyzed descriptively using SPSS and Microsoft Excel. Proportions of respondents who use each drug, dosage, or technique will be calculated for each question. Short answer questions will be analyzed qualitatively. Multiple regression analysis will be conducted to determine factors, such as residency site and years in practice, that may influence decongestion practices in ESS. Reported complications will also be collected.

**Conclusions:**

The results will help determine current decongestant use practices in Endoscopic Sinus Surgery, and will identify factors that influence choice, as well as observed complications from topical decongestant.

## #E021

**Draf Iii and single layer biomaterial repair of frontal sinus encephalocele in a pediatric patient: First reported case in the literature**

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## Introduction:

Endoscopic repair of anterior skull base defects can be accomplished successfully in adult patients using a variety of techniques and grafts. While use of vascularized flaps and multi-layer approaches are well-described, experience with single layer repairs using biomaterials is still controversial. We present a case of a frontal sinus encephalocele and cerebrospinal fluid (CSF) leak repaired successfully utilizing a single layer onlay graft in a pediatric patient.

## Methods:

Case report of a pediatric patient with an encephalocele secondary to trauma, treated at a tertiary academic medical center.

## Results:

An 11-year old girl presented with a right frontoethmoidal encephalocele (13mm by 11mm by 19mm) found on imaging after an episode of meningitis preceded by clear rhinorrhea. She did have a history of remote head trauma and prior frontal bone fracture. An endonasal endoscopic approach was performed with a Draf III to provide exposure to the skull base defect and encephalocele. The defect extended superiorly and laterally over the orbit, which limited the choice of reconstructive options. The defect was repaired successfully with a single layer onlay graft of bovine collagen matrix. After 4 months of follow-up, the graft site has healed with no evidence of meningitis or recurrent CSF leak.

## Conclusions:

Reconstructive options for skull base defects are determined by size, location, and complexity of the defect. Single layer repairs using commercially available biomaterials should be considered in both adults and pediatric patients where multilayer closure or use vascularized flaps may not be possible or optimal.

## #E022

**Durability of improved healthy utility after frontal sinus surgery**

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## Introduction:

As the number of endoscopic frontal sinus surgeries performed on patients with chronic rhinosinusitis (CRS) continues to rise, so does the need for long-term measurement of patient-reported quality of life (QOL) following these procedures. The purpose of this study was to assess four-year clinical outcomes in patients who underwent endoscopic sinus surgery (ESS) with frontal intervention.

## Methods:

Retrospective review of a prospective cohort of 464 patients with CRS who underwent frontal sinus intervention during ESS. All patients completed the Sino-nasal Outcome Test-22 (SNOT-22), Chronic Sinusitis Survey (CSS), EuroQoL-5 Dimension (EQ-5D) questionnaires pre-operatively and at three, 12, 24, 36, and 48 months after ESS. Scores were assessed with paired T-tests and multiple regression analysis.

## Results:

Change from baseline to each follow-up period (three months to four years) was significant for all three outcome measures (SNOT-22, CSS, and HUV) demonstrating durable improvement in sinonasal-specific and general health-related QOL after frontal intervention ( $p < 0.001$ ). Predictors for improved disease-specific outcomes included the presence of preoperative headache ( $p = 0.006$  for SNOT-22,  $p = 0.008$  for CSS) and a history of hypertension ( $p = 0.019$  for SNOT-22,  $p = 0.035$  for CSS). Predictors for improved general health-related QOL outcomes included headache ( $p = 0.032$ ), reflux ( $p = 0.036$ ), and chronic obstructive pulmonary disease ( $p = 0.041$ ).

## Conclusion:

Patients with CRS who undergo frontal intervention during ESS have significant and durable improvements in disease-specific and general health utility observed up to four years after surgery.

## #E023

**Eds-flu (exhalation delivery system with fluticasone) is effective for nasal polyposis (np) patients either with or without history of prior surgery: Integrated results from navigate I and li**

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## Introduction:

An objective of endoscopic sinus surgery (ESS) is to allow delivery of topically-acting medication into the opened sinus cavities. Exhalation Delivery Systems have been shown to deliver drug into key anatomic areas, such as the ostiomeatal complex, where polyps commonly originate and sinuses normally ventilate and drain. The efficacy of EDS-FLU was evaluated and compared in patients with or without a prior history of ESS.

## Methods:

Two prospective randomized placebo-controlled trials were analyzed. Patients received EDS-FLU 372 µg bid (49 with previous surgery; 111 without previous surgery) or EDS-placebo (53 with surgery; 108 without surgery). Outcomes included polyp grade, polyp elimination, Sinonasal Outcome Test-22 (SNOT-22) and Patient Global Impression of Change (PGIC) based on surgical history.

## Results:

At week 16, EDS-FLU decreased polyp grade similarly (-1.33 and -1.26) in patients with and without prior surgery ( $p < .001$  vs. placebo for both), with polyp elimination achieved in 17.0% and 15.7%, respectively. At week 24, polyp grade was reduced further (-1.62 with prior surgery and -1.58 without,  $p < .05$  vs. EDS-placebo for both). At week 16, SNOT-22 improved similarly (-19.32 and -20.72) in patients with and without prior surgery ( $p < .05$  vs. placebo for both). At week 16, there was a similar response as measured by PGIC in both groups (70.2% with prior surgery and 65.7% without surgery reported "much" or "very much" improvement,  $p = .001$  vs placebo for both).

## Conclusion:

Surprisingly, EDS-FLU significantly improves objective, subjective, and quality of life outcomes in patients with NP irrespective of surgical history.

## #E024

**Endoscopic and external approaches for orbital decompression: An analysis of trends from a nationwide perspective**

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## Objectives/Hypothesis:

Although the endoscopic approach has been increasingly utilized for a variety of sinonasal and skull base pathologies, there has been little inquiry into its adoption in the surgical management of orbital disease. Our objective was to evaluate nationwide temporal and geographic trends in approaches for orbital decompression.

## Methods:

Data available from the Centers for Medicare and Medicaid Services (CMS) were evaluated, focusing on the use of open and endoscopic approaches for orbital decompression (CPT codes 67414, 67445, 31292, 31293) among Medicare beneficiaries over a ten-year period. Regional data were also analyzed.

## Results:

There were 8,047 orbital decompressions billed to Medicare from 2007-2016. The number of external and endoscopic approaches increased by 73.0% and 29.2%, respectively, while the number of Medicare beneficiaries increased by 29.1%. Endoscopic decompression represented 23.5% of Medicare billed orbital decompressions in 2016 (221 of 939), down from 29.2% in 2007 (171 of 586). The South had the greatest proportion of decompressions utilizing an endoscopic approach (30.2%).

## Conclusion:

There has not been a clear movement towards the endoscopic approach for orbital decompression, with modest growth compared to external approaches. Potential explanations include the specialty-exclusive nature of approaches, as well as a lack of consensus; the latter idea is further reinforced by geographic variation. High quality prospective trials may clarify the role of endoscopic approaches in these patients.



## #E025

**Endoscopic endonasal repair of a massive middle cranial fossa meningocele and cerebrospinal fluid leak**

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**Background:**

The endoscopic endonasal approach is a minimally invasive and effective method to repair cerebrospinal fluid (CSF) leaks and meningoencephaloceles arising from skull base defects. We present a unique case of a massive middle cranial fossa meningocele causing CSF leak with successful endoscopic repair.

**Methods:**

Case report with literature review.

**Results:**

A 29-year-old male presented for evaluation for unilateral beta-2 transferrin positive rhinorrhea and multiple episodes of meningitis. Nasal endoscopy verified clear fluid originating from the left sphenoid sinus. Computed tomography and magnetic resonance imaging identified a massive encephalocele involving the left sphenoid sinus, cavernous sinus, and middle cranial fossa with complete erosion of the left greater wing of the sphenoid and pterygoid root. The patient underwent endoscopic endonasal repair of the CSF leak. Intraoperatively, the lesion appeared to be a meningocele filled with CSF and was in continuity with Meckel's cave, the left cavernous sinus, and the parasellar carotid. Following decompression of the potential space, successful skull base repair was performed using abdominal fat for cavity obliteration and a pedicled nasoseptal flap. At 1 month postoperatively, he has healed well without evidence of recurrent leak.

**Conclusion:**

We present a unique case of a massive meningocele with extensive erosion of the surrounding bone with exposure of the cavernous sinus, cranial nerves, and carotid artery. Successful repair using a nasoseptal flap remains a robust option for repair of such massive skull base defects.

## #E026

**Endoscopic endonasal surgery for sino-nasal polyposis: General versus local anesthesia**

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**Introduction:**

One of the most common inflammatory mass lesions of the nose are Nasal polyps (NP), which affect up to 4% of the population. Endoscopic surgery under local anesthesia (LA) may allow for a day care surgical procedure for the patient, however, extensive procedures, revision surgeries and uncooperative and pediatric age group patients will warrant use of general anesthesia (GA). Aim of this work is to compare the efficacy local versus general anesthesia for endoscopic surgical treatment of Sino nasal polyposis during operation as well as early and late postoperative period together with patient's acceptance for surgery.

**Methodology:**

A total of 60 patients with sino-nasal polyposis were divided randomly into two groups. Group 1 underwent endoscopic nasal surgery under local anesthesia and Group 2 underwent endoscopic nasal surgery under general anesthesia. Results: Most of patients who were done under local anesthesia showed good acceptance for surgery, short time of surgery and less bloody field than those were done under general anesthesia (P-Value was significant regarding bleeding and time during surgery under local anesthesia).

**Conclusion:**

Surgery of sinonasal polyposis under local anesthesia is an effective method for treatment of nasal polyposis as regard patient acceptance for surgery, time of surgery, very good surgical field and less cost procedure.

## #E027

**Endoscopic management of lateral sphenoid cerebrospinal fluid leaks: Creating a surgical algorithm**

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**Introduction:**

The lateral recess of the sphenoid (LRS) sinus is the most common area for sphenoid CSF leaks and can be difficult to access by the endoscopic transsphenoidal approach. The endoscopic transpterygoid approach can improve surgical access to the lateral recess but requires more extensive surgical dissection. Herein, we review our experience with LRS CSF leak repair via both techniques to determine whether pre-operative radiologic data can help choose the most appropriate surgical approach.

**Methods:**

Electronic medical records of patients with LRS CSF leaks were retrospectively reviewed. Radiographic measurements from pre-operative computed tomography (CT) images were reviewed.

**Results:**

Twenty-two LRS CSF leaks were identified. The transsphenoidal and transpterygoid approach were used in 6 (27.3%) and 16 (72.7%) cases, respectively. The median vidian to foramen rotundum (V-R) angle of the repairs accessed transsphenoidally as compared to the transpterygoid approach were not significantly different (42.25 degrees  $\pm$ 10.91, 38.85 degrees  $\pm$ 19.49, respectively;  $p=0.63$ ). However, the median volume of the LRS accessed by the transpterygoid approach was significantly greater compared to those accessed transnasally (1.02cm<sup>3</sup> $\pm$ 0.48, 0.37cm<sup>3</sup> $\pm$ 0.40, respectively;  $p=0.04$ ; AUC=0.829).

The accessible volume of the LRS based on access through a bilateral transsphenoidal approach with septectomy was not found to be significantly different from that of the transpterygoid approach (5.65cm<sup>3</sup> $\pm$ 2.38, 6.98cm<sup>3</sup> $\pm$ 2.62;  $p=0.14$ ).

**Conclusions:**

This study demonstrated that LRS CSF leaks accessed by the transpterygoid approach had a significantly larger lateral recess volume as compared to those accessed transnasally. Assessment of the LRS volume is a quantifiable parameter to aid in pre-operative surgical planning.

## #E028

**Endoscopic management of the orbital tooth: Displaced molars in the maxillary sinus roof**

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**Introduction:**

Displacement of maxillary teeth is a known cause of sinusitis. However severe displacement with involvement of the orbit is rarely seen. Both congenital and acquired causes of tooth displacement can lead to clinical challenges with management of the orbital tooth to safely extract while preserving sinus and orbital function.

**Methods:**

Two cases of tooth displacement in the maxillary sinus with orbital floor involvement are presented. The clinical factors, imaging, surgical approaches, and outcomes are presented.

**Results**

Two patients were found to have molars displaced within the maxillary sinus, sitting within the bone of the orbital floor. One patient with an odontogenic keratocyst had a third molar that was larger than the maxillary ostium and was removed through a combined endoscopic and Caldwell Luc approach that enabled sectioning of the tooth in vivo. The second patient had a large odontogenic keratocyst which pushed the third molar within the orbital floor. The cyst and tooth were successfully removed through a solely endoscopic approach. There were no orbital complications with either case.

**Conclusions:**

Ectopic teeth within the maxillary sinus can be successfully approached by endoscopic means, but the anatomical constraints of the tooth size may necessitate an open or combined approach for sectioning of a floating tooth to allow for removal.

## #E029

**Endoscopic modified medial maxillectomy (emmm) for orbital floor fractures**

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**Background:**

Orbital wall fractures are classified into orbital floor, medial wall, and combined fractures. Trapdoor fractures typically occur in children and young adults and can cause nausea, vomiting, and bradycardia because of the oculocardiac reflex. These symptoms may reflect ischemic damage to the entrapped tissue and indicate the need for immediate surgical intervention. Surgical approaches for accessing the orbital floor are varied and include transcutaneous approaches via an infraorbital or lower eyelid incision, transconjunctival approaches, endoscopic transnasal approaches, and transoral approaches with Caldwell–Luc procedures. However, it is difficult to access the orbital floor via the endoscopic transnasal approach. We report the use of endoscopic modified medial maxillectomy (EMMM) for accessing the orbital floor.

**Methods:**

Case report with literature review.

**Results:**

A 12-year old girl presented with diplopia, nausea, and vomiting following ocular trauma. She was found to have an orbital floor fracture and underwent surgery. While preserving the nasolacrimal ducts, most of the medial wall of the maxillary sinus was drilled away. We could reach the broken bone and repair it. Subsequently, uncinectomy and middle meatal antrostomy were performed, and a balloon was placed via the middle meatus to fix the point of fracture. Nausea and vomiting disappeared shortly after the surgery, and the balloon was removed on postoperative day 7. The patient's diplopia resolved, and she did not suffer from eye movement disorders or any other complications.

**Conclusion:**

EMMM is useful for accessing the orbital floor and can be applied to orbital wall fracture surgery.

## #E030

**Endoscopic sinus surgery simulator to optimize surgical outcomes: a pilot study on conductive olfactory losses**

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**Introduction:**

Endoscopic sinus surgery remains a common modality in the treatment of chronic rhinosinusitis, yet the outcomes are highly variable. One reason is that predicting functional outcomes (e.g., nasal airflow) based solely on CT or endoscopy can be difficult. We have developed a virtual planning tool aimed at simulating and pre-operatively predicting optimal surgical outcomes related nasal airflow. Here, we report a pilot study to identify optimal surgery to relieve nasal obstruction and potentially reverse olfactory dysfunction.

**Methods:**

Virtual surgeries were performed on the simulator based on computed tomography (CT) scans of four patients with confirmed olfactory loss. After each surgery, air/odor flow to the olfactory fossa (OF) was computed and the process reiterated until optimal result reached. A total of 12 isolated or combined procedures were performed that includes polypectomy (PP), partial middle turbinectomy (PMT), septal body reduction (SBR), etc. A normative range was established based on 22 healthy controls.

**Results:**

Two patients showed no improvement in airflow directed to the OF regardless of procedures performed, one of whom had normal OF airflow pre-surgery, indicating a likely sensorineural olfactory loss rather than conductive. For one patient, an isolated medial aspect PMT demonstrated the best outcome and was better than traditionally performed lateral PMT, while SBR worsened air/odor flow to OF. For the last patient, just a PP restored airflow to OF while adding PMT didn't provide further benefit.

**Conclusion:**

This study suggests that some patients may obtain maximum benefit with targeted approaches, while for some, surgically restoring OF airflow is impractical. This simulator could potentially be a valuable tool for personalizing surgery.

## #E031

**Endoscopic transorbital approach to the infratemporal fossa: A cadaveric study**

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**Introduction:**

Lesions which arise from or adjacent to the infratemporal fossa (ITF) may go undiagnosed for considerable time, allowing them to grow and increasing the potential for intracranial or intraorbital extension. Despite increased utilization of endoscopic corridors, tumors that extend into the lateral ITF or orbit are still often approached in an open fashion. There has been a growing interest in the use of transorbital approaches to the skull base. We present an adaptation of this approach utilizing an endoscopic inferior orbital corridor to access the ITF.

**Methods:**

6 orbits on 3 cadaveric heads were dissected through a lower lid crease incision. A bony aperture in the inferolateral quadrant of the orbit was created for access to the ITF. Endonasal transseptal transmaxillary access was then performed bilaterally for the purposes of photographic documentation.

**Results:**

The endoscopic transorbital access achieved through a bony aperture bounded medially by the inferior orbital nerve (ION), posteriorly by the ION canal and laterally by the orbital process of the zygoma allows for wide access to the entire ITF.

**Conclusions:**

The endoscopic transorbital approach to the ITF affords wide exposure to the entirety of the ITF in a minimally invasive fashion. It would be ideal for achieving full resection of masses, such as juvenile nasopharyngeal angiofibromas, with orbital or lateral ITF extension. It could be utilized in a single modality fashion or in combination with the endonasal approach, minimizing morbidity and the potential for disfigurement, without compromising the likelihood of gross total resection.

## #E032

**Endoscopic transseptal approach with use of the vascular nasoseptal flap in transsphenoidal pituitary adenoma surgery: preventing disease recurrence and reducing complications**

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The endoscopic transnasal transsphenoidal approach for resection of pituitary tumors has become the preferred technique of many neurosurgeon and otolaryngologist teams. A vascularized nasoseptal flap is often used for reconstruction of the skull base, and its harvest is carefully planned during the resection approach. The literature regarding postoperative outcomes in subjects who undergo reconstruction with a nasoseptal flap following endoscopic transseptal/transsphenoidal resection of pituitary adenomas is limited by small sample size. This is the largest case series describing outcomes and recurrence rates of pituitary adenoma resection with this approach. It is also the largest series examining outcomes of consecutive subjects who underwent skull base reconstruction with the vascularized nasoseptal flap. This is a retrospective chart review of 95 adult subjects at a tertiary academic medical center who underwent resection of a pituitary adenoma from January 2013 to August 2016. Subjects are divided into two groups (primary adenomas and recurrent adenomas), and each group is analyzed to describe complete resection, the need for postoperative radiation, the rate of CSF leak rate and complications. This approach resulted in complete resection in over 80% of primary adenomas and in 60% of recurrent tumors. Postoperative radiation was required in only 7% of subjects. The nasoseptal flap reconstruction results in low rates of postoperative complications, including a 7% rate of CSF leak. Low volume of residual pituitary tissue and high rates of complete resection with this technique may reduce the morbidity and mortality associated with persistent pituitary disease, postoperative radiation therapy, and recurrent surgery.

## #E033

**Epistaxis health disparities in the U.S. pediatric population**

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**Introduction:**

Despite epistaxis occurring in up to 60% of the population, few studies have investigated health disparities in the pediatric epistaxis population. The aim of this study was to evaluate sociodemographic risk factors associated with epistaxis visits for pediatric patients.

**Methods:**

Data were extracted from the National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey Outpatient Department from 2001-2010. Outpatient visits of children less than 18 years who received a primary, secondary, or tertiary diagnosis of epistaxis (ICD-9CM code 784.7X) were included. Bivariate and stepwise multivariate regressions were conducted to develop a final model for epistaxis visits described by sociodemographics.

**Results:**

Epistaxis visits accounted for  $5 \pm 0.6$  million visits in children less than 18 years. 51% and 33% of children presenting with epistaxis had private insurance and Medicaid, respectively ( $p=0.001$ ). 69% of epistaxis visits were evaluated at a pediatric clinic, 18% at an ENT/surgery clinic, and 13% at a general/family medicine clinic ( $p<0.0001$ ). After multivariate adjustment, epistaxis visits were associated with older age ( $p=0.006$ ). Black children were more likely to present with epistaxis (95%CI 1.3-4.1,  $p=0.005$ ) compared to white children. Patients were also more likely to present to an ENT/surgery clinic (95% CI 4.5-16.5,  $p<0.0001$ ) compared to a general/family medicine clinic.

**Conclusions:**

Epistaxis visits by children are associated with age, race, and specialty. Targeted interventions to help reduce this common presentation should be developed.

## #E034

**Evaluating for resolution of symptoms in sinonasal fibrous dysplasia based on presentation and management**

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**Introduction:**

Sinonasal fibrous dysplasia is rare and often incidentally found, with observation advocated for these lesions. However, these patients can be symptomatic, and there is little data currently available on whether type of presentation or management influence outcomes. We sought to examine our patient population to answer these questions.

**Methods:**

A retrospective database review was conducted at a tertiary institution. 54 charts of patients diagnosed radiologically with sinonasal fibrous dysplasia were included. Fischer's exact test and Chi-squared test was used as appropriate to analyze association between presentation, treatment and symptom resolution.

**Results:**

30 patients were asymptomatic and were thus excluded. Of the remaining 24, age ranged from 13 to 61 years with 62.5% females and 37.5% males. Of the different types of presentation, sinonasal symptoms were the most prevalent at 39.13%. Other symptoms were headache, ophthalmopathy, craniopathy, and cosmetic complaints. 29.17% received medical treatment, 66.67% underwent surgery, and 4.17% were observed. Medical treatment was offered most commonly for those presenting with headache as their primary symptom of the fibrous dysplasia. Resolution of symptoms was seen in 83.33%, and there was no significant difference in resolution of symptoms between those offered medical versus surgical treatment, with symptom presentation appropriately determining management options.

**Conclusion:**

In symptomatic patients with sinonasal fibrous dysplasia, nasal obstruction or sinusitis are the most common presentation. These patients benefit from surgical intervention, while patients presenting with primary headache without sinusitis benefit from medical therapy.

## #E035

**Evaluating the characteristics of central nasal polyposis**

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**Introduction:**

Certain patterns of nasal polyposis have been associated with varying comorbidities, histology, disability, and radiographic imaging. Central nasal polyposis (CNP), polyposis of the olfactory cleft, is an understudied area, and this study seeks to describe its associated findings.

**Methods:**

A retrospective cohort study was performed evaluating all patients who underwent endoscopic sinus surgery (ESS) in 2016 at a tertiary care center. Patients' computed tomography scans were evaluated for olfactory cleft opacification (OCP), which were graded 0-4, and Lund-MacKay (LM) scores were calculated. Charts were reviewed for demographic information, polyposis, comorbidities, previous surgeries, need for revision ESS, and complaints of olfactory dysfunction.

**Results:**

154 patients had ESS performed at our institution, of which 67 (43.5%) of patients had OCP. There was no significant difference in age between groups ( $p=0.539$ ), but the OCP group was chiefly male (34.5% vs 64.2%,  $p=0.025$ ). OCP patients compared to non-OCP patients were more likely to have aspirin exacerbated respiratory disease (7.5% vs 1.1%,  $p=0.045$ ), greater number of surgeries (1.12 vs 0.62,  $p=0.031$ ), higher LM scores (14.1 vs 5.8,  $p<0.001$ ), have nasal polyposis (73.1% vs 27.6%), and have hyposmia (49.3% vs 25.3%,  $p=0.002$ ). There was no significant difference in presence of asthma ( $p=0.077$ ) and need for revision ESS ( $p=0.171$ ). Patients with higher OCP scores were significantly more likely to have asthma, AERD, hyposmia, higher LM scores, and nasal polyposis ( $p<0.05$ ).

**Discussion:**

CNP patients have greater comorbidities, olfactory dysfunction, and disease burden than their non-CNP counterparts. Further studies evaluating its prognostic factors and immunogenic etiologies are needed.

## #E036

**Evaluation of intraoperative MRI for endoscopic and microscopic transphenoidal surgery**

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**Introduction:**

Intra-operative MRI (iMRI) has been described as a useful adjunct for transsphenoidal surgery (TSS) performed with either the microscope or endoscope. We sought to evaluate our experience with iMRI for TSS.

**Methods:**

Retrospective review of all iMRI cases performed at an academic institution from Jan 2011 – June 2017.

**Results:**

A total of 624 cases were performed in the iMRI suite (1.5 T MRI). 112 met inclusion criteria as TSS for tumor resections (54 endoscopic and 58 microscopic). Surgery for recurrent tumors represented 35.1% of all cases. Most frequent pathologies included pituitary adenoma (80.4%), craniopharyngioma (4.5%), and clival chordoma (4.5%). There was a significant trend towards more complex tumors in endoscopically performed surgery, e.g. clival or suprasellar / anterior skull base tumors (33.3% v. 8.6%,  $\chi^2=10.47$ ,  $p=0.0012$ ). However, the majority of cases were based within the sella with parasellar or suprasellar extension (89%). Operative times were comparable with the endoscope and microscope (4.2 v 3.7 h,  $t=1.517$ ,  $p=0.132$ ), with significantly fewer iMRI's performed when endoscopic approaches were utilized (0.79 vs. 1.0,  $t=77.1$ ,  $p=0.008$ ). There was a trend toward total rather than subtotal resection with use of the endoscope versus microscope (61.1% v. 43.1%,  $\chi^2=3.63$ ,  $p=0.057$ ).

**Conclusion:**

When available, iMRI is a useful adjunct for complicated and revision TSS. Endoscopic approaches tended to be favored for more complex lesions with extended approaches. Implementation of the endoscope resulted in similar overall operative times with significantly fewer iMRI's acquired for sellar-based lesions and a trend toward a higher likelihood of total resection.

#E037

**Evidence of symptomatic and radiographic improvement following conjunctivodacrocystosinusotomy (cdcs) with lacrimal diversion device (ldd) placement as a novel therapeutic platform for sinusitis**

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**Introduction:**

Lacrimal diversion, an established surgical treatment for dacrocystitis and epiphora, may hold utility for treatment of chronic rhinosinusitis (CRS), but remains unexplored. Conjunctivodacrocystosinusotomy (CDCS) followed by silicone lacrimal diversion device (LDD) placement from the medial canthus into the ethmoid complex, may effectively deliver irrigants, and improve symptoms, for CRS patients.

**Methods:**

CDCS with LDD was evaluated in 23 patients at two institutions with symptoms of sinusitis/CRS. Bilateral LDDs were placed under conscious sedation, after which topical saline and steroid-antibiotic drops were administered. SNOT-20 scores in both institutions, and Lund-Mackay radiographic scores at 1 institution, were assessed pre- and post-treatment.

**Results:**

At one institution, in 15 patients/30 sides, the mean pre-procedure vs. post-procedure SNOT-20 scores declined at day 7 (63.1 vs. 34.5,  $p=0.001$ ) and day 30 (63.1 vs. 22.8,  $p=0.002$ ). Following LDD optimization, an independent surgeon at a second institution enrolled 8 patients/16 sides to receive CDCS with LDD for CRS treatment. Mean pre-procedure vs. post-procedure SNOT-20 scores decreased at week 4 (58.4 vs. 11.25,  $p<0.0001$ ) and week 8 (58.4 vs. 9.4,  $p<0.0001$ ) in this group. Mean Lund-Mackay scores approached significance in declining from 14.5 to 11.5 over 8 weeks follow-up ( $p=0.054$ ). Locoregional complications, including foreign body sensation, pre-septal inflammation and device occlusion, were recorded in a minority of cases and self-limited.

**Conclusions:**

CDCS with LDD may be a novel, minimally-invasive conduit for topical irrigant administration to the ethmoid sinuses, and an option for effectively addressing signs/symptoms of CRS. Further prospective study of this treatment platform for CRS appears warranted.

#E038

**Evolution of the diagnosis and management of allergy-mediated disorders**

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**Objectives/Hypothesis:**

There has been increased interest in the management of allergy-mediated disorders among otolaryngologists. This analysis explores trends in the diagnosis and management of allergic disease.

**Methods:**

CMS data were obtained for: (1) temporal trends in allergy immunotherapy injection (CPT 95115, 95117) and testing (95004, 95024) from 2007-2016 (2) geographic trends (3) individual practitioners administering immunotherapy. Although there are no distinct sublingual immunotherapy (SLIT) CPT codes, data detailing billing for unlisted allergy/immunologic services (95199) were obtained.

**Results:**

Over the past decade, there were 99.5 million allergy tests and 33.5 million immunotherapy injections billed to Medicare beneficiaries. Increases in allergy testing have outpaced rising immunotherapy administration (49.7% vs. 19.6% increase). Significant regional variation in testing rates was noted, with the greatest ratio of testing to immunotherapy in the South (0.35) and smallest ratio in the Northeast (0.18). The maximum unlisted allergy services billed was 594 (presumably SLIT), compared to annual SCIT totals in the millions. The majority of immunotherapy in 2016 was administered by allergists/immunologists (51.6%) followed by otolaryngologists (31.2%), trends that have remained consistent since 2012.

**Conclusion:**

Physicians have been more aggressive in the workup of allergy-mediated disorders in recent years. Although differences in allergen load may partially explain divergent patterns, there is tremendous geographic variation in the ratio of testing to immunotherapy administration. While the role Otolaryngologists play in immunotherapy administration remains stable, allergists manage the majority of patients, reinforcing the importance of interdisciplinary cooperation and outreach. SLIT does not appear to play a significant role in this population.

## #E039

**Examining the "July Effect" on patients undergoing pituitary surgery**

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**Objectives:**

To analyze the impact of the turnover of residents in July on patients undergoing pituitary surgery.

**Study Design:**

Retrospective cohort study of cases from the National Inpatient Sample (NIS).

**Methods:**

Patients that underwent pituitary surgery from 2003-2012 were selected in NIS. Patients undergoing surgery in July and in non-July months were compared to determine differences in demographics, comorbidities, and complications.

**Results:**

A total of 15,598 patients (8.6% in July) were included in the NIS cohort. On bivariate analysis, patients in July had similar demographics and Agency for Healthcare Research and Quality comorbidity values compared to patients in other months. There were no significant differences in mortality, CSF leakage, pulmonary edema, cerebral edema, iatrogenic pituitary complications, iatrogenic cerebrovascular accidents, neurological complications, pulmonary complications, or cardiac complications. There were also no differences in the rate of post-operative fistulas, hematomas, perforations, or infections. There was a significant increase in the use of pedicled or free flap reconstruction ( $p=0.008$ ) in July. However, multivariable analysis accounting for demographic values identified no relationship between the use of pedicled or free flap reconstruction ( $p=0.565$ ) and the month of July. The use of meningeal suturing and skin reconstruction was also increased in July. Finally, hospitalization costs in July were similar to costs in other months.

**Conclusion:**

The turnover of new residents in July shows no change in complication rates for patients undergoing pituitary surgery. Patient care in July is similar to care during other months, demonstrating that hospitals are adequately supervising surgical residents during this transition.

## #E040

**Exhalation delivery system (eds) provides superior deposition of liquid in post-surgical cavities in comparison to conventional spray or irrigation modalities**

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**Introduction:**

An objective of endoscopic sinus surgery (ESS) is to facilitate delivery of topical medication into sinus cavities. Sino-nasal irrigation with budesonide has been advocated in the post-surgical patient, and computer simulations suggest improved delivery to sinuses. EDS delivery is a new mechanism of intranasal delivery shown to deliver medication to the superior/posterior areas of the nasal cavity.

**Methods:**

A silicone cast of the sino-nasal cavity representing the geometry of a patient that underwent ESS including Draf III-procedure was made from a CT-scan using 3D-printing. The internal surfaces of the cast were coated with gel that changes color upon contact with liquid. Areas where liquid was deposited following sino-nasal irrigation (~80-102ml/~8-12ml/sec) with head tilted either 45° or 90° were evaluated. EDS-delivery (0.1mlx2) and conventional spray delivery (0.1mlx2) were compared. Volume of liquid retained in the cast was also compared.

**Results:**

Conventional spray delivery deposited liquid only in anterior nasal segments. EDS deposited liquid throughout the nasal cavity and ethmoid space with some delivery to the entrances of the maxillary and frontal sinuses. Tilted a full 90°, sino-nasal irrigation enters the frontal sinuses, but only minimally at 45°. With sino-nasal irrigation, the ethmoid region was not reached and maxillary deposition varied. >95% of liquid from sino-nasal irrigation drained from the cast; no leakage was observed with EDS.

**Conclusions:**

Both sino-nasal irrigation and EDS produce much deeper intranasal deposition than conventional spray, and both deposit liquid inside surgically opened sinuses; however, EDS may be more efficient, convenient, and produce patient higher adherence.



## #E041

**Extent of skull base surgery as a risk stratifier for surgical complications in the elderly**

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## Introduction:

Skull base pathologies can be treated with endoscopic and open approaches. The extent of surgery and pathology along with potential postoperative complications in the elderly population has not been studied in depth. We sought to classify risks in the elderly based on extent of skull base surgical dissection and determine frequency of postoperative complications based on this grading system.

## Methods:

A retrospective review of patients >70 years old who underwent resection of skull base lesion at our institution was conducted. Obtained data included skull base pathology and postoperative complications. We stratified the patients with the following grading system:  
 Grade I – Endoscopic: benign extradural lesions  
 Grade II – Endoscopic: pituitary tumors and encephaloceles  
 Grade III – Endoscopic: intra-arachnoid tumor, malignant tumors  
 Grade IVa – Open: no free flap  
 Grade IVb – Open: free flap  
 We then calculated frequency of postoperative complications

## Results:

218 patients met inclusion criteria. From Grade I to IVb, the percentage of complications were the following: Grade I (9%, 4/45), Grade II (17%, 11/65), Grade III (10%, 5/52), Grade IVa (22%, 11/49), Grade IVb (29%, 2/7). We further stratified between endoscopic and open with the following results: Endoscopic (12%, 20/162), Open (13/56, 23%) with a chi-square significance of  $p < .05$ .

## Conclusion:

Our results indicate that the more extensive the skull base procedure was, the more likely postoperative complications occurred. Open procedures had significantly more complications than endoscopic ones in the elderly. This data should be utilized to counsel elderly patients on the potential risk of skull base surgery.

## #E042

**Feasibility of advanced molecular diagnostics for sinonasal specimens compared to standard culture**

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## Introduction:

Newer molecular diagnostic approaches have revealed that standard culture of sinus purulence is a poor representation of the sinus microbiota. In this case series, we compare the cost, time profile, and clinical utility of molecular techniques to standard culture.

## Methods:

3 patients presented with an acute exacerbation of rhinosinusitis with findings of mucopurulence on exam. Patients were offered combination diagnostic assessment with both standard culture and advanced molecular techniques, by which DNA fragments were isolated, the bacterial 16S subunit amplified, and sequences compared to known species. A hypothetical, brief clinical vignette and results of standard culture versus molecular techniques were presented to a fellowship-trained rhinologist, to assess choice of antibiotic treatment.

## Results:

Standard culture versus molecular techniques had an average cost of \$198.50 vs. \$250.00 and required an average of 4 days vs. 4.67 days after specimen collection for a final result. In all three patients, the two different methods revealed non-congruent dominant organisms. Standard culture averaged 2.33 organisms of which 14.3% (1/7) were anaerobic, whereas molecular techniques averaged 3 organisms of which 66.7% (6/9) were anaerobic. The clinician chose a different antibiotic regimen for one patient based on different diagnostic results; Keflex versus Augmentin.

## Conclusion:

Culture-independent techniques do not require live bacteria; anaerobic and less abundant, fastidious organisms are much more readily identifiable than standard culture. Molecular techniques are clinically feasible as they have a similar cost and time profile to standard culture, and may even lead to different treatment regimens.

## #E043

**Financial implications of derivation from AAO-HNS clinical practice guidelines for adult sinusitis**

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**Introduction:**

The costs associated with lost work days and decreased productivity due to acute rhinosinusitis (ARS) is an estimated \$3 billion per year nationally. In 2015, the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) published an update to the 2007 clinical practice guideline for adult sinusitis. There is limited research examining adherence to the updated AAO-HNS sinusitis guidelines in the primary care setting. As there are both serious clinical consequences and significant economic implications, accurate diagnosis and management of ARS is essential.

**Methods:**

A retrospective study was performed examining electronic medical record data for outpatient diagnostic and treatment selections across an integrated health system. This included review of CT scans ordered, antibiotics selected and associated diagnoses. Primary endpoints were determining the rate of adherence to the AAO-HNS sinusitis guidelines and measuring costs associated with deviation from such.

**Results:**

Over a 12-month period from October 2016 to September 2017, there were 3,312 patients diagnosed with acute sinusitis. 917 (27.86%) of these patients received an antibiotic prescription. 343 (10.41%) of these patients had sinus imaging ordered during their encounters. Estimated cost savings of those scans not being ordered, in adherence to the updated AAO-HNS sinusitis guidelines, was approximately \$500,000 across the health system.

**Conclusions:**

Outpatient management of ARS is associated with unnecessary health care spending across a large health system. The institution of a system-wide clinical care pathway represents an opportunity for quality improvement of patient care outcomes while reducing costs.

## #E044

**Follow-up management of patients after transsphenoidal approach for pituitary adenoma resection**

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**Background:**

Endoscopic transsphenoidal adenomectomy (eTSA) is widely utilized for pituitary adenoma resection. eTSA patients undergo healing for weeks to months and are potentially at risk for substantial complications intraoperatively or postoperatively. Multidisciplinary follow-up monitoring is crucial. However, no standardized postoperative rhinologic follow-up algorithm has been published for this patient group. We hypothesized that patients with complications following eTSA would increase the duration of follow-up in the rhinology clinic.

**Methods:**

Patients undergoing eTSA for pituitary adenoma from August 2007 to May 2016 at a single tertiary care center were reviewed for postoperative follow-up parameters. Routine rhinologic follow-up is recommended beginning 14 days postoperatively. Specific complications were reviewed for their influence on follow-up time.

**Results:**

987 patient records were reviewed (mean age 50.97 years, 544 females). 761 patients (77.1%) attended rhinologic follow-up without reported postoperative issues/concerns. Fifty patients (5.1%) did not follow-up with the rhinology service, although 14 of these (28%) had complications or postoperative issues documented by other services. For patients seen postoperatively by the rhinology service, complications of interest significantly increased the number of rhinologic follow-up visits (median 2 [IQR 2] vs 3 visits [IQR 2],  $p < 0.001$ ), duration of rhinologic follow-up (median 54 days [IQR 43] vs 89 days [IQR 54.8],  $p < 0.001$ ), and duration of overall multidisciplinary follow-up (median 368 days [IQR 104] vs 502 days [IQR 160],  $p < 0.001$ ), compared to those without complications.

**Conclusions:**

Patients who develop postoperative complications after eTSA have significantly extended follow-up duration with both the rhinology service and other services in the multidisciplinary team.

#E045

**Frontal ostium grade (FOG) - A new ct grading system for a safe approach to the frontal sinus**

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The location and size of the frontal sinus ostium is critical in determining the level of surgical difficulty. The more anterior the ostium location, the more difficult is the surgical access. We propose a new CT grading for the frontal sinus that is specific to the anatomical position of the frontal sinus ostium. On sagittal CT, vertical line is drawn through the frontal process of the maxilla along its vertical axis(R). The second line(S) is placed at the point of upturn of the anterior skull base. If the second line(S) is posterior to the reference line(R), then the Frontal Grade is termed FOG positive(+ve). A positive FOG grade implies that the frontal ostium will be surgically more accessible as opposed to a CT, where the S(second) line is anterior to the R line, which will be termed as a FOG(-ve) Negative, which is surgically more difficult. If both S and R lines overlap, then the frontal sinus ostium grade is termed FOG Neutral(0). 348 CT scans were examined. 297(85.3%) CT scans were found to be suitable. 206 (69.4%) on the left and 188(63.3%) on the right were found to be FOG +v compare to 27(9.1%) on the left side and 25(8.4%) on the right side found to be FOG -ve. 45(15.2%) on the left and 58(19.5%) on the right were FOG Neutral.

**Conclusion:**

New CT grading system is introduced which is designed to help planning and predicting frontal sinus surgery difficulty and expertise required to safely perform endoscopic frontal sinus surgery.

#E046

**Frontal sinus stent usage and safety: a systematic review**

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**Objectives:**

Frontal stent is a controversial surgical device used with frontal sinus diseases. The current study systematically reviews the literature to determine the safety and reliability of usage of frontal stents.

**Study Design:**

Systematic review.

**Methods:**

The PubMed, Google Scholar, and Cochrane databases were reviewed and studies evaluating the usage and reliability of Frontal stent were extracted based on defined inclusion criteria.

**Results:**

30612 studies were retrieved from the initial search. Eleven studies comprising a total of 192 patients met inclusion criteria and were evaluated for usage, stent form, materials, stenting duration, surgical techniques, patient outcomes and complications. All studies were classified as level 4 evidence per definition provided by Oxford Center for Evidence Based Medicine. Stents were used in different frontal sinus diseases. Different forms and materials of stents were used. Stenting duration is variable & important in the outcomes, Benoit used it for 5 weeks with 79% patency & Banhanian defined no benefit from short term stenting(2 months) &Rubin used it for 5 months with 81% completely cure, Orlandi preferred long term stenting at least 6 months and Weber & Mansour used it for 6 months with patency 71.4% & 85% respectively. Rubin reported 6% scar formation & 2% fistula in the scar with infection. Lin reported 14% dislodgement & 5% obstruction with 9% failure.

**Conclusions:**

Current literature is limited and comprised entirely of level 4 studies. Accurate determination was not possible due to the small number of studies. Future larger studies are needed.

**#E047****Gender bias and reporting in basic science/translational rhinology research**

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 Adam M. Zanation, MD  
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**Introduction:**

The National Institutes of Health recently proposed best practices for conducting basic science/translational research in subjects of both genders to account for gender-based physiologic differences. Our objective was to determine the prevalence of gender bias and under-reporting in Rhinology basic science/translational literature.

**Methods:**

All articles from 2016 in International Forum of Allergy and Rhinology, American Journal of Rhinology and Allergy, and Rhinology were reviewed. Manuscripts with animal subjects, human subject cells, or commercial cell lines were included. Data collected included study type, cell/animal gender, and gender-based statistical analysis.

**Results:**

Of 369 articles reviewed, 46 basic/translational research articles were identified. 54.4% (25/46) provided gender breakdown and 4.6% (2/46) performed gender-based data analysis. Of studies that reported gender, 13/25 (52%) included both sexes, and 2/25 (8%) performed gender-based data analysis. Of eleven studies (23.9%) using animal subjects, 8/11 (72.7%) utilized only one gender animal and the remaining 3/11 (27.3%) did not report gender. Four (8.7%) cell studies used a total of 3 cell groups. None reported cell gender. 6/13 (46.2%) domestic studies and 9/33 (57.6%) international studies reported gender breakdown. 1/13 (7.7%) domestic and 1/33 (3.0%) international studies performed gender-based analysis.

**Conclusions:**

In basic science/translational Rhinology literature just over half of studies report gender, and gender-based data analysis is rare. Furthermore, animal studies commonly utilize one gender or fail to report gender. In order to direct evidence-based clinical management for both male and female patients, future Rhinology research should include and report outcomes for both genders.

**#E048****Gender bias and reporting: An analysis of clinical rhinology research**

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**Objective:**

Analysis of general surgery literature has revealed noteworthy gender bias and underreporting. This study's goal was to determine if a similar bias pattern exists in Rhinology clinical research and investigate the prevalence of gender-based statistical analysis.

**Methods:**

All articles in 2016 issues of Rhinology, American Journal of Rhinology and Allergy, and International Forum of Allergy and Rhinology were reviewed. Excluded studies were cadaveric, meta-analysis/review, editorial and non-patient-centered. Data collected included study type, demographics and gender-based statistical analysis.

**Results:**

248 of 369 articles met inclusion criteria. Clinical studies comprised 202/248 (81.5%). Subject gender was not specified in 6.9% (14/202). Of 188/202 (93.1%) studies with known gender, only one (1/188, 0.5%) included participants of a single gender. There were 1,096,253 total participants in all studies; 631,012 (57.6%) male and 465,241 (42.4%) female. Gender matching >50% was found in 154/188 (81.9%) studies. 48.0% (97/202) did not perform gender-based statistical analysis. Of 105/202 (52.0%) studies with gender-based analysis, 29 (27.6%) reported statistically significant gender-based results. International studies performed statistical analysis by gender more frequently than domestic (52.4% vs 41.0%,  $p>0.05$ ) and exhibited a higher rate of gender matching (19.7% vs 15.5%,  $p>0.05$ ).

**Conclusions:**

While gender may have a significant impact on Rhinology outcomes, lack of gender-based data analysis is prevalent in Rhinology literature. However, compared to our prior study of general Otolaryngology literature, gender matching and gender-based analysis are more common in Rhinology literature. Future research should account for gender in both demographics and statistical analysis to best guide evidence-based clinical guidelines.

## #E049

**Health related quality of life ss predictive of health utility in patients with nasal polyposis: Analysis of sinonasal outcomes test (SNOT-22) and SF-6DR2 in pooled randomized controlled trials with EDS-FLU**

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**Introduction:**

SNOT-22 is a widely used patient-reported outcome measure for assessing symptoms, functioning, and quality of life in patients with chronic sinusitis and nasal polyposis (NP). Patient "utility" is an important global measure of health state used particularly in economic analysis. We assess the relationship between SNOT-22 and patient utility using data from 2 large pivotal trials which evaluated the Exhalation Delivery System with fluticasone (EDS-FLU).

**Methods:**

Correlation between SF-6Dr2 (0-1; derived from SF-36) and SNOT-22 total score (0-110) were calculated at baseline, week 16, and week 24. Two generalized linear repeated measures models of SF-6Dr2 on SNOT-22 (continuous and categorical severity) controlled for visit, age, sex, race, country, and surgical eligibility.

**Results:**

Across all visits, mean (SD) SNOT-22 was 49.9 (19.60) (n=638), and SF-6Dr2 was 0.68 (0.114) (n=641); correlation -0.60. In the continuous model a 1-point decrease in SNOT-22 significantly predicted an SF-6D increase of 0.0030 (95% CI: 0.0033, 0.0028; p<0.0001). All factors except race were significant (p<0.005). The categorical model found decreasing SNOT-22 severity category significantly predicted non-overlapping higher patient utility score measured by mean SF-6Dr2: Severe, 0.66 (95% CI: 0.65 – 0.67); Moderate, 0.73 (95% CI: 0.72 – 0.74); Mild, 0.80 (95% CI: 0.79 – 0.81); and Healthy, 0.84 (95% CI: 0.82 – 0.86); (p<0.0001).

**Conclusions:**

Among patients with nasal polyposis, there is a significant relationship between SNOT-22 and utility (SF-6Dr2). SNOT-22 severity categories were associated with non-overlapping SF-6D scores suggesting that improvements in SNOT-22 severity categories would be associated with significant improvements in health utility.

## #E050

**Immunologic function in adult patients with recurrent acute rhinosinusitis**

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**Introduction:**

The underlying pathophysiology of recurrent acute rhinosinusitis (RARS) remains incompletely understood as anatomic, host, and environmental factors are potentially implicated. The role of immunologic dysfunction in patients with RARS remains poorly defined.

**Methods:**

A case series and chart review of immunologic function in a cohort of patients with RARS and no prior known history of immune deficiency was performed. All patients underwent immunologic evaluation including measurement of immunoglobulin levels and baseline immunity to different serotypes of Streptococcus pneumoniae. Patients with inadequate baseline immunity to S. pneumoniae were offered the polyvalent anti-pneumococcal vaccine. Serology was repeated following vaccination.

**Results:**

There were 42 patients that met inclusion criteria, 35(83%) of whom were female. Immunoglobulin deficiency was noted in 12 patients(28.6%): one patient (2.4%) had IgA deficiency, seven patients (16.7%) had IgG subclass deficiency, and four patients (9.5%) had combined immunoglobulin deficiency. Non-protective IgG levels to H. influenzae type B were noted in 11 of 27(40.7%) patients. Non-protective IgG levels to S. pneumoniae were noted in 32 of 42(76.2%) patients at baseline. Patients with immunoglobulin deficiency had a lower likelihood of protective immunity to S. pneumoniae at baseline (16.7% versus 30%), though this did not reach statistical significance. Post-vaccination titers were protective in 14 of 18 (77.8%) patients who received the anti-pneumococcal vaccine.

**Conclusions:**

A high incidence of immune dysfunction including specific antibody deficiency was noted in patients with RARS in this study. These findings support the role of immunologic testing and therapy as part of a multi-modality strategy in RARS.

## #E051

**Impact factor of using local steroid nasal spray in the prevention of recurrent nasal symptoms and adenoid regrowth after adenoidectomy**

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## Introduction:

Adenoidectomy is one of the most frequent surgeries conducted in children along with tonsillectomy. The persistence of nasal obstruction and recurrent infection symptoms following adenoidectomy was reported in the range of 19–26% in the literature. In a recent survey of otolaryngologists in the United Kingdom, 38.8% recognized that the need for revision adenoidectomy is a problem. This study aims at evaluation of the value of using intranasal steroids to prevent recurrence of adenoid and related symptoms after adenoidectomy. This is to judge whether the use of intranasal steroids may obtain successful results in children to avoid surgery for adenoid recurrence.

## Material and methods:

Sixty children after adenoidectomy were divided randomly into 2 groups. Group I received postoperative intranasal steroid and group II received postoperative intranasal saline spray. Both medications were administered for 8 weeks postoperatively. Patients were followed up for 6 months using the nasopharyngeal lateral X-rays and reporting the degree of the symptoms.

## Results:

The intranasal steroid group recurrence as evident by lateral X-ray nasopharynx was found in 1 case (3.3%) and for intranasal saline group recurrence was found in 7 cases (23.3%) (P-value= 0.05). The intranasal steroid group had significantly lower score after 6 months as regards nasal obstruction, nasal discharge, snoring, nasal tone and recurrent infection than the intranasal saline group.

## Conclusion:

This study has demonstrated that the use of steroid nasal spray following adenoidectomy significantly reduces the rate of adenoid regrowth and the recurrence of nasal symptoms.

## #E052

**Impact of EDS-FLU on work productivity: Results from two phase III trials, NAVIGATE 1 and 2**

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## Introduction:

Chronic rhinosinusitis, with or without nasal polyposis, is associated with adverse health effects, including pain, poor sleep quality, and fatigue, and generates more than \$20B annually in lost work productivity (days lost to missed work [absenteeism] and reduced on-the-job performance [presenteeism])<sup>1</sup>. In two pivotal trials, the Exhalation Delivery System with fluticasone (EDS-FLU) reduced symptoms, polyp grade, and surgical eligibility in patients with nasal polyposis. We report the effect of EDS-FLU on work productivity.

## Methods:

Pooled pivotal trial data (N=643) were analyzed for differences between the combined EDS-FLU treatment arms (93+186+372mcg BID) vs. placebo. Productivity was measured using a work productivity questionnaire (measuring employment status, missed work days, and reductions in work productivity due to nasal polyposis) every four weeks through the end-of-double-blind (16 weeks). Productivity losses were summarized using descriptive statistics and t tests.

## Results:

Of 643 patients, 487 (76%) were employed at baseline. On average, 10.3% in placebo group missed at least one day of work each month compared with 4.0% receiving EDS-FLU; 2.3% with the highest dose. From randomization through week 16, employed patients receiving EDS-FLU (vs. placebo) missed fewer work days (mean (95% CI): 0.4 (0.19, 0.53) vs. 1.4 (0.52, 2.19); P=0.022) and had fewer presenteeism days (mean (95% CI): 2.2 (1.77, 2.60) vs. 4.1 (3.18, 5.11); (P<0.001)), representing 2.9 productive days gained per employee.

## Conclusions:

In this pooled analysis, employed patients gained an average of 0.73 productive days per month over 16 weeks with EDS-FLU. Higher doses had numerically larger reductions in absenteeism.

## #E053

**Improving efficiency in epistaxis management in a large health system: Analyzing emergency department treatment variability as pretext for a clinical care pathway**

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## Introduction:

Epistaxis is a common condition with an estimated \$100 million in health care costs annually. A significant portion of this stems from Emergency Department (ED) management and transfers. Given the lack of standardized care there is potential for inefficient treatments. Clinical care pathways (CCP) are a way to standardize care, improve quality, and improve efficiency. Our goal was to evaluate the variability in epistaxis management between ED and ENT physicians in order to determine the potential impact of a system wide CCP.

## Methods:

A retrospective case series study was conducted including all patients transferred between EDs for epistaxis over an 18-month period. Exclusion criteria comprised patients under 18 years-old, recent sinonasal surgery, known bleeding disorders, or recent facial trauma. Data analyzed included demographics, ED interventions, and ENT interventions. Cost analysis of ED patient transfers was calculated.

## Results:

73 patients met inclusion criteria. Common comorbidities included hypertension (82%) and anticoagulation (51%). ED physicians used nasal cautery in 8%, absorbable packing in 1% and non-absorbable packing in 92% (with 33% being bilateral). In comparison, ENT physicians used nasal cautery in 37%, absorbable packing in 34%, and non-absorbable packing in 23%. Care variability contributed to costs associated with patient transfers.

## Conclusions:

Epistaxis management varied significantly between ED and ENT physicians. Numerous patients were treated immediately with non-absorbable packing. On post-transfer ENT evaluation, many of these patients had less invasive interventions. This study highlights the variability of epistaxis treatment within our hospital system and warrants the need for a standardized care pathway.

## #E054

**Incidence of postoperative epistaxis after posterior septal branch injury during sphenoidotomy**

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## Introduction:

Postoperative arterial epistaxis after sinus surgery is uncommon. One potential source is from the posterior septal branch (PSB) of the sphenopalatine artery after sphenoidotomy. PSB injury can occur during sphenoidotomy when resecting the anterior sphenoid face inferiorly. The purpose of this study was to determine the incidences of PSB injury during sphenoidotomy, and of postoperative epistaxis from the PSB after being injured.

## Methods:

A single-institution prospective case series was conducted by analyzing 231 sphenoidotomies (146 primary, 86 revision), performed between August 2015-June 2017. Outcome measures included intraoperative PSB injury, postoperative epistaxis requiring emergency department (ED), postoperative epistaxis requiring operating room (OR), and postoperative epistaxis from the PSB. Median follow-up was 203 days.

## Results:

PSB was injured/cauterized during 32 sphenoidotomies (13.9%), with incidences of 8.3% in primary, and 23.3% in revision sphenoidotomies ( $p=0.003$ ,  $OR=3.36$ ). After PSB injury there were no episodes of postoperative epistaxis requiring ED intervention, compared to one episode without PSB injury (1.0%). After PSB injury there were two episodes of postoperative epistaxis requiring OR intervention (6.3%), compared to one episode in cases without PSB injury (0.5%). However, in only one patient with PSB injury taken to the OR was the PSB the source of postoperative bleeding (3.1%). There were no significant differences in ED and OR visits between patients with or without PSB injury ( $p=0.40$ ).

## Conclusion:

Incidence of PSB injury during sphenoidotomy was 13.9% and was more likely during revision sphenoidotomy. After PSB injury during sphenoidotomy, there was a 3.1% incidence of postoperative epistaxis from the PSB.

## #E055

**Incorporation of antibiotics into the management of sinus disorders: A nationwide perspective**

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**Objectives/Hypothesis:**

To evaluate factors associated with antibiotic prescription among otolaryngologists who perform sinus surgery on a regular basis.

**Methods:**

Rhinologists were identified via the ARS website, including those who are fellowship directors as well as those who underwent fellowship training. Otolaryngologists performing > 25 balloons (frontal/maxillary) or >25 FESSs (frontal/maxillary/ethmoids) were also included in "sinus surgeon" and "balloon dilation surgeon" cohorts. Otolaryngologist prescribing data for Medicare Part D beneficiaries was obtained for 2015.

**Results:**

Otolaryngologists who were included in this analysis wrote a median of 54 scripts for antibiotics, with a 15.1% antibiotic prescription rate. The overall length of scripts per antibiotic was 11.1 days. Of rhinologists, 90.2% wrote fewer than 100 scripts compared to 25.6% and 32.5% of sinus surgeons and balloon dilation surgeons, respectively. Rhinologists wrote lengthier antibiotic scripts (14.1d vs. 10.3d,  $p < 0.05$ ). These differences persisted upon exclusion of otolaryngologists serving as faculty in residency/fellowship programs. More experienced practitioners tended to prescribe antibiotics significantly more frequently than younger otolaryngologists.

**Conclusions:**

Utilization of antibiotics varies significantly by type of training, as non-fellowship-trained sinus surgeons and balloon dilation surgeons tend to utilize antibiotics more aggressively in the treatment of sinus disorders than rhinologists. Additionally, experienced otolaryngologists are significantly more likely to incorporate antibiotics in the management of sinus disorders, although these conclusions must be considered in the context of the limitations of this resource. Further clarification of guidelines may be helpful for minimizing divergent practices and maintaining a consensus.

## #E056

**Increased expression of bip/grp78 in inverted papilloma: An immunohistochemical study**

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**Objectives:**

As histological appearance of inverted papilloma (IP) is not very useful in predicting recurrence or malignancy, there is a need to identify biomarkers that can serve as surrogates to predict recurrence, risk of malignancy, and ultimately as therapeutic targets. Previous studies have demonstrated the up-regulation of unfolded protein response (UPR) in head and neck cancers. Our aim was to identify the presence and expression pattern of the UPR marker BiP/GRP78 in IP.

**Methods:**

Formalin-fixed paraffin embedded (FFPE) samples were evaluated for BiP/GRP78 protein expression and compared to normal sinonasal mucosa. Immunohistochemistry (IHC) was utilized to examine the expression profile of BiP/GRP78 protein, using a blocking peptide as control. H-score analysis was used to quantify staining based on the product of staining intensity (0 – 3) and the percentage of stained area.

**Results:**

BiP staining was positive in 4/4 IP samples versus 0/4 in sinonasal samples. There was a statistically significant difference between BiP expression patterns ( $p = 0.0286$ ). In addition, the average H-score for positive samples in IP was 5/9 indicating a moderate intensity and widespread area staining positive for BiP/GRP78.

**Conclusion:**

BiP/GRP78 is significantly upregulated in IP tissue, specifically in basement membrane. The role of increased BiP activity to enhance the endoplasmic reticulum to fold proteins in physiologically stressed cells is well characterized. Further analysis with a larger sample size is underway to extend and confirm these observations and to determine whether small molecules that modulate UPR activity might be used to treat IP in clinical settings.



## #E057

**Indications for endoscopic sinus surgery in the geriatric population**

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**Background:**

Nasopharyngeal carcinoma and paranasal sinus cancer have been associated with a prior diagnosis of chronic rhinosinusitis (CRS) and allergic rhinitis (AR) among Americans over 65 years of age. The purpose of this study was to determine if older patients were more likely to have endoscopic sinus surgery (ESS) for non-inflammatory disease.

**Methods:**

Patients undergoing ESS in a single institution were considered for inclusion. Patients having transsphenoidal surgery were excluded. Patients were divided into cohorts  $\geq 65$  and  $<65$  years of age. The final diagnosis for each case was determined and divided into inflammatory and infectious diseases compared to benign and malignant tumors. Subgroup analysis considering only malignancies compared to inflammatory and infectious conditions was performed.

**Results:**

487 patients were identified for study inclusion. The relative risk (RR) of a final diagnosis of a benign or malignant tumor in patients  $\geq 65$  years of age undergoing ESS was 3.17 (95% confidence interval [CI], 1.90-5.28). The number needed to harm (NNH) was 7.1 (95% CI, 5.0-12.1). The RR of a malignant diagnosis in the elderly cohort was 5.96 (95% CI, 2.30-10.68). The NNH was 9.1 (6.4-10.58).

**Conclusions:**

Sinonasal tumors are more common in elderly Americans, and there have been reports of an increased risk of malignancy within this population who have a previous diagnosis of CRS or AR. In this study of patients having ESS the relative risk a benign or malignant tumor in the older cohort was increased. Subjective sinonasal complaints in elderly patients may warrant prompt diagnostic intervention.

## #E058

**Indications for revision endoscopic sinus surgery: A systematic review**

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**Objective:**

Revision endoscopic sinus surgery (ESS) addresses a wide range of clinical scenarios and disease processes. This systematic review aims to examine the common indications for revision endoscopic sinus surgery as well as post-revision findings.

Data Sources: A computerized Embase and Medline database search was conducted (1 January 1990 – 14 July 2017).

**Review Methods:**

The study protocol was developed a priori using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Articles were classified by year, anatomic focus, technique utilized, and pre- and post-operative findings.

**Results:**

Computerized searches yielded 1,772 eligible articles, 57 (3.2%) of which met inclusion criteria. The most prevalent site foci were frontal (45.6%) and pansinus (38.6%). The most commonly addressed surgical techniques for revision were the endoscopic modified Lothrop procedure (EMLP) (24.6%) and the "mega-antrostomy" (3.5%), though a specific named surgical technique was not always noted. The most commonly mentioned findings in patients ultimately undergoing revision were Chronic Rhinosinusitis (CRS) (42.1% of included studies, 83.5% of patients, SD 23.0%), presence of polyps (42.1% of included studies, 58.7% of patients, SD 29.5%), and asthma (33.3% of included studies, 39.7% of patients, SD 19.2%). The most commonly cited negative predictors for future revision were asthma (10.5% of included studies) and aspirin intolerance (8.8% of included studies).

**Conclusion:**

Recalcitrant CRS, polyposis, and asthma were the most common findings in patients undergoing revision ESS. The frontal sinuses were the most commonly addressed in revision ESS, most often via EMLP. Future study should further define risks for revision.

## #E059

**Intralesional bevacizumab for recurrent septal hemangioma**

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**Introduction:**

Nasal hemangiomas are a rare benign tumor of vascular endothelium. The pathogenesis is closely linked to abnormalities in the vascular endothelial growth factor (VEGF) signaling pathway. Many interventions have been investigated, but wide local excision remains the preferred treatment. Bevacizumab, an anti-VEGF monoclonal antibody, has known efficacy against hemangiomas, though there are no reported cases of sinonasal hemangiomas managed with bevacizumab.

**Methods:**

A 67-year-old man presented to our clinic with a history of a left sided nasal hemangioma originating from the nasal septum. He reported progressive left nasal obstruction and recurrent epistaxis after previous excision at an outside institution. The lesion was re-excised with wide local excision and septoplasty. A third recurrence was treated with a re-excision and septectomy. A fourth recurrence was noted on one year follow up endoscopy. In-office intralesional injection of 50mg bevacizumab was then performed. No improvement in the tumor size was noted at 2 months post-injection, with the tumor measuring up to 2.5cm. At ten months the tumor had dramatically involuted to 3mm in greatest dimension. The patient reported complete resolution of his epistaxis and nasal obstruction.

**Results:**

Bevacizumab reduced the size of the nasal hemangioma from 2.5cm to 3mm. The patient reported complete resolution of nasal obstruction and epistaxis.

**Conclusion:**

This study demonstrates the first reported successful treatment of a sinonasal hemangioma with intralesional bevacizumab. Intralesional bevacizumab could be useful for definitive or neoadjuvant treatment. Further evaluation of intralesional bevacizumab in the treatment of nasal hemangiomas is warranted.

## #E060

**Intraoperative identification of internal carotid aneurysm during transsphenoidal pituitary surgery**

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**Introduction:**

Endoscopic transsphenoidal pituitary surgery has grown tremendously and continues to demonstrate good outcomes with low complication rates. One of the main contraindications to this approach, however, includes an ectatic carotid artery or intrasellar aneurysm. These findings are typically identified on pre-operative imaging and require neurovascular intervention. We present a case of internal carotid artery aneurysm that was discovered intra-operatively that was not evident on pre-operative imaging.

**Methods:**

Case report.

**Results:**

A 53-year-old female was referred to our tertiary care center with headaches, and work-up revealed a 1.5x 2.4x 1.9 cm sellar/suprasellar mass. Pre-operative magnetic resonance imaging (MRI) revealed the mass had mild extension into the bilateral cavernous sinus with abutment of the cavernous internal carotid artery (ICA). The patient was taken to operating room for endoscopic transsphenoidal resection of sellar mass. During the approach, a prominent protuberance was noted in the region of the cavernous carotid, which was confirmed by stereotactic navigation and doppler. Interventional neuroradiology performed intraoperative cerebral angiogram that demonstrated a 5.7x 4.5x 4.3mm left cavernous carotid aneurysm. Further surgical resection was aborted, and patient underwent repeat angiogram and endovascular coiling of the aneurysm two days later without complication. Six weeks later, patient underwent endoscopic transsphenoidal resection of pituitary adenoma without issue.

**Conclusion:**

Carotid artery aneurysm is an absolute contraindication to transsphenoidal surgery, and thus patients must undergo intervention prior to further surgery. Careful review of radiology and a systematic approach during sellar exposure are required for safe and effective transsphenoidal surgery.

## #E061

**Intraseptal fungal ball after septoplasty: An unusual cause of epistaxis**

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## Introduction:

Fungal balls (FBs) are accumulations of degenerating hyphae and mucus that are generally not known to invade the mucosa. We describe the first known case of epistaxis secondary to a FB that developed submucosally within the nasal septum after septoplasty.

## Method:

Case report

## Results:

A 74-year-old male presented with recurrent right-sided epistaxis for the past year. He had undergone septoplasty 3 years prior with no history of nasal trauma or anticoagulation use. Physical examination was unremarkable, but nasal endoscopy showed mucosal inflammation with active bleeding from a focal area of the right mid-septum. Despite cauterization with silver nitrate and a trial of saline irrigations and oral steroids, the epistaxis did not improve. A sinus computed tomography scan showed an area of calcification within the nasal septum, corresponding to the area of septal inflammation. Surgical exploration revealed a FB between the mucoperichondrial flaps of the septum. The FB was removed and granulation tissue over the septal mucosa was debrided as well. Postoperatively, the inflammation overlying the septum resolved and the patient reported resolution of his epistaxis.

## Conclusion:

This is a rare case of an intraseptal FB that developed after septoplasty. Fungal material likely entered the area between the mucoperichondrial flaps through a tear in the septal mucosa. The mucosa subsequently healed, but the underlying FB produced persistent inflammation and epistaxis of the overlying mucosa. Clinicians should consider imaging in patients with refractory epistaxis.

## #E062

**Introduction of topical irrigants to post-surgical frontal sinuses using mygind positioning: Evaluation of delivery patterns using contrast and colorimetric methods**

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## Introduction:

Optimizing ventilation and irrigant delivery to the sinus mucosa is an overriding principle of maintaining ostia patency and improving mucociliary clearance following endoscopic sinus surgery. Frontal sinuses, given their cephalad location and increased nostril-to-ostial distance, provide specific challenges regarding irrigant penetration. Mygind's lying head back (LHB) position is frequently recommended to address this problem. We sought to evaluate how irrigant volume impacted efficacy of topical delivery to the frontal sinuses in LHB position.

## Methods:

Eight cadaver heads underwent endoscopic frontal sinus dissection. Using colored dyes and radiopaque contrast, topical delivery of solution was performed in sixteen nasal cavities using volumes of 10 drops from eyedropper, 2mL from respules, 5mL from syringes and 10mL from irrigation bottles. Delivery was performed in LHB position and irrigant distribution patterns were visualized by endoscopy and computed tomography.

## Results:

In LHB, 10 drops of labeled irrigant did not reach the frontal sinus. Increasing the volume of topical irrigation from 2mL to 5mL improved penetration into the frontal sinus from 21% to 93% ( $p < 0.01$ ). Higher volume irrigations of 10mL provided wide irrigant distribution to the frontal sinus cavity, predominantly coating the posterior table and frontal sinus roof. Despite higher volume irrigations, irrigant contact with the anterior table was confined to 21% of frontal sinuses in the LHB position.

## Conclusions:

Topical delivery to post-surgical frontal sinuses is readily achieved using 5mL of irrigant in Mygind LHB position. Using this technique, all aspects of the frontal sinus vault, save the anterior table surface, receive broad irrigant dispersion.

## #E063

**Lack of sphenoid pneumatization does not affect endoscopic endonasal pediatric skull base surgery outcomes**

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## Introduction:

Currently, due to the rarity of pathology, there is limited data surrounding outcomes of pediatric skull base surgery. Traditionally, surgeons have proceeded with caution when electing endonasal endoscopic transsellar/transplanum approaches to the skull base in pediatric patients due to poor sphenoid pneumatization. In this study, we review outcomes of endoscopic pediatric skull base surgery based on sphenoid pneumatization patterns.

## Methods:

Retrospective chart review of all cases of pediatric (age < 18 years) craniopharyngioma managed via an endonasal endoscopic approach at a tertiary academic medical center.

## Results:

A total of 30 patients were included in the analysis. The mean age was  $8.6 \pm 3.9$  years. 22 (73%) patients were male. Presellar, sellar/postsellar, and conchal sphenoid pneumatizations were found in 9, 11, and 10 patients, respectively. There was no significant association between sphenoid pneumatization pattern and extent of resection (gross vs. subtotal,  $p=0.058$ ), postoperative cerebrospinal fluid (CSF) leak ( $p=0.576$ ), intraoperative estimated blood loss ( $p=0.067$ ), and length of stay ( $p=0.882$ ). On multivariate analysis, after accounting for age, sex, preoperative cranial nerve involvement, cavernous sinus invasion, and suprasellar extension, there remained no significant association between sphenoid pneumatization pattern and extent of resection ( $p=0.109$ ) and postoperative CSF leak ( $p=0.880$ ).

## Conclusion:

Sphenoid pneumatization pattern does not appear to affect outcomes in endoscopic skull base surgery in the pediatric population. Importantly, lack of sphenoid pneumatization does not impede gross total resection or increase complications. Thorough knowledge of the anatomy during the endoscopic approach is critical in order to optimize outcomes.

## #E064

**Levels of evidence in rhinology-skull base surgery research**

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## Introduction:

The purpose of this study was to evaluate the quality of evidence of rhinology – skull base surgery (RSBS) research and its evolution over the past decade.

## Methods:

We reviewed articles from 2007 to 2015 in four leading peer-reviewed otolaryngology journals and three rhinology specific journals. Levels of evidence were assigned using the Oxford Centre for Evidence-Based Medicine 2011 guidelines. High quality was defined as level of evidence 1 or 2.

## Results:

868 articles were reviewed in this study spanning a 10-year period. Overall, the absolute number of RSBS publications increased by 30% per year. While high quality publications increased at a rate of up to 16% per year, this was not deemed to be statistically significant due to a wide confidence interval. Only 26% of RSBS articles overall were deemed to be of high quality which did not vary in relation to the type of journal (otolaryngology vs rhinology specific).

## Conclusions:

While the quantity of RSBS publications has increased over the last decade, the proportion of these publications deemed to be high quality still makes up a minority of RSBS research overall with no statistically significant growth trend observed."

## #E065

**Long-term complication rates following septoplasty with inferior turbinate reduction: a modern look at an old procedure**

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**Background:**

Septoplasty with submucous resection of the inferior turbinate (SMRT) is a common correctional surgery performed in patients with deviated nasal septum resulting in nasal obstruction. Complications from this procedure are infrequently encountered, with the majority of the literature examining short-term complications. To date, the prevalence and types of long-term complications following septoplasty with SMRT remains incompletely defined, as is the duration necessary to follow these patients post-operatively.

**Methods:**

A case series with chart review was performed on consecutive patients age 16 and older presenting to a tertiary rhinology clinic that elected to undergo septoplasty with SMRT from January 2007 to December 2015. Demographic data, intra-operative findings, duration of follow-up, and short- and long-term complications were collected. Exclusion criteria included patients who underwent either septoplasty or turbinate reduction, any other nasal surgery, patients lost to follow-up within one year, or patients with incomplete charts.

**Results:**

A total of 362 patients met inclusion criteria. There were 241 males (66.6%), and the average age of the cohort was 36.8 (+/- 12.3) years. The mean follow-up time was 23.3 months. Short-term complications included post-operative infection (n = 12, 3.3%) and epistaxis that required intervention (n = 16, 4.4%). There were ten long-term complications encountered (2.8%) including hyposmia and/or anosmia (n = 1, 0.3%) and revision septoplasty (n = 9, 2.5%). There were no instances of synechiae, septal perforation, or saddle nose deformity.

**Conclusions:**

Long-term complications following septoplasty with SMRT are infrequently encountered. The most common long-term complication in this cohort was revision septoplasty.

## #E066

**Management of chronic frontal sinusitis using the axillary flap approach**

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Giza, Giza

**Background:**

Surgery of the frontal recess continues to provide several challenges which include understanding the endoscopic anatomy of the frontal recess, several approaches have been described, the axillary flap approach is based on the dissection on the close relationship of the agger nasi with the frontal recess.

**Objectives:**

To evaluate the access to the frontal recess using the axillary flap approach by identifying the frontal ostium during endoscopic sinus surgery.

**Methods:**

Prospective study applied on thirty patients (54 sides) with computerized tomography evidence of frontal sinus disease underwent axillary flap exposure of the frontal recess between May 2014 and August 2015. Demographic data, identification of the frontal ostium, the presence of postoperative symptoms and revision surgery were collected. The operative technique is presented.

**Results:**

The frontal sinus ostium was identified in 98% of patients (53 of the 54 sides). After six months of follow up, recurrence of frontal sinus symptoms was encountered in only 3 sides (5.6%) and minimal disease recurrence in postoperative CT in 6 sides (11.1%), 2 patients have required revision surgery. 3 sides (5.6%) had adhesions in the frontal recess requiring division under local anesthesia.

**Conclusion:**

The axillary flap approach to the frontal recess provides excellent access to the frontal recess and allows clearance of cells in the recess with identification of the frontal ostium in the majority of cases. Also, coverage of the raw area of bone using axillary flap prevents adhesions in the frontal recess.

**Key words:**

Axillary flap, frontal recess, endoscopic sinus surgery

**#E067****Management of epidermal inclusion cyst within the frontal bone**

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**Introduction:**

Epidermoid cysts are benign lesions comprising 1% of intracranial tumors, though rarely may develop within the diploic space. Although observation is an option, a small percentage may cause mass effect. While surgical excision is the standard of care, factors such as location, cosmetic effect, and patient comorbidities may complicate management.

**Objective:**

We present an uncommon manifestation of a left frontal bone epidermoid cyst in a young woman.

**Case Presentation:**

A healthy, 26-year-old woman presented with a left frontal bone mass. On CT and MRI, a fluid-filled lesion was noted within the left frontal bone with erosion through the anterior and posterior table. Given the aggressive nature of the mass, a biopsy was performed via a bicoronal approach with stereotactic navigation. Intraoperatively, the frontal bone was dehiscent anteriorly and posteriorly with exposed dura. Frozen section was consistent with an epidermoid cyst and the mass was removed entirely. There were no post-operative complications or neurologic sequelae.

**Discussion:**

Diploic space epidermoid cysts should be included in the differential diagnosis of indolent, expanding bony lesions. Unaddressed, cysts may expand, resulting in cosmetic deformities, headaches, seizures, or hydrocephalus. Prompt recognition and tailored management is important in preventing these complications.

**Conclusion:**

Epidermoid cysts can be locally destructive, and careful review of the history, imaging, and location is of utmost importance in guiding management. In this case, a bicoronal approach with stereotactic navigation provided adequate exposure, diagnosis, resection, and reconstruction.

**#E068****Minimally invasive transorbital approaches to the anterior skull base: A 6-year update**

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**Background:**

While endonasal endoscopic approaches have revolutionized surgery of the frontal sinus and anterior cranial base, there are inaccessible anatomic limits, leading to the development of alternative transorbital approaches. We describe our transorbital approach to the midline skull base - via transconjunctival or transpalpebral incisions - with the purpose of detailing the approach and results.

**Methods:**

Retrospective chart review of 24 patients and 26 cases undergoing transorbital approaches to the anterior skull base by a single surgeon from 2012-2017. Preoperative imaging, intraoperative, and post-operative records were reviewed.

**Results:**

Indications for surgery were broad and were most commonly for mucocele (15%), osteoma (15%), and inverting papilloma (11.5%). Lesions most frequently involved the frontal sinus (77%), orbit (35%), and/or the nasal cavity (27%). The majority of cases (73%) had previously undergone skull base or sinus surgery. A combined endonasal approach was required in 15 (58%) cases. Surgery achieved gross total resection and partial resection in 69% and 23% of cases, respectively. The mean length of stay was 1.4 days, with 4 patients undergoing outpatient surgery. The most frequent complications were eyelid swelling (27%), forehead numbness (15%), and diplopia (15%) – all of which later improved or resolved.

**Conclusions:**

Transorbital approaches to the anterior skull base provide a safe, minimally invasive keyhole approach to difficult to access lesions located along the anterior cranial fossa and may be used for a wide variety of pathologies, either alone or with endonasal approaches. To our knowledge, this study represents the largest series to date of this approach.

## #E069

**Mobile applications for allergic rhinitis**

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## Introduction:

Allergic rhinitis is a common inflammatory disease of the airway, affecting 10 to 30% of the United States population. With the development of mobile technology and the ubiquity of smartphones, many mobile health applications (apps) have been developed for patients with allergic rhinitis.

## Methods:

The Apple and Google mobile app stores were queried with search terms relating to allergic rhinitis. Apps were assigned to categories based on description, and characteristics such as popularity, reviews, cost, platform, and physician involvement in development were analyzed.

## Results:

A total of 72 apps related to allergic rhinitis were identified. Fifty-four apps were unique, with 18 apps found on both operating systems. Forty (55.5%) apps were available in the Apple App Store, and 32 (44.4%) apps were available in the Google Play App Store. They were grouped into the following categories: patient education (18 [25%]), journals (15 [20.8%]), symptom-tracking (14 [19.4%]), clinical/private practice (13 [18.1%]), pollen forecast (7 [9.7%]), medical education (4 [5.6%]), other (1 [1.4%]). The majority of apps were free of charge (67 [93.1%]), with paid apps ranging from \$1.47 to \$4.99. Apps that were reviewed had an average rating of 3.9 out of 5. Physicians were involved in the development of 37 (51.4%) apps.

## Conclusions:

The collection of mobile apps developed for patients with allergic rhinitis includes those for both educational and clinical use. Mobile apps may have an increasing role in otolaryngic allergy and rhinology practices in the future. Thus, physicians should have greater involvement in their development.

## #E070

**Modulators of rhinovirus incidence and severity**

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## Rationale:

Rhinovirus infections are the most frequent cause of the common cold. Although the majority of upper respiratory infections (URIs) symptoms are self-limiting and minor, in others URIs can progress to sinusitis and/or asthma exacerbations.

## Objectives:

To identify factors that influence the severity of HRV illnesses in those with pre-existing airway disease.

## Methods:

465 nasal swabs were randomly collected from 268 patients over a 2-year period (11/2015–11/2017) from healthy controls and those with upper airway disease over a 2-year period and HRV species and type identified. The Wisconsin Upper Respiratory Symptom Score (WURSS) were collected to identify viral upper respiratory symptoms. Sinonasal air-liquid-interface (ALI) cultures were challenged with HRV-A and HRV-C types and cytokine response measured.

## Results:

In total, 72 HRV infections (15.4%) were identified. There was a slight increase in HRV-A in the winter and HRV-C in the spring/fall. Persons with existing upper airway disease did have higher self-reported URI symptoms, however there were no significant differences in the RV-prevalence between these groups. HRV-A and HRV-C infections resulted in significant increases in inflammatory cytokine response as compared to control, corresponding to an increase in symptom severity in those with RV-infections.

## Conclusions:

RV-A and RV-C infections are common in adults, and those with upper airway disease tend to self-report more significant URI symptoms. In vitro studies of sinonasal epithelia determine a significant inflammatory cytokine response post-RV challenge. These finding suggest that RV infections are significant in an adult population and may predispose to upper airway disease.

## #E071

**Multicenter experience with acute invasive fungal sinusitis**

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**Objectives:**

Describe the multicenter experience with the management and outcomes of acute invasive fungal sinusitis (AIFS) in 69 patients.

**Study design:**

Retrospective chart review.

**Methods:**

Patients were identified by review of patients undergoing surgery for AIFS from 2001 to 2017 at three academic tertiary care institutions. Patient demographics, medical comorbidities, operative details, and treatment outcomes were recorded.

**Results:**

Sixty-nine patients underwent biopsy and/or surgery for suspected AIFS, with pathologic confirmation in 58 patients. Hematologic malignancy was the most common case of immunosuppression (81%); 72% of patients were on immunosuppressant medications and 35% had diabetes. The most common symptoms at presentation were unilateral facial pain (67.2%), fever (56.9%) and eye pain (43.1%), while only 26% of patients reported nasal congestion, drainage or epistaxis. On bedside endoscopic exam, 83.3% of cases demonstrated mucosal evidence of disease, with frank necrosis in 50% of cases. Average time from symptom onset to surgery was 8 days (range: 0 – 36), and mean number of procedures was 2.8 per patient (range: 1-10). Mucormycosis was the most common pathogen (56.9%), followed by Aspergillus (32.8%) and other fungus (15.5%). Fifteen patients (26%) died as a result of AIFS at mean 16.7 days after surgery, while 30 patients (51.7%) discharged from the hospital.

**Conclusions:**

This represents one of the largest reports of AIFS in the literature. Immunocompromised patients with unilateral facial pain, fevers, and/or orbital symptoms should raise concern for AIFS and prompt nasal endoscopy with biopsy of suspicious areas. Overall prognosis and survival in these patients remains poor."

## #E072

**Multiple bioabsorbable corticosteroid-eluting stent placement with associated skull base injury – Too much of a good thing?**

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**Introduction:**

Bioabsorbable corticosteroid-eluting sinus stents (BCES) are widely used at the conclusion of endoscopic sinus surgery (ESS) to optimize postoperative healing with new designs allowing for stent placement in multiple sinuses. Although safe and effective, this technology is not without potential risks if used incorrectly.

**Methods:**

We report a case of multiple BCES placement in a single patient, including introduction of BCES into a skull base defect with concomitant cerebrospinal fluid leak.

**Results:**

A 70-year-old man with chronic rhinosinusitis underwent bilateral ESS at a community hospital. According to the operative report, a BCES was placed in each sinus for a total of eight stents placed. Immediately postoperatively, the patient was noted to have confusion, severe headaches, and nausea. Computed tomography revealed large volume pneumocephalus and a right fovea ethmoidalis defect with associated hyperdense foreign body. After transfer to a tertiary care rhinology center, the patient was taken to the operating room for surgical exploration. Intraoperatively, a BSES was identified extending through an approximately 1cm defect in the ethmoid skull base and dura. The stent was carefully extracted and the skull base defect was repaired in multilayered fashion using a free mucosal graft. The patient recovered without any permanent neurological sequelae.

**Conclusion:**

This is the first report of a significant complication related to the placement of a bioabsorbable stent in the literature. Although there are studies that demonstrate the benefit of placement of a single BCES, the benefit of multiple stent usage is unclear. Safe and judicious use is advised.



## #E073

**Myhre-laps syndrome - A case report**

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 Jackson, MS

Myhre-LAPS (laryngotracheal stenosis, arthropathy, prognathism and short stature) syndrome is a rare genetic disorder caused by a mutation in the SMAD4 gene, with few cases described in the otolaryngology literature. The syndrome is characterized by laryngotracheal stenosis, cardiac conduction abnormalities, and a pronounced fibroproliferative response to surgical intervention. Our patient, a 42-year-old female, was referred for evaluation of chronic rhinosinusitis, having no prior nasal or sinus surgery. On examination bilateral nasal synechiae with complete obstruction of the right nasal cavity and a severe septal deviation on the left were noted. Imaging revealed complete opacification of the right paranasal sinuses and an expansile cystic mass of the nasal cavity, prompting surgical intervention. Intraoperative findings included complete choanal atresia on the right and near complete on the left, in addition to the above. She did well both symptomatically and endoscopically following endoscopic sinus surgery with repair of vestibular and choanal atresia. Subsequently, she developed recurrent symptoms and extensive scar tissue formation after being lost to follow up. When taken for revision surgery, subglottic stenosis was identified following a difficult intubation, leading to the diagnosis of Myhre-LAPS syndrome. There are currently no available treatments for Myhre-LAPS syndrome, making early diagnosis and judicious decision-making regarding surgical intervention key to the long-term management of these patients. Because these patients present to an otolaryngologist for management of the airway component of their disease, which is a common cause of morbidity and mortality, we aim to educate otolaryngologists to recognize the features of this rare condition.

## #E074

**Nasal manifestations of Crohn's Disease: Literature review and case report of nasal septal perforation**

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**Objective and Importance:**

To report a rare case of a nasal septal perforation in a patient with Crohn's disease. To provide a literature review on nasal manifestations of Crohn's disease and discuss the challenges in their treatment.

**Clinical Presentation:**

A 29-year-old male with Crohn's disease presented with acute sinusitis, painful nasal septal ulcers, and diffuse edema of nasal mucosa. He was treated with systemic steroids and antibiotics, as well as topical steroids, antibacterial ointments, and emollients for the nasal septum. Despite the medical treatment, nasal septal ulcers progressed, resulting in loss of cartilage and a subsequent perforation. With the restart of his REMICADE® treatment for Crohn's disease, these nasal manifestations eventually resolved. The patient underwent nasal septal button placement for the perforation with satisfactory results.

**Intervention:**

Nasal septal button placement.

**Conclusion:**

Nasal manifestation is rare in patients with Crohn's disease and its mechanism is yet unclear. It is typically characterized by severe inflammation of the nasal mucosa, and patients may present with nasal obstruction, rhinorrhea, epistaxis, nasal crusting, acute or chronic sinusitis, or deformity of the nasal pyramid. Rarely, as in our case, they can present with a nasal septal perforation. Due to the chronic inflammatory nature of Crohn's disease, treatment can be challenging and limited. In addition to controlling the underlying systemic disease, medical treatments include topical steroids, antibiotics, and emollients. Systemic steroids may be helpful. For symptomatic nasal septal perforation, a nasal septal button can be considered.

## #E075

**Nasal myiasis in a patient with hemorrhagic shock from acute gastrointestinal bleeding**

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**Introduction:**

Myiasis refers to parasitic infestation by fly larvae. Human myiasis is relatively uncommon and has typically been reported in tropical nations, often in patients who are neurologically debilitated. We report an unusual case of nasal myiasis in a patient with hemorrhagic shock due to acute gastrointestinal bleeding.

**Methods:**

This case report was performed by chart review.

**Results:**

A 56-year-old woman with a history of HIV infection, end-stage renal disease, peripheral vascular disease, and dementia was sent to the emergency room from her nursing home after being found unresponsive, hypotensive, and cyanotic with agonal breathing. She was intubated in the field and found to have active melena on arrival to the emergency department. Central venous access was obtained; intravenous fluids, proton pump inhibitor, and pressors were initiated; and she was transferred to the medical intensive care unit. Otolaryngology was consulted after she was noted to have maggots arising from the nasal cavity. Examination showed several larvae in the anterior nasal vault and septum. These were removed by suctioning, and nasal endoscopy revealed no additional larvae. Imaging showed no evidence of infectious complications, and she received daily irrigations with saline and peroxide without recurrence. Unfortunately, the patient developed increasing pressor requirements and persistent anemia despite transfusions, and subsequently expired.

**Conclusion:**

Nasal myiasis is exceedingly rare in the developed world but can occur in patients with poor perfusion and immunosuppression. Thorough bedside endoscopy and manual extraction of larvae followed by frequent irrigation and reevaluation is sufficient treatment in most cases.

## #E076

**Neutrophil activation pathway is suppressed in human nasal polyps**

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**Introduction:**

Chronic Rhinosinusitis with Nasal Polyps (CRSwNP) is characterized by Th2 skewed immune profiles. While multiple studies have examined the pathways involved in eosinophilic inflammation, less is known about the pathways involved in suppression of neutrophil function. The purpose of this study was to examine the role of neutrophil activation pathways in the pathogenesis of CRSwNP.

**Methods:**

IRB approved study in which tissue proteomes were compared between control and CRSwNP (n=10/group) using an aptamer based proteomic array. Protein expression was analyzed using Student's t-test and Benjamini Hochberg procedures followed by the application of Ingenuity Pathway, MetaCore, and Genemania bioinformatics analyses.

**Results:**

Compared with controls, proteins involved in neutrophil activation pathways such as Calcineurin B, ZAP70, 14-3-3 protein theta, and 14-3-3 protein zeta/delta, and PKC-D were significantly decreased in CRSwNP (Fold change range(FCR) -1.05 to -1.85; p=0.003, 0.040, <0.001, 0.008, and 0.004; respectively). Similarly, neutrophil activity related proteins such as Interleukin-17B, Interleukin-17B receptor, and Interleukin-23 were significantly decreased in CRSwNP(FCR -1.09 to -1.25; p<0.001, 0.022, <0.001; respectively). In contrast, eosinophil chemoattractants and biomarkers such as CCL17, Periostin, and Galectin 10 were all significantly increased in CRSwNP (FCR 1.56-3.95; p=0.009, <0.001, <0.001; respectively).

**Conclusion:**

Neutrophilic activation and functional protein pathways are significantly suppressed in CRSwNP. These findings, coupled with commensurate increases in eosinophilic chemoattractants and biomarkers, harmonize with previous studies demonstrating Th2 skewing in CRSwNP and validate the aptamer based proteomic approach as a novel research tool in the study of airway inflammation.

## #E077

**Olfactory neuroblastoma: The SUNY Upstate Medical University experience 1980-2016**

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**Introduction:**

To review the long-term outcomes and prognostic variables of patients treated for olfactory neuroblastoma (ONB) at a single institution.

**Methods:**

A retrospective review of all patients treated for ONB at a single institution over a 35-year period.

**Results:**

Eighteen patients were treated from 1980-2016. Nine out of 18 patients (50%) underwent endoscopic surgery, while 5 (28%) had craniofacial resection. Sixteen patients (89%) had radiotherapy, while 8 (44%) had chemotherapy. Twelve patients (66%) had adjuvant radiotherapy in addition to surgery. Four patients (20%) were managed non-surgically. The mean length of follow-up time was 5.2 years (range 0.33 -14.6 years). The 5-year overall survival was 61%, and the 5-year disease-free survival was 55%. Eight patients (44%) were alive without disease, one was alive with recurrence, seven died of disease, and one died of other causes. The mean time to local and regional recurrence was 3.38 years, with a range of 3 months to 7.75 years. Endoscopic versus craniofacial resection did not significantly affect survival. Dulguerov stage was predictive of disease-free survival ( $p=0.01$ ), and margin status was predictive of both overall and disease-free survival ( $p=0.025$ ,  $p=0.003$ ).

**Conclusions:**

Endoscopic versus craniofacial resection for ONB did not significantly affect survival. Improved survival was associated with lower stage and negative surgical margins. The majority of patients were treated with multimodal treatment. Dulguerov stage best predicted disease-free survival, and most patients recurred locally. Given the incidence of late recurrence, lifelong follow-up is essential.

## #E078

**Open versus endoscopic approach for sinonasal melanoma: A systematic review and meta-analysis**

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**Background:**

Open resection (OR) of sinonasal mucosal melanoma (SNM) traditionally has been the gold standard for treatment. However, endoscopic resection (ER) has recently become a surgical alternative. The aim of this study was to compare survival outcomes between OR and ER of SNM.

**Methods:**

A literature search encompassing PubMed, Web of Science, ClinicalTrials.gov, Embase, Google Scholar, and Cochrane Library was performed. Two reviewers independently screened for original studies comparing survival outcomes between OR and ER for SNM. Data was systematically collected on study design, patient demographics, outcomes, and level of evidence. Quality assessment was performed using the Newcastle-Ottawa scale (NOS). Meta-analysis of overall survival outcomes was performed on hazard ratios extracted from relevant studies.

**Results:**

The initial search yielded 1967 abstracts, of which 9 retrospective cohort studies were included for a total of 521 patients (254 ER, 267 OR) from 6 different countries. The average quality of all included studies using the NOS was 7.44 stars. Six out of 7 studies reported no differences in the stages of SNM between patients receiving ER versus OR. Overall survival was higher in the ER group compared to OR group (HR 0.68, 95% CI 0.49-0.95). There was no significant difference in disease-free survival between groups (HR 0.59, 95% CI 0.28-1.25).

**Conclusion:**

Based on the available literature, an endoscopic approach for SNM resection is as safe as an open approach. Further research to assess postoperative morbidity and cost between the two approaches should be conducted.

**#E079****Opioid prescription among sinus surgeons**

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**Objectives/Hypothesis:**

Misuse and diversion of opioids have contributed to the U.S. opioid crisis, making an understanding of specialty-specific and procedure-specific trends essential. The objective of this analysis was to evaluate opioid prescribing patterns among sinus surgeons, specifically examining factors associated with variations.

**Methods:**

High-volume sinus surgeons were identified through the CMS database and cross-referenced against prescriptions to Medicare Part D beneficiaries during 2015. Number of opioid prescriptions, prescription lengths, and demographic information were obtained.

**Results:**

This cohort of 570 surgeons wrote 21,042 opioid prescriptions (5.7d per prescription) in 2015, with 80.3% writing > 10 prescriptions. Surgeons writing a greater amount of prescriptions wrote lengthier courses ( $p = 0.01$ ). Female otolaryngologists wrote lengthier prescriptions (6.2 vs. 5.3d,  $p = 0.01$ ). Early-career otolaryngologists (< 10y) offered fewer prescriptions compared to those who had greater experience (31.1 vs. 39.3,  $p = 0.02$ ). 73.6% of fellowship-trained otolaryngologists offered > 10 prescriptions vs. 82.7% of non-fellowship-trained otolaryngologists ( $p = 0.02$ ). Practitioners in the South on average prescribed the greatest amount of opioids ( $p < 0.05$ ).

**Conclusion:**

A majority of sinus surgeons prescribe > 25 opioid prescriptions annually, with otolaryngologists who write a greater amount of prescriptions writing lengthier courses. As the mean opioid prescription length is 5.7 days, recent legislation limiting opioid prescriptions to five days may only have a modest impact for preventing the diversion of perioperative opioid prescriptions. These data suggest further standardized guidelines may be beneficial in elucidating the appropriate indications for the prescription of opioids among sinus surgeons.

**#E080****Oropharyngeal squamous cell carcinoma with distant metastasis to clivus**

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**Introduction:**

Squamous cell carcinoma of the oropharynx typically develops distant metastasis to the lung, liver, and bone. Metastasis specifically to the clivus from oropharyngeal squamous carcinoma has only been reported in the literature once before.

**Methods:**

Case report

**Results:**

A 56-year-old man with a past medical history of HIV and hepatitis B and definitive treatment for a T3N2bM0 squamous cell carcinoma of the left tonsil. He presented with multiple cranial nerve palsies 2 years following concurrent chemoradiotherapy. A surveillance CT scan revealed a new clival mass with skull base erosion. Bilateral endoscopic sphenoidotomy and biopsy revealed squamous cell carcinoma consistent with metastasis. His primary site remains free of tumor. Review of previous imaging revealed this to be lesion separate from the original tumor.

**Conclusion:**

This is a rare case report on a delayed distant clival metastasis from non-HPV oropharyngeal squamous cell carcinoma.

## #E081

**Outcomes and complications of endoscopic sinus surgery based on age**

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## Introduction:

As our population experiences greater longevity, older patients with chronic rhinosinusitis (CRS) are increasingly being considered candidates for endoscopic sinus surgery (ESS). This study compared quality of life (QOL) outcomes and perioperative complication rates between older and younger patients undergoing ESS.

## Methods:

A retrospective comparison was performed between 126 patients >65 years and 104 patients <65 years who underwent ESS. 22-Item Sinonasal Outcomes Test (SNOT-22) and endoscopy scores were collected pre-operatively and at 1, 2, 6, and 12-month follow-up. Patient demographics, co-morbidities, and complications were recorded.

## Results:

Both groups had similar baseline disease characteristics, extent of surgery, and pre-operative endoscopy scores. Younger patients had higher pre-operative total SNOT-22 (48.8 versus 41.4,  $p=0.02$ ) than older patients. At 6 months post-operatively, both groups showed comparable degrees of improvement in total SNOT-22 (-23.9 versus -16.5,  $p=0.06$ ), including all sinus-specific domain scores, and endoscopy scores (-2.8 vs -2.7,  $p=0.754$ ). No differences were seen in a sub-analysis of further stratified age groups (=55, 55-64, 65-74, and =75 years). Both groups were equally likely to achieve a minimal clinically important difference (MCID) of -9 points in the SNOT-22 (OR 1.11, 95% CI 0.40-3.1,  $p=0.841$ ). When adjusted for American Society of Anesthesiologists (ASA) physical status, there was no inter-group difference in post-operative admission rates ( $p=0.09$ ), complications ( $p=0.44$ ), or emergency department visits ( $p=0.81$ ).

## Conclusions:

Older patients with CRS show similar degrees of improvement after ESS when compared to younger patients. There are were no differences in perioperative and postoperative complication rates between age groups.

## #E082

**Outcomes of endoscopic surgical treatment of sinonasal hemangiopericytoma**

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## Introduction:

Sinonasal hemangiopericytomas (SNHPC) are rare vascular tumors of the nasal cavity, traditionally believed to have a strong propensity for recurrence. The gold standard in management is wide surgical excision. Resection via an endoscopic approach has gained acceptance over the last decade. In this series, we discuss endoscopic surgical resection and outcomes of patients with SNHPC at our institution.

## Methods:

This case series was a retrospective chart review of eleven patients evaluated for SNHPC at an academic, tertiary referral hospital between January 1, 2007 to December 1, 2017. Patient data was analyzed with respect to demographics, pathology, management, and survival.

## Results:

Eleven patients with SNHPC were evaluated at our institution. This cohort was composed of 7 men and 4 women. Mean age at diagnosis was 55 years (range 24-77 years). The most common presenting symptom was unilateral nasal obstruction (55%) followed by epistaxis (45%). All patients were managed with endoscopic surgical resection, with one case requiring a combined endoscopic and open approach. The most common site of attachment was the nasal septum (81%). 3 patients underwent postoperative adjuvant radiation and 1 received concurrent chemotherapy. There were no recurrences or metastatic disease with a mean follow-up of 38 months (range 2.8-108 months).

## Conclusions:

Endoscopic surgical resection of SNHPCs with curative intent, with consideration of adjuvant therapy, bestows significant oncologic control for these patients.

**#E083****Patient satisfaction in a multidisciplinary rhinology and allergy/immunology clinic**

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**Introduction:**

Patients who present to the rhinology clinic may have an allergic component of their disease process, oftentimes requiring an allergy/immunology referral. We describe our experience with a multidisciplinary clinic and report on patient satisfaction.

**Methods:**

Eighty-one patients were seen in a tertiary academic multidisciplinary rhinology and allergy/immunology clinic from 2016 to 2017. Patients were seen by both specialists and underwent nasal endoscopy and skin prick testing to 18 allergens during their visit. Patient satisfaction was assessed using a 16-question telephone survey following their visit.

**Results:**

Of 81 patients who presented for evaluation of chronic sinonasal symptoms, 64% (n=52) were female and 36% (n=29) were male. The median age was 51 years (range, 18-91). After the visit, the most common diagnoses were allergic rhinitis (66.7%) and chronic rhinosinusitis (39.5%). The median SNOT-22 score was 40 (range, 4-122). 75.3% were treated with medical management only, while 24.7% underwent surgery. Forty-six patients completed the satisfaction survey (response rate 56.8%). On a 0-10 Likert scale, patients felt that understanding of their sinonasal disease improved after their visit (mean, 8.6; SD 2.2) and that their visit was a good use of time (mean, 9.5; SD 1.4). 97.8% of patients were satisfied or very satisfied with their overall experience and almost all patients would recommend this clinic to others (95.6%).

**Conclusion:**

Patients report high satisfaction and increased understanding of their sinonasal disease following their visit in our combined rhinology and allergy/immunology clinic. The multidisciplinary approach might be of benefit to patients with sinonasal diseases.

**#E084****Perioperative analgesia for patients undergoing endoscopic sinus and skull base surgery: An evidence-based review with recommendations**

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**Objectives:**

Misuse, diversion, and dependence of legitimately prescribed opioids have been recognized as critical factors in the opioid epidemic. Our objective was to perform a systematic evidence-based review delineating perioperative regimens evaluated for endoscopic sinus and skull base surgery.

**Methods:**

Several databases were evaluated for studies detailing analgesics employed by patients undergoing endoscopic sinus/skull base surgery. Studies were assessed for level of evidence. Bias risk was evaluated using the Cochrane Bias tool and GRADE criteria. Method of pain control, administration, adverse effects, pain scores, and rescue analgesic consumption were collected. A summary of recommendations detailing benefits, harm, cost, and recommendation level was prepared.

**Results:**

Thirty-five studies (34 RCTs) encompassing 1,935 patients were included. The GRADE criteria determined the overall evidence to be of moderate quality. Perioperative acetaminophen had few adverse events and reduced immediate need for opioid rescue after sinus surgery; studies evaluating acetaminophen demonstrate a preponderance of benefit over harm. NSAIDs also reduce post-operative opioid consumption, although a significant portion of patients undergoing sinus surgery harbors the potential for NSAID intolerance. The aggregate level of evidence for studies evaluating NSAIDs was A, while the aggregate grade of evidence for several other agents was B.

**Conclusion:**

There is evidence supporting the use of NSAIDs for the control of pain following sinus surgery (Recommendation). Acetaminophen, alpha-agonists, local anesthetics, and gabapentin all have literature supporting their use as an option for post-operative pain. Familiarity with these data is essential to facilitate the use of perioperative alternatives to opioid-containing medications.

## #E085

**Physician variation in debridements after endoscopic sinus surgery**

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**Introduction:**

The role of debridements after endoscopic sinus surgery (ESS) is controversial as few studies have demonstrated differences in patient outcomes based on the number of postoperative debridements. We sought to determine current practice variation in the volume of debridements performed after ESS.

**Methods:**

Using 2014-2016 Medicare physician claims data, patients with chronic or acute recurrent sinusitis who underwent ESS were identified using ICD and CPT codes. Physicians who performed greater than ten sinus procedures were included. For each physician, we calculated the mean number of postoperative debridements performed per patient and the percentage of patients who received three or more debridements within six months.

**Results:**

Among 3,766 physicians who met inclusion criteria, on average, 23% never performed a debridement, 38% performed (0,1] debridements, 26% performed (1,2] debridements, 10% performed (2,3] debridements, and 3% performed greater than 3 debridements. The mean number of mean debridements after ESS was 0.88 (range 0-10.7). Fifty percent of physicians never performed three or more debridements on any patient, while 20% of physicians performed three or more debridements on 1-10% of patients, and 10% of physicians performed three or more debridements on 11-20% of patients. Two percent of physicians performed three or more debridements on more than 80% of patients.

**Conclusions:**

Current literature does not support the use of multiple debridements after ESS. However, there exists a wide disparity in the number of debridements performed after ESS at the physician level. High outlier variance may represent low-value care and have implications on healthcare resource utilization.

## #E086

**Post-traumatic organized maxillary sinus hematoma causing proptosis in a patient with Von Willebrand Disease**

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 Jamie Schaefer, MD  
 Brian M. Kellermeier, MD  
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**Objective:**

To review the presentation, radiologic findings, and surgical management of a case of organized maxillary sinus hematoma with proptosis in a patient with Von Willebrand Disease.

**Methods:**

Case report, chart review

**Significance:**

Hemorrhage into the maxillary sinus following orbital floor fractures is common. However, hemorrhage with organized hematoma formation is less common. There are several reports of organized maxillary sinus hematoma and its management. Moreover, bleeding disorders are well documented in association with organized hematoma formation in the sinuses. However, there are few reported cases of orbital complications due to organized hematoma formation of the maxillary sinus.

**Case:**

A 46-year-old male with Von Willebrand Disease presented with diplopia and proptosis following an orbital floor fracture suffered 5 weeks prior. He initially had mild epistaxis and did not seek medical evaluation. CT revealed an expanding mass of the maxillary sinus with displacement of the orbital floor. He was given preoperative DDAVP followed by intraoperative TXA. Endoscopic right middle meatal antrostomy with evacuation of an organized maxillary sinus hematoma was performed with immediate improvement in orbital firmness and proptosis. Hemorrhage at the orbital floor was controlled with cauterization and absorbable packing. The patient was discharged home on oral TXA and returned to his 3-week post-op with resolution of diplopia/proptosis.

**Conclusions:**

Although orbital complications of organized hematoma are rare, patients with bleeding disorders are at an increased risk. Conservative management following orbital floor fractures in such patients should include close follow-up and prompt surgical intervention to avoid delayed complications.

## #E087

**Povidone-iodine: A novel treatment option for recalcitrant chronic rhinosinusitis**

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**Introduction:**

Recalcitrant chronic rhinosinusitis (CRS) is a persistent inflammatory condition affecting the sinonasal mucosa, despite medical therapy after functional endoscopic sinus surgery (FESS). With limited alternatives, these patients continue to experience a reduced quality of life. We aim to demonstrate the effectiveness of povidone-iodine (PVP-I) sinus rinses on endoscopic Modified Lund-Kennedy (MLK) scores.

**Methods:**

This is a retrospective chart review of 59 recalcitrant CRS patients who added PVP-I to their saline rinses (0.08%) between September 2016 and August 2017. Patients were evaluated endoscopically at baseline and at least 40 days later.

**Results:**

PVP-I sinus rinses resulted in a significant decrease of the median total MLK score (64% of all patients improved by =1 point;  $p=0.0001$ ), and of the median total MLK discharge score (63% of all patients improved by =1 point;  $p=0.0001$ ). Median total MLK score decreases were not significant in patients with a baseline total MLK score of 1 to 4, nor in patients diagnosed with CRS with nasal polyps (CRSwNP). Decreases in median MLK discharge scores were also not significant in CRSwNP patients or in patients concurrently on antibiotics or antifungals. The decrease was instead significant amongst patients not on these medications (68% improved by =1 point;  $n=37$ ,  $p=0.0001$ ).

**Conclusions:**

PVP-I rinses as an adjunct therapy to recalcitrant CRS management is associated with a significant positive improvement in sinonasal endoscopic appearance. Further research to delineate the efficacy and safety of PVP-I is currently ongoing at our centre.

## #E088

**Primitive neuroectodermal tumors (PNETs) of the nose: A case report and a literature review**

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**Objectives:**

Primitive neuroectodermal tumors (PNETs) are highly malignant tumors composed of small round cells of neuroectodermal origin that affect soft tissue and bone. Rare in the head and neck. Exhibit pathologic similarities with other small, round cell tumors. We report and review the second case in the literature of PNET arising in the nose.

**Study Design:**

A Case report and literature review

**Methods:**

We report a 17 years old female patient presented with long history of bilateral nasal obstruction. On examination, a firm and non-painful mass occluding both sides of nasal cavity and expanding causing fascial disfigurement with proptosis of the left eye. CT was performed and showed a nasal cavity mass infiltrating the left orbit with invasion of both maxillary and ethmoidal sinuses and the hard palate.

**Results:**

Biopsy was taken and pathology diagnosed Angiofibroma. Pre-operative angiographic embolization was performed then complete excision was done. Immunohistopathology examination of specimen was consistent with (PNET). Radiochemotherapy was introduced to the patient. She was completely cured and free of the disease in the past three years of the follow up.

**Conclusions:**

With aggressive tumors in the nose, (PNETs) should be considered as a differential diagnosis, immunohistochemistry is essential in the diagnosis. Complete excision with negative margins should be done and affect the prognosis. Surgery followed by radiochemotherapy is the best treatment modality, the orbital location seems to be associated with a particularly better prognosis. Larger studies are needed to assess the nature of (PNETs) and to formulate more effective therapeutic protocol.



## #E089

**Rapid progression of odontogenic sinusitis leading to fulminant orbital infection**

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## Introduction:

Odontogenic infection is a well-known cause of sinusitis that, if left untreated, can spread beyond the paranasal sinuses to the orbit or intracranially. There have been several case reports in the literature of orbital and subperiosteal abscesses arising from odontogenic sources. We report a case of aggressive odontogenic sinusitis leading to permanent blindness.

## Methods:

Retrospective case study of an otherwise healthy patient who developed acute necrotizing odontogenic sinusitis and orbital abscess resulting in blindness, treated at a tertiary medical center.

## Results:

A 57-year old man with no past medical history presented to the emergency department with 4 days of left upper molar pain and progressive left eye pain and swelling. Urgent evaluation on site found no light perception in that eye while imaging revealed acute pansinusitis. He underwent bedside lateral canthotomy and cantholysis for decompression, and was urgently taken to the operating room for endoscopic sinus surgery, teeth extraction, and orbital exploration. Intraoperatively, he was noted to have extensive necrosis of both sinonasal mucosa and medial orbital contents. Intraoperative cultures grew *Staphylococcus epidermidis* and *Klebsiella pneumoniae*, and he improved on intravenous broad-spectrum antibiotics, though did not regain any vision. He subsequently underwent left orbital exenteration on post-operative day 16.

## Conclusions:

While rare, orbital complications from odontogenic sinusitis can progress rapidly with irreversible consequences. We present a case of odontogenic sinusitis in an immunocompetent patient where vision loss occurred within days of symptom onset, which highlights the importance of urgent evaluation and surgical intervention whenever orbital involvement is suspected.

## #E090

**Recurrence of skull base lesions attributed to tumor seeding: A systematic review of the literature**

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 Hosheng Lin, MD  
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## Objectives:

Technological innovations have drastically improved outcomes and morbidities associated with surgical extirpation of skull base lesions. Nevertheless, there have been concerns regarding the potential for tumor implantation along surgical access pathways. Our objective was to evaluate recurrences that have been attributed to iatrogenic tumor seeding.

## Methods:

A systematic review of the literature was performed, searching for recurrence of ventral skull base lesions attributed to iatrogenic implantation. Studies were assessed for level of evidence. Primary intervention, pathology, and other clinical factors were reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.

## Results:

Of 57 patients with recurrent skull base lesions attributed to seeding, the most common pathologies included craniopharyngioma (45.6%), chordoma (35.1%), adenocarcinoma (8.8%), adenoid cystic carcinoma (3.5%) and squamous cell carcinoma (3.5%). Median time to recurrence was 36 months. Time to recurrence was significantly longer for Craniopharyngiomas than Chordomas (48 vs. 24 months,  $p = 0.01$ ). Surgical approaches among these patients included: craniotomy (66.7%), transseptal (14.0%), transfacial (15.8%), and transpalatal approaches (5.3%). Only three cases (5.3%) employed endoscopic/endoscopic-assisted approaches. Commonly reported recurrence sites included: subarachnoid (31.6%), Dura (22.8%), septum (31.6%), and ethmoid sinuses (5.3%).

## Conclusion:

The potential for iatrogenic tumor seeding exists for numerous skull base lesions, most notably craniopharyngioma and chordoma. Only a small percentage of reported cases involve lesions originally treated with transnasal endoscopic techniques. Further direct comparison of traditional "open" and microscopic approaches to endoscopic approaches may be invaluable in further elucidating the role of surgical technique in tumor implantation and recurrence.

**#E091****Reliability of the supraorbital ethmoid cell versus keros classification in predicting the course of the anterior ethmoid artery**

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**Objective:**

We previously demonstrated that the supraorbital ethmoid cell (SOEC) is a reliable landmark for identifying the anterior ethmoidal artery (AEA). Recent data have suggested that Keros classification is also a dependable predictor. We aim to characterize the location of the AEA and its relation to the skull base in patients with and without SOEC through utilizing the Keros classification.

**Study Design:**

Retrospective radiographic study

**Subjects and Methods:**

Computed tomography (CT) scans of 76 patients (40 with SOEC, 36 without) were evaluated. Distance of AEA from skull base and prevalence of AEA outside of the skull base were measured on each side and compared between groups using the two-sample t-test and X2 test, respectively. Subgroup analysis was carried out based on the Keros classification.

**Results:**

Mean distance of AEA from the skull base was 1.321.5mm in patients with SOEC and 0.471.08mm in those without ( $p < 0.001$ ). Prevalence of AEA outside of the skull base was 55.4% in those with SOEC and 18.1% in those without ( $p < 0.001$ ). Comparing patients with SOEC to those without, AEA was found below the skull base in 30% vs. 0% of cases with Keros class I ( $p = 0.45$ ), 58% vs. 14.5% with Keros class II ( $p < 0.001$ ), and 60% vs. 50% with Keros class III ( $p = 0.72$ ).

**Conclusion:**

Presence of SOEC is associated with higher prevalence of AEA course below the level of the skull base in all Keros classes, thus placing the artery at greater risk for injury. Careful surgical planning is needed to avoid potential orbital complications.

**#E092****Replication study of patient-specific factors that correlate with the average number of post-operative sinonasal debridements**

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 Kevin Shi, BA  
 Stephanie A. Joe, MD, FARS  
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**Introduction:**

Debridement of the sinus cavity is a procedure commonly performed following endoscopic sinus surgery (ESS). This replication study was performed to support the data from a prior study, which identified patient specific risk factors that correlate with the average number of post-operative sinonasal debridements.

**Methods:**

New data on ESS performed from 2006 to 2016 were collected from a tertiary care academic database. The number of post-operative sinonasal debridements were identified for each patient and correlated with patient specific factors.

**Results:**

106 patients were included in the replication study (48 females, 58 males). Average age is 45.2 years old. Range is 4 to 83 years old with standard deviation of 16 years. Surgical indication, tobacco use, alcohol use, age, number of medications used, number of post-operative upper respiratory tract infections treated with antibiotics, and number of diagnoses do not correlate with the average number of post-operative sinonasal debridements needed ( $p > 0.05$ ). Number of sinuses opened during surgery positively correlated with the average number of post-operative sinonasal debridements needed ( $p < 0.05$ ).

**Conclusions"**

Consistent with a prior study, the number of sinuses opened during ESS positively correlates with the average number of post-operative sinonasal debridements and demonstrates reproducibility of earlier findings.

## #E093

**Rhinotillexomania in the cystic fibrosis patient population: A review of the literature**

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 Brian D'Anza, MD  
 Kenneth Rodriguez, MD  
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## Introduction:

Cystic fibrosis (CF) is a multisystem disease that profoundly affects the upper respiratory tract, particularly the nasal mucosa and paranasal sinuses. Persistent discomfort and nasal manifestations of this disease significantly affect quality of life and patients' attempts to remove crusting can lead to significant septal and turbinate damage.

## Methods:

We undertook a literature review to identify populations at risk for septal perforation and present a case report.

## Results:

There have been no documented cases of manual destruction of the nasal septum and turbinates in CF patients, or an increased prevalence of septal perforation in this population. Additionally, in the general population there are very few documented cases of extensive septal and turbinate destruction resulting from digital trauma, as was seen in this patient.

## Conclusions:

This case underscores the importance of sinus disease symptom management, as it demonstrates the lengths that patients will go to in trying to relieve their discomfort. Further investigation as to a cause of such persistent nasal manipulation is warranted, as this may be especially important in the cystic fibrosis patient population, who experience refractory sinonasal symptoms from a young age. In the future, establishing appropriate treatment guidelines for this particular patient population is warranted, keeping in mind cases such as this, which demonstrate the consequences of ineffective symptom management.

## #E094

**Septoplasty and rhinoplasty in the pediatric population: Epidemiology using a population based approach**

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## Objective:

Although septoplasty and rhinoplasty are accepted procedures to treat nasal obstruction and improve nasal airflow, there remains discourse on whether these procedures should be readily performed in the pediatric population. This project was designed to better understand the current epidemiology of septoplasty and rhinoplasty performed in pediatric hospitals.

## Study Design:

Population level database analysis.

## Methods:

The Pediatric-Health-Information-System provides admission data on 43 US children's hospitals. Pediatric patients that underwent a septoplasty or rhinoplasty from 10/1/2013 to 12/31/2015 were identified by corresponding procedural codes. Database analysis generated summary statistics and regression analysis was performed to identify an association between patient characteristics and surgical procedure.

## Results:

3315 pediatric patients with a mean age of  $13.6 \pm 4.1$  years underwent a septoplasty or rhinoplasty. Of these children, 2325 underwent a septoplasty ( $14.3 \pm 3.1$  years; 65% male and 35% female) and 990 underwent a rhinoplasty ( $11.9 \pm 5.4$  years; 51% male and 49% female). Regression analysis suggested that the incidence of both procedures was higher in Non-Hispanic ( $p < 0.001$ ), Caucasian ( $p < 0.001$ ), and low socioeconomic status population ( $p = 0.02$ ) with no significant difference across regions. Analysis of physician sub-specialty profiles showed that septoplasty procedures were predominantly performed by Otolaryngologists (86%) and rhinoplasty procedures by Plastic Surgeons (72%). Otolaryngologists were shown to perform rhinoplasty procedures on a significantly older age group ( $14.0 \pm 4.4$  years) than Plastic Surgery ( $11.5 \pm 5.4$  years) ( $p < 0.001$ ).

## Conclusion:

Despite the controversy, both procedures have been shown to be performed in patients prior to adolescence. Comparison between various systems is critical to better understand the effects of these procedures on this patient population.

**#E095****Septoplasty with inferior turbinectomy, In-patient or out-patient?**

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**Objectives:**

Septoplasty with inferior turbinectomy is one of the most common surgeries in otorhinolaryngology and it can be performed either as an in-patient or an out-patient procedure. The study is aimed to compare the surgical outcomes between the in-patient and out-patient groups.

**Methodology:**

Retrospective study

**Setting:**

Hospital

**Patients:**

One hundred and fifty-two patients who underwent septoplasty with inferior turbinectomy between May 2012 and February 2013

**Interventions:**

The patients were divided into two groups based on whether or not they were admitted for the procedure: the in-patient group (Group I) and the out-patient group (Group O)

**Main Outcome Measures:**

The two groups were compared in three aspects: (i) consumption of medical resources, including payment of National Health Insurance, surcharge for patients, and total surgical expenses (sum of previous two items); (ii) prognostic indicators, including the duration of nasal decongestant used, number of follow-up visits, and total period of complete recovery; and (iii) post-operative complications, including post-operative hemorrhage, adhesions, septal hematoma, septal perforation, and wound infection.

**Results:**

By t-test, there was no statistically significant difference between these 2 groups in prognostic parameters ( $p < 0.05$ ) except for "duration of nasal decongestant". By Chi-square test, there was also no statistically significant difference in incidence of post-operative complications. In terms of medical expenses, the in-patient group had higher medical resource consumption than the out-patient group in all aspects.

**Conclusions:**

Septoplasty with inferior turbinectomy can be performed with good cost-effectiveness, satisfactory quality, and adequate safety as an out-patient procedure.

**#E096****Severe refractory epistaxis in patient with a left ventricular assist device: a case report**

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**Introduction:**

Non-operative bleeding events are well-recognized complications in patients with left ventricular assist devices (LVAD), particularly the continuous-flow type (CF-LVAD). Gastrointestinal hemorrhage is the most frequently reported bleeding complication, which can occur due to the evolution of secondary arteriovenous malformations (AVM). Severe epistaxis is an underreported, potentially life-threatening complication of CF-LVADs that can occur by a similar mechanism. We describe for the first time in the Otolaryngology literature the unusual presentation of a CF-LVAD patient with refractory epistaxis that required operative intervention to address diffuse endonasal telangiectatic lesions.

**Methods:**

We present the case of a 61-year-old female with a CF-LVAD for non-ischemic cardiomyopathy with recurrent epistaxis recalcitrant to nasal packing requiring bilateral sphenopalatine artery ligations and aggressive KTP ligation of endonasal AVMs. We reviewed the literature to report on the prevalence and management of gastrointestinal and upper aerodigestive bleeding events related to CF-LVAD placement.

**Results:**

The CF-LVAD population harbors a strong predisposition to mucosal bleeding due to altered arterial flow dynamics, acquired von Willebrand syndrome, and vascular neogenesis. Few studies mention epistaxis as a major potential sequela of CF-LVADs. The case presented here is an uncommon but robust demonstration that recalcitrant epistaxis in the LVAD population can be the result of a similar process as is seen in LVAD patients with gastrointestinal AVMs.

**Conclusion:**

CF-LVAD patients constitute a unique cohort susceptible to severe epistaxis. Operative intervention (i.e. sphenopalatine artery ligation, laser ablation of vascular lesions) can be successful, and may indeed be necessary, to address LVAD-secondary epistaxis.

#E097

**Should endoscopic technique be considered the preferred approach for pediatric septoplasty?**

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**Background:**

Treatment of septal deviation in the pediatric population has proved safe and effective, thus gaining acceptance in recent years among otolaryngologists. Studies demonstrate that nasofacial growth is indeed not affected by surgical correction, and pediatric quality of life shows improvement after this procedure.

Concomitantly, research into endoscopic septoplasty (ES) in the past two decades has generated great interest. ES has been touted as superior to traditional techniques in terms of visualization, addressing directed structural abnormalities, and proving beneficial for instruction at teaching institutions.

**Objective:**

In this review, literature on pediatric septoplasty and endoscopic septoplasty are compared, and indications and results of meta-analyses are discussed. Though pediatric septoplasty is advocated as safe and beneficial, surgeons still proceed with minimal invasiveness and to correct only select pathologies. It may be of further research interest to examine endoscopic septoplasty in pediatric patients as the preferred approach to pediatric nasal septal surgery.

**Methods:**

A structured review of PubMed was undertaken using the terms: pediatric septoplasty, endoscopic septoplasty, pediatric endoscopic septoplasty.

**Conclusions:**

Given the ability to better visualize and address distinct septal abnormalities with the endoscope, it may be of interest to investigate outcomes of endoscopic versus other methods of septoplasty in pediatric nasal surgery. Endoscopic septoplasty may prove a better approach than traditional septoplasty for limited, less invasive work in pediatric patients. Furthermore, since many pediatric otolaryngology cases may be performed at tertiary centers and programs, the ability to both teach and train with endoscopic techniques may improve education for mastering pediatric septoplasty.

#E098

**Silent sinus syndrome masquerading as recurrent graves' orbitopathy**

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**Introduction:**

Orbital decompression is performed for Graves' orbitopathy refractory to medical management, and involves removal of one or more of the bony walls of the orbit. Sinonasal complications following this procedure are uncommon, and typically occur within the first few months postoperatively. Iatrogenic silent sinus syndrome is rare, and presents with unilateral enophthalmos and hypoglobus.

**Objective:**

To describe the clinical presentation and management of delayed silent sinus syndrome in a patient with prior orbital decompressions for Graves' orbitopathy nine years earlier.

**Methods:**

The patient's chart, photographs, and imaging results were reviewed. A literature review of silent sinus syndrome, complications of orbital decompression, and surgery for Graves' orbitopathy was performed.

**Results:**

The patient was a 48-year-old woman with a history of bilateral lateral orbital wall decompressions, left medial orbital wall and posterior floor decompression, and left external ethmoidectomy nine years previously. At presentation, there was orbital asymmetry suggestive of either left enophthalmos due to continued resolution of Graves' orbitopathy or right exophthalmos due to reactivation of Graves' orbitopathy. However, CT scan demonstrated an opacified, hypoplastic left maxillary sinus suggesting silent sinus syndrome. She underwent endoscopic left maxillary antrostomy with creation of a wide inferior meatal window. The patient recovered well postoperatively with gradual resolution of enophthalmos.

**Conclusions:**

Collapse of the maxillary antrum secondary to orbital decompression can lead to a delayed presentation of iatrogenic silent sinus syndrome. In a patient with a history of orbital decompression presenting with new orbital asymmetry, silent sinus syndrome should be considered in the differential diagnosis.

## #E099

**Silent sinus syndrome with lateralized middle turbinates: A case report**

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**Introduction:**

Silent sinus syndrome (SSS) is an uncommon condition characterized by gradual collapse of the orbital floor, likely resulting from chronic obstruction of the ostiomeatal complex (OMC) with resultant negative pressure in the maxillary sinus. We present a unique cause of obstruction where the lateralized middle turbinate is retracted into an accessory maxillary ostium and address its surgical considerations.

**Methods:**

Patients with sinus computed tomography (CT) findings consistent with SSS and with endoscopic findings of middle turbinate retraction into the maxillary ostium were identified at a tertiary referral center.

**Results:**

Two patients with sinonasal symptoms were found to have SSS on sinus CT. Nasal endoscopy was notable for lateralized middle turbinate with "sucked-in" appearance into the maxillary ostium. Endoscopic sinus surgery including maxillary antrostomy was performed. In addition, one patient underwent a partial middle turbinectomy, while the other patient underwent suture medialization to prevent future re-obstruction. Follow-up at 8 months revealed resolution of symptoms.

**Conclusion:**

SSS is rare, and typically manifests as orbital symptoms including enophthalmos and hypoglobus, often without preceding signs of sinusitis. Diagnosis is confirmed using sinus CT, demonstrating inward retraction of the sinus walls with associated decrease in sinus volume. Endoscopic sinus surgery with maxillary antrostomy is an effective approach to addressing the ostial obstruction, the suspected underlying cause. Patients with lateralized middle turbinate may require additional intervention such as partial middle turbinectomy or suture medialization to prevent re-obstruction and reduce risk of recurrence.

## #E100

**Silent sinus syndrome: 5% criteria**

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**Introduction:**

Silent Sinus Syndrome (SSS) manifests in progressive enophthalmos, hypoglobus and ipsilateral maxillary sinus atelectasis. Ostiomeatal obstruction precedes sinus collapse, inducing hypoventilation and mucus secretions. However, standardized radiographic criteria for identification of SSS do not exist.

**Materials and Methods:**

Imaging software (Amira) compared sinus CTs of 15 patients with SSS to their contralateral non-pathological side. This was then compared to 15 healthy controls without SSS. Receiver operating characteristic curve (ROC) analysis was then performed to compare respective distance of the medial orbital floor to medial maxillary floor (MOF-MMF) taken from a standardized location, and maxillary volumes, which were integrated over all slices.

**Results:**

Control shows remarkable symmetry between left and right side with average maxillary volume differences=0.02%. Maxillary sinus volumes side-difference cutoff at 20%, yielded 93% sensitivity and 0% false positives in differentiating control vs SSS patients. ROC area was 0.962 with standard error (SDER) of 0.039. MOF-MMF difference of 5% yielded a 93% sensitivity and a 7.1% false positive, with area under ROC 0.952 and SDER of 0.044. MOF-MMF difference of 7% yielded 86% sensitivity and 0% false positives.

**Discussion:**

We propose the following criteria for radiographic diagnosis of SSS: 1) the pathological maxillary sinus appears visibly smaller than the contralateral side, 2) the uncinate process is lateralized, 3) the sinus has a heterogeneous appearance, 4) the MOF-MMF ratio is >5%.

**Conclusion:**

While differences in volumes of maxillary sinuses are the most accurate, these objective criteria allow rapid and reliable identification of SSS.

## #E101

**Sinonasal disease in total laryngectomy patients**

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**Introduction:**

Total laryngectomy (TL) results in complete abolition of nasal airflow, with notable pathologic alterations of intranasal mucosa, mucociliary clearance, and nasal cycle. Despite these observed morphological changes, it remains unclear whether this subpopulation experiences clinically significant sinonasal disease. The goal of this study was to identify rhinosinusitis in TL patients using radiographic imaging.

**Methods:**

An IRB-approved retrospective review (January 2005—July 2017) identified 50 patients who underwent radiographic imaging before and after TL. The Lund-Mackay Staging System (LM) was applied to 197 surveillance Computed Tomography scans. Simple linear regression was modeled to LM; tests of statistical significance were estimated via the method of Kenwood and Roger. Demographic as well as relevant clinical factors were also analyzed.

**Results:**

The mean age was 62.4 years, with a 5:1 male-to-female ratio. A series of abstracted rhinologic associated comorbidities include acid reflux (50%) allergic rhinitis (2%), asthma (8%), chronic rhinosinusitis (10%), radiation therapy (56%), and tobacco use (24%). A median of 3 scans were obtained, 49% within 12 months after TL. For every 1 month after TL, postoperative LM was +0.01-point ( $p=0.49$ ). Conversely, for every +1-point in preoperative LM, postoperative LM was +1.08-point ( $p<0.001$ ). Two patients required endoscopic sinus surgery after TL for persistent sinonasal disease.

**Conclusions:**

Preoperative sinonasal disease burden likely plays an important role in the development of clinically significant rhinosinusitis in TL patients. Correlating radiographic findings to validated outcome measures remains a critical aspect of determining optimal surgical candidates, this arena is still under investigation in this unique patient cohort.

## #E102

**Sinonasal inflammation in inverted papilloma**

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**Introduction:**

Pathogenesis of inverted papilloma (IP) has not been elucidated and evidence of chronic inflammation has often been observed independent of the obstruction caused by the tumor. This study assesses the association between sinonasal inflammation with IP.

**Methods:**

A retrospective chart review was performed from 2008 to 2017 treated at a tertiary referral center. Pertinent clinical data was obtained, and comparative analysis of surgical history, CT imaging, and histopathology was performed. Patients with bilateral tumors were excluded. A sample of intracranial non-IP tumors (e.g. pituitary adenoma) was used as the control cohort ( $n=20$ ). The Lund-Mackay scoring system was used and the sides opposite of the tumor were compared to the control sample.

**Results:**

152 patients were included in the analysis, with a median follow up of 32 months. Preliminary analysis revealed 51.9% of patients with IP had evidence of contralateral sinusitis at the time of presentation, with 40.7% of the patients had prior sinus surgery or septoplasty. When compared to the control cohort, the contralateral sinus of IP patients had higher Lund-Mackay scores (2.67 vs. 1.08,  $p<0.001$ ). Of the patients who had concurrent sinus surgery at the time of IP resection, the incidence of chronic inflammation was also higher when compared to controls (51.9% vs. 0%,  $p<0.001$ ).

**Conclusions:**

In this study, IPs were associated with a higher incidence of history of sinus disease, concurrent disease at time of tumor diagnosis, imaging, and by pathologic examination. Further studies are needed to better understand the temporal relationship between chronic inflammation and tumorigenesis.

## #E103

**Sinonasal quality of life and radiographic outcomes following endoscopic skull base surgery with nasoseptal flap reconstruction**

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## Introduction:

The utilization of the vascularized nasoseptal flap (NSF) in endoscopic anterior skull base surgery (EASB) has resulted in improved rates of post-operative cerebrospinal fluid leak. Its impact on sinonasal function after surgery remains incompletely defined.

## Methods:

A consecutive series of patients undergoing EASB with NSF and at least three months follow up was prospectively evaluated. Patient demographics, pre- and post-operative Sino-nasal Outcome Test-22(SNOT-22) scores, pre- and post-operative Lund-Mackay scores (LMS), cerebrospinal fluid (CSF) leak, and long-term sinonasal complications were analyzed.

## Results:

A total of 46 patients undergoing EASB with NSF met inclusion criteria. No statistically significant differences were noted between the mean overall pre(16) and post-operative SNOT-22 scores(18). Additionally, sub-domain analysis did not reveal any significant differences. SNOT-22 scores decreased in 27 patients(58.7%), increased in 17 patients(37.0%) and stayed the same in 2 patients(4.3%) following surgery with a mean follow up of 276 days. A statistically significant increase in LMS was noted at last radiographic follow-up (mean 656 days): mean pre-operative LMS 0.9 versus mean post-operative LMS 2.2 ( $p=0.001$ ). The LMS decreased in 9 patients(19.6%), increased in 22 patients(47.8%) and remained the same in 15 patients(32.6%). One patient(2.2%) developed a post-operative CSF leak following resection of metastatic disease and was successfully treated with conservative measures. One patient(2.2%) developed a post-operative mucocele requiring decompression three years after initial surgery.

## Conclusions:

The impact of EASB with NSF on sinonasal quality of life and radiographic outcomes appears favorable overall but supports the need for long-term post-operative care and further study.

## #E104

**Sinonasal tract mucoepidermoid carcinoma: A review of the national cancer database**

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## Introduction:

Primary sinonasal mucoepidermoid carcinoma is an uncommon malignancy arising from minor muco-serous glands of the nasal cavity and paranasal sinuses. Given its rarity, few large-scale studies are available. This study describes the incidence and determinants of survival of patients with mucoepidermoid carcinoma between the years of 2004 to 2012 using the National Cancer Database (NCDB).

## Methods:

This was a retrospective, population-based cohort study of patients diagnosed with mucoepidermoid carcinoma between 2004 and 2012 within the NCDB. The main outcome measure was overall survival (OS).

## Results:

A total of 164 patients were identified. The cohort was composed of 47.6% males. Mean age at diagnosis was 59.7 years. The maxillary sinus was the most common primary site, accounting for 45.7% of cases. 7.3% of patients presented with nodal disease, while 1.8% had distant metastases. 20.7% of cases presented with stage IV disease. 79.3% of patients underwent surgery, 59.1% received radiation therapy, and 14.6% had chemotherapy. Overall survival (OS) at 1, 2, and 5 years was 83%, 77.0%, and 57%, respectively. On multivariate analysis, Medicaid insurance status ( $p=0.007$ ), advanced tumor stage ( $p=0.028$ ), and advanced nodal disease ( $p=0.045$ ) were associated with worse OS.

## Conclusions:

Mucoepidermoid carcinoma is the most common salivary gland malignancy, but a rare sinonasal malignancy with 5-year survival approximating 50%. A significant proportion of patients present with advanced disease. Both socioeconomic factors and tumor characteristics are associated with survival.



## #E105

**Sinus surgery online information: A systematic analysis of the website and videos that our patients see**

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## Introduction:

Physicians should be aware of websites and videos available online regarding sinus surgery in order to provide quality care. This study analyzes authorships, reliability, quality, and readability of websites; as well as the authorships and primary objectives of videos regarding sinus surgery.

## Methods:

A Google search was performed, and the first five pages of results were included in this study. Websites were categorized by authorship (physician, patient, academic, or unaffiliated) and analyzed using the validated DISCERN instrument for reliability and quality, as well as various other instruments to measure readability. A Youtube search was also conducted, and the first 50 relevant videos were included in the study. These videos were categorized by authorship and primary objective.

## Results:

Website authorships were physician and academic-dominated. Reliability and overall DISCERN score differ between the four authorship groups by a statistically significant margin (Kruskall-Wallis test,  $p < 0.05$ ). Unaffiliated websites were the most reliable and had the highest overall score while patient/community websites were least reliable and had the lowest overall score. Readability did not differ significantly between the groups, though the readability measurements showed a general lack of material easily readable by the general public. Youtube was dominated by physician-authored videos. The majority of physician-authored and unaffiliated videos sought to inform, while the majority of patient-authored videos sought mainly to provide the perspective of the patient.

## Conclusions:

Professional organizations such as the AAO—HNS should publish more understandable, readily-accessible websites and videos targeted to the general public regarding sinus surgery.

## #E106

**Skull base osteomyelitis secondary to pediatric radium exposure**

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## Introduction:

Radium was widely used in the medical field during the mid-nineteenth century for treatment of various disorders ranging from chronic middle ear effusions to malignancy. It has since been discovered to have many toxic side effects and its use has been curtailed. We present a case of skull base osteomyelitis in a patient with a remote history of nasopharyngeal radium exposure for treatment of chronic middle ear effusions and adenoid hypertrophy.

## Methods:

Case report.

## Results:

A 73-year-old male was referred to our tertiary care center for evaluation of bilateral debilitating headaches persistent for two months. Imaging revealed nasopharyngeal soft tissue thickening with erosion of the anterior clivus and left petrous apex concerning for nasopharyngeal carcinoma. After initial cultures and biopsy showed pseudomonas and confirmed the presence of osteomyelitis, the patient was taken to the operating room for extensive debridement involving bilateral sphenoidotomy and biopsy, nasopharyngeal biopsy, lysis of nasal synechiae, and bilateral myringotomy with tube placement. He was subsequently discharged on long term intravenous antibiotics and experienced resolution of headache symptoms with normalization of all inflammatory markers.

## Conclusion:

Remote history of nasopharyngeal radium exposure may represent a risk factor for future development of skull base osteomyelitis. A detailed history and physical exam plays a vital role in evaluation and management of these patients. Tissue diagnosis with biopsy must be obtained prior to planning definitive treatment due to the potential for this disease to masquerade as malignancy.

**#E107****Spindle cell lipomas of the respiratory tract: Case report and literature review**

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**Introduction:**

Spindle cell lipomas (SCLs) are benign tumors that characteristically present on the upper back and posterior neck. There have been rare reports of SCLs involving the respiratory tract, including the nasal vestibule, oropharynx, hypopharynx, and bronchi. The objective of this study is to review the locations, treatments, and recurrence rate of respiratory spindle cell lipomas and report a case originating from the nasopharynx.

**Methods:**

A review of Medline was performed for reports of spindle cell lipomas in the respiratory tract. The location of the tumor, as well as method of resection and outcome for each case report was recorded.

**Results:**

There have been 24 cases of spindle cell lipoma in the respiratory tract, including one new case reported here. Thirteen were found originating from the larynx, two from the nasal mucosa, two from the soft palate, two from the retropharynx, two from endobronchial tissue, one from endotracheal tissue and one from the parapharyngeal tissues. The case we detail here is the first report of an SCL originating from the nasopharynx. All 24 respiratory SCLs were treated with excision, with the two endobronchial lipomas requiring lobectomy and the parapharyngeal lipoma requiring parotidectomy and submandibulectomy. There were no lasting complications and no recurrence noted for any of the tumors.

**Conclusions:**

Although rare, spindle cell lipomas may arise from various parts of the respiratory tract and cause nasal obstruction, dyspnea, hoarseness and stridor. Surgical excision is an effective way to prevent recurrence.

**#E108****Spontaneous CSF otorrhea and pneumocephalus from multiple skull base defects: Case report and literature review**

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**Background:**

Cerebrospinal fluid (CSF) otorrhea or rhinorrhea due to defects in the skull base is a serious disorder that typically requires surgical repair. Rarely are multiple symptomatic skull base defects observed.

**Methods:**

case report and literature review

**Results:**

A 66-year-old woman presented with 3 months of persistent left sided otorrhea from multiple skull base defects and a small encephalocele over the left mastoid, which was repaired through a middle fossa approach. Postoperatively, the patient developed mental status changes from right-sided tension pneumocephalus and was taken emergently to the OR for endoscopic evaluation of a possible anterior skull base defect. Intrathecal fluorescein through a lumbar drain was injected, which led to the identification of multiple encephaloceles in the right ethmoid and planum sphenoidale regions, which were repaired using autologous fascia lata, fat, and a pedicled nasal-septal flap. CSF otorhinorrhea resolved following the operation and the patient returned to baseline mental status. Only a handful of cases of spontaneous CSF otorhinorrhea from multiple skull base defects in a single patient were identified in the literature.

**Conclusion:**

Identification of spontaneous CSF leaks and repair of all skull base defects is necessary to prevent serious complications such as tension pneumocephalus.

## #E109

**Stab wounds affecting the anterior skull base: trajectory analysis as a means of directing clinical decision-making**

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## Introduction:

Stab wounds to the anterior skull base place critical structures of the head and neck at risk of injury. Appropriate and thorough evaluation of surrounding critical structures of the skull base, orbit, and paranasal sinuses is required prior to operative intervention.

## Methods:

Case Series and Literature Review

## Results:

We present two cases of assault in which knife trajectory was used to direct care. Case #1: 18-year-old female with a stab wound in which the knife entered at the left temporo-parietal region, coursing through the left temporal lobe, cavernous sinus, 1mm anterior to the carotid artery, and into the sphenoid sinus. Exam with third cranial nerve palsy; MRA with cavernous sinus thrombosis without injury to the ICA. Endonasal repair of the sphenoid sinus and encephalocele performed with abdominal fat graft and nasoseptal flap. Case #2: 19-year-old male with a stab wound to the left anterior forehead, with blade entering the left medial brow, left frontal sinus, crossing midline inferior to the skull base through the anterior ethmoids, into the right lamina papyracea and orbit. Exam with blade in situ without handle. Ophthalmology and neurosurgical evaluation normal; CT angiography negative for associated injury. The blade was removed and superficial skin layer closed with no further operative intervention or skull base repair.

## Conclusions:

Detailed analysis of blade trajectory is imperative in the evaluation of stab wounds to the head and neck in order to direct management and identify at-risk structures in the operative repair, including approach to and removal of foreign body.

## #E110

**Sublabial approach to excision of paranasal kimora disease**

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## Introduction:

Kimura disease (KD) is a chronic inflammatory disorder with clinical features of painless subcutaneous masses in the head and neck region, blood and tissue eosinophilia, and markedly elevated serum IgE levels. Treatment modalities described include excision, cetirizine therapy and mycophenolate mofetil monotherapy. The authors report a case of right paranasal and right submandibular KD that was treated with a sublabial approach for debulking of the more symptomatic paranasal lesion combined with medical therapy.

## Methods:

This patient was treated at the authors' facility and data was collected via chart review.

## Results:

A 52-year-old Korean patient presented to the authors' facility complaining of a right paranasal mass, pruritus overlying the lesion, right epiphora, right neck fullness and serum IgE of 958 IU/mL. Contrast CT scan demonstrated 1.9 x 2.4 right paranasal mass, and 1.3 x 3.3 cm right submandibular mass. Core needle biopsies of both masses demonstrated lymphocytic infiltrate, reactive germinal centers and many eosinophils. Surgical debulking of the more symptomatic paranasal lesion was performed via a translabial incision. Histopathology was consistent with core needle biopsy. After excision, his peripheral blood eosinophil count dropped from 4400/uL to 1800/uL. He was then treated with 10 mg cetirizine daily with improvement in symptoms.

## Conclusions:

KD is a rare disorder for which surgical debulking and medical therapy can effectively control patient symptoms. To the best of the authors' knowledge, this is the first sublabial approach for debulking a paranasal KD that has been described.

## #E111

**Technology and experience in functional endoscopic sinus surgery: role in surgical timing and complications management**

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We have examined the surgical times in the last 8 years of endoscopic surgery (263 cases of extended nasal pathology) in relation to surgical aids that have been used over the years. Technological aids may be especially helpful in revision surgery when normal anatomic landmarks are lacking, reducing significantly overall the complications. Nevertheless, incorrect use of microdebrider, which is a fast and efficient aid for the surgeon, the lack of tactile feedback and speed of tissue removal created the potential for markedly more severe orbital and intracranial complications. The results didn't show a significant difference regarding the extent of surgical duration and the use of various instruments and technologies such as Computer-assisted surgery (CAS), microdebrider, 3d optical lenses, rotating endoscope or endoscope lens washing sheaths. Although the preparation of the operating room is more intuitive, complex and prolonged, safety in terms of decrease in incidence of complications are favorable factors. Complications of homogeneous pathology were also investigated and demonstrated a significant reduction progressively related to increased experience and manuality. Training programs and acquisition of surgical skills have a more important impact than technologies on decreasing the risk of complications and surgical duration.

## #E112

**Telementoring in endoscopic sinus surgery: A feasibility trial**

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**Background:**

Teaching of endoscopic sinus surgery (ESS) holds unique challenges, as ESS is a single-surgeon, video-based procedure. Surgical mentoring requires a hands-off approach, and the transfer of knowledge occurs by verbal guidance. These characteristics make ESS an ideal procedure for remote telementoring. We performed a feasibility study for teaching ESS from a remote location using audio and video telementoring.

**Methods:**

Residents were asked to complete an ESS task checklist in a cadaver lab setting. Residents first performed the tasks autonomously without supervision, followed by performing the same tasks with telementoring assistance from an expert surgeon. The remotely situated telementor communicated with the resident via 2-way audio and video and a telestrator, facilitated by a telementoring robot. Residents completed a self-assessment of confidence after performing each of the tasks, rating their comfort level on a 10-point visual analog scale.

**Results:**

16 otolaryngology residents were assessed. All 16 residents reported significant improvement in comfort level with performing each ESS task when telementored, compared to independently performed ESS. The rate of overall confidence in performing ESS improved from 3.6/10 in the independent group to 7.8/10 in the telementored group ( $p < 0.0001$ ). When asked if a telementored session could safely and appropriately teach a new technique, participants strongly agreed, with a mean response of 9.2/10 (SD: 1.01)

**Conclusions:**

Telementoring is a novel and potentially effective method of teaching endoscopic sinus surgery. Telementoring carries the promise of teaching ESS in remote locations, where an expert sinus surgeon may not be geographically available.

## #E113

**The association between symptom severity and quality of life in patients with chronic rhinosinusitis and cystic fibrosis**

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**Introduction:**

Chronic rhinosinusitis (CRS) is highly prevalent in patients with cystic fibrosis (CF), causing substantial morbidity and decreased quality of life. Our study aimed to determine the association between sinonasal symptomatology and general health-related quality of life (QOL) in CRS patients with CF.

**Methods:**

Cross-sectional study of 159 patients with CRS (59 with CF, 100 without CF). CRS symptom burden was measured using the 22-item Sinonasal Outcome Test (SNOT-22), while general QOL was measured using the visual analog scale of the 5-dimension Euroqol survey (EQ-5D VAS). Associations were determined between EQ-5D VAS and SNOT-22 while controlling for clinical and demographic characteristics.

**Results:**

Mean SNOT-22 scores in CRS patients with and without CF were 27.5 (SD=17.1) and 29.6 (SD=21.4), respectively. Total SNOT-22 score was correlated with EQ-5D VAS in patients with ( $\beta = -0.57$  [95% CI -0.89 to -0.25],  $p=0.001$ ) and without CF ( $\beta = -0.45$  [95% CI -0.58 to -0.31],  $p<0.001$ ). Both groups demonstrated significant associations between decreased QOL and sinonasal symptomatology across all SNOT-22 subdomains, with consistently greater decreases in the CF group. Of the subdomains, emotional symptoms were associated with the greatest decrease in QOL in CF patients ( $\beta = -9.34$  [95% CI -15.43 to -3.25],  $p=0.004$ ).

**Conclusions:**

The significant association between CRS symptomatology and decreased general health-related QOL is similar in CRS patients with and without CF. However, given the trend towards greater magnitude association between CRS symptomatology and decreased QOL in CF patients, further studies utilizing larger cohorts are needed.

## #E114

**The effect of anti-il-5 antibody therapy on chronic sinusitis and eosinophilic otitis media**

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**Introduction:**

Chronic sinusitis and eosinophilic otitis media co-existent with asthma are very difficult to treat and can recur postoperatively. The IL-5 antibody mepolizumab became available in Japan in June 2016 for use in the treatment of serious asthma and its effectiveness has been acknowledged. However, its effects on eosinophilic sinusitis and otitis media have not yet been investigated. We investigated the effectiveness of IL-5 antibody in these diseases.

**Methods:**

From June 2016 to October 2017, 16 patients with severe bronchial asthma were treated using anti-IL-5 antibody. We retrospectively examined the effectiveness of the therapy on asthma, chronic sinusitis, and otitis media. Therapeutic effect was assessed based on the presence or absence of symptoms, nasal polyps score, and middle ear fluid.

**Results:**

Of the 16 patients started on IL-5 antibody therapy, one patient discontinued treatment after experiencing the adverse event of rash. Six patients had neither chronic sinusitis nor eosinophilic otitis media; seven of the remaining nine patients showed improvement in asthmatic symptoms, but only three showed improvement in the symptoms of sinusitis. One patient did not present with co-existent otitis media, four of the remaining eight showed symptomatic improvement with IL-5 antibody therapy while four did not.

**Conclusion:**

Anti-IL-5 antibody therapy shows clinical effectiveness in lower respiratory tract disease, but is less effective in upper airway tract disorders. More studies with larger patient sets might not be advisable, and a new treatment strategy is needed.

## #E115

**The effect of mucosal grafts on rates of restenosis and revision surgery following Draf III procedures**

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**Introduction:**

Draf III frontal sinusotomy is often a treatment option for patients with severe or recurrent frontal sinus disease. Frontal ostium stenosis is a known complication and often requires revision surgery. Recent studies have suggested mucosal grafting as a solution. The objective of our study was to examine the relationship of mucosal grafting on rates of restenosis and revision surgery following Draf III frontal sinusotomy.

**Methods:**

A retrospective review of patients who underwent Draf III frontal sinusotomy between October 2008 and August 2016 was performed. Follow-up records were obtained for these patients through May 2017. Data collected included demographics, mucosal grafting subsite, postoperative complications, and pre and postoperative SNOT-22 scores.

**Results:**

51 patients underwent Draf III procedures. 14 (27.45%) received mucosal grafting. Subsites included the middle turbinate (n=6), septum (n=6), and nasal floor (n=2). There were no cases of restenosis or revision surgery among the 14 patients that received mucosal grafts. Of the 37 patients without mucosal grafting, 4 (10.81%) cases were complicated by restenosis and 4 (10.81%) required revision surgery (p=0.5647). The change in SNOT-22 scores from baseline in the mucosal grafting group was greater compared to the control, although not statistically significant (-30.11 vs. -27.71, p=0.7052).

**Conclusion:**

Our data suggests that mucosal grafting during Draf III procedures may improve outcomes with lower rates of frontal ostium restenosis and revision surgery. Additional studies with larger sample sizes are needed to further describe this relationship."

## #E116

**The endoscopic trans-pterygoid approach to the lateral sphenoid recess: A review of the literature**

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**Introduction:**

Lateral sphenoid recess (LSR) encephaloceles are rare entities which are difficult to address due to challenging exposure. Historically, open transcranial and endoscopic trans-sphenoid approaches had high rates of failures. Since the endoscopic trans-pterygoid approach to the LSR was introduced in 1999, this technique was quickly adopted. Yet, the level of success of this technique has yet to be systematically evaluated. The goal of this study is to review the existing literature regarding the endoscopic trans-pterygoid approach to LSR to assess associated success and complications rates in addition to practice patterns.

**Methods:**

A systematic search was conducted using the Pubmed database. 16 case reports and series were identified. Primary outcomes of initial and overall surgical success rates in addition to complication rates were analyzed. Practice patterns including skull base closure technique and utilization of post-operative CSF diversion were evaluated.

**Results:**

Sixteen case reports and series were identified for a total of 110 cases. Significant demographic characteristics found were female gender (68%) and overweight body habitus (85%). Primary success rates were 50-100% with overall success rates of 91-100%. Complications were found in 9% of cases with meningitis occurring in 2%. Majority of studies reported multilayer skull base repairs and CSF diversion therapy was utilized in 27% of cases.

**Conclusion:**

The endoscopic trans-pterygoid approach has proven to be effective technique with a high overall success rate of 91-100% while incurring minimal morbidity.

## #E117

**The endoscopic transpterygoid versus endoscopic transorbital approach to meckel's cave: A comparison of surgical freedom**

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## Introduction:

Access to the Meckel's cave is possible through a variety of approaches including endonasal and transcranial routes. Traditionally, the microscopic subtemporal approach was used, usually involving some retraction of the temporal lobe, which may result in significant morbidity. The development of minimally invasive endoscopic approaches to Meckel's cave include the endonasal transpterygoid, anterior maxillotomy and transorbital approaches. To our knowledge, this is the first study which compares the area of exposure and surgical freedom afforded by the endoscopic transpterygoid and transorbital approaches.

## Methods:

Three cadaveric heads were dissected bilaterally using both the transpterygoid and transorbital approaches to Meckel's cave. Prior to dissection, computed tomography (CT) scans were obtained on each head to obtain anatomical measurements. The surgical freedom was determined by stereotactically marking the superior, inferior, lateral and medial limits of endoscopic visualization and reach of instrumentation. These measurements and points of reference were then compared between to the two approaches.

## Results:

Both the transpterygoid and transorbital approaches provide wide exposure to Meckel's cave. The transorbital approach is more direct and provides improved visualization of the entirety of meckel's cave, especially its lateral aspect. The transpterygoid approach provides adequate exposure of the medial aspect of Meckel's Cave though visualization may be limited by the cavernous sinus.

## Conclusions:

By characterizing the area of exposure and surgical freedom afforded by both the endoscopic transorbital and transpterygoid approaches to Meckel's Cave, we aid in the surgical decision-making process for choosing the most suitable approach.

## #E118

**The histopathologic features of chronic sinusitis precipitated by odontogenic infection**

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 Paolo Gattuso, MD  
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## Introduction:

Odontogenic infection can be a contributor to chronic sinus disease. The histopathologic features of odontogenic chronic rhinosinusitis (CRS) cases have yet to be determined and may have important implications on pathophysiology and disease management in this subset of patients.

## Methods:

A structured histopathology report of 11 variables was utilized to analyze sinus tissue removed during functional endoscopic sinus surgery (FESS). Histopathology variables, Lund-Mackay Score (LMS) and SNOT-22 scores were compared among CRS patients with odontogenic disease, CRS without nasal polyps (CRSsNP) patients and CRS with nasal polyps (CRSwNP) patients. Results: 23 odontogenic CRS, 38 CRSwNP, and 53 CRSsNP patients who underwent FESS were analyzed. Compared to CRSwNP, odontogenic CRS cases had fewer eosinophils per high-power field (HPF) (39.1% vs. 63.2%,  $p < 0.05$ ), decreased squamous metaplasia (0.0% vs. 18.4%,  $p < 0.03$ ), decreased fibrosis (26.1% vs. 63.2%,  $p < 0.005$ ), and a trend towards fewer eosinophil aggregates (21.7% vs. 42.1%,  $p < 0.09$ ). Additionally, odontogenic CRS cases had significantly lower mean LMS ( $7.83 \pm 2.77$  vs.  $12.18 \pm 6.77$ ,  $p < 0.005$ ) compared to CRSwNP. Odontogenic CRS was more comparable to CRSsNP in terms of histopathologic findings.

## Conclusions:

The propensity to develop chronic sinus disease in patients with odontogenic infection is not fully understood. Underlying eosinophilia is unlikely to be a risk factor and histopathology profile supports a similar pathophysiology to CRSsNP.

## #E119

**The impact of video nasal endoscopy on patient satisfaction**

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**Introduction:**

Video nasal endoscopy has significant associated expense for practices, but its use has been justified by the benefit it provides to the examiner. No study has examined the perceived benefit to the patient. In this study, the impact of video endoscopy on patient satisfaction is evaluated.

**Methods:**

A prospective, randomized single-blinded study was performed on new patients receiving care in the rhinology clinics of a tertiary-care center. Patients were randomized into the standard endoscopic examination (SEE) or a video endoscopic examination (VEE) groups. SEE patients had their examination performed with the physician viewing the exam through the eyepiece and subsequently had their examination explained by the physician. VEE patients had their examination performed on the screen, recorded, and then used for the explanation. All patients were asked to complete the Sinonasal Outcome Test-22 (SNOT-22) and the Patient Satisfaction Questionnaire Short-Form 18 (PSQ-18). Statistical analysis was performed to identify differences between cohorts.

**Results:**

25 patients were included in each cohort. There was no significant demographic difference between groups. SNOT-22 total and domain scores were similar between both groups ( $p > .05$ ). VEE patients had significantly higher general satisfaction ( $p = .048$ ) and communication ( $p = .028$ ) domains within the PSQ-18, while technical quality domain approached significance ( $p = .059$ ). There were no differences between other domains ( $p > .05$ ).

**Conclusions:**

VEE is a valuable tool for otolaryngologists and patients. Further studies evaluating patient compliance and symptomatology may provide further justification in its use.

## #E120

**The prognosis of appropriately managed chronic rhinosinusitis with nasal polyposis and its relation to preoperative eosinophil/basophil levels**

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 Al-Farwaniyah

**Introduction:**

Chronic rhinosinusitis with nasal polyposis (CRSeNP) patients have a high risk of disease recurrence. The ability to predict a polyp recurrence in these patients is critical in order to provide appropriate post-operative management.

**Objectives:**

1. Explore the predictive ability of eosinophil and basophil levels for refractory CRSeNP.
2. Study the role of appropriate post-operative care and its relation to preoperative eosinophil and basophil levels.

**Methods:**

A retrospective case series on CRSeNP patients. Preoperative eosinophil and basophil levels were retrieved and quantified based on previously set standards. Postoperative data was collected over a period of 15 months. Polyp recurrence, co-morbidities and medication adherence were documented.

**Results:**

102 patients were included in the statistical analysis. 63.7% of the patients experienced no recurrences of polyps, 25.5% experienced one acute exacerbation, and 11 (10.8%) experienced multiple recurrences. Mean baseline eosinophil levels in the multiple recurrences group was significantly higher when compared with the no recurrences group. 42.3% of patients who experienced acute exacerbations were adherent to medical therapy prior to the first episode of recurrence, significantly lower than the 88.9% adherence rate prior to recurrence in the multiple recurrences group.

**Conclusion:**

There is a distinction between patients who experience an acute exacerbation and those with multiple recurrences which is caused in part by non-adherence to post-operative care. In those with multiple recurrences, the adherence rate was high suggesting truly refractory disease. Hence, acute exacerbations were not true failures of surgery but rather a failure of post-operative medical care.



## #E121

**Topical nasal therapy in hereditary hemorrhagic telangiectasia**

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**Background:**

Recurrent spontaneous epistaxis is the most common symptom of Hereditary Hemorrhagic Telangiectasia (HHT) and is a socially isolating and debilitating problem for patients. Prevention of epistaxis with nasal humidification with topical emollients, gels and saline irrigations is a mainstay of therapy. Little is known, however about the current topical nasal therapy practices adopted by patients or their compliance with these regimens.

**Objective:**

The aim of this study is to characterize the nasal humidification strategies adopted by HHT patients.

**Methods:**

This is a cross-sectional survey design. Patients were included if they had a confirmed diagnosis of HHT based on Curacao Criteria. A questionnaire regarding frequency, type and compliance of topical nasal therapy was administered to consenting patients.

**Results:**

All patients used some form of nasal humidification. Saline spray (eg. Rhinaris, Salinex), saline irrigation and nasal gel (eg. Scaris, Nasogel) were the most commonly used products. All patients used multiple agents on a daily basis and found that it provided either mild to moderate improvement in the frequency and severity of their epistaxis. Topical estrogens, herbal medications and allergy therapy were used infrequently among our patients. Financial burden of HHT remains a significant concern, with patients spending up to \$50/month on nasal humidification regimens.

**Conclusion:**

Nasal humidification is used commonly to prevent dryness and subsequent epistaxis in patients with HHT. Patients report a symptomatic improvement with their use. Specific product type and frequency of use appears to be an individualized decision with patients adopting a regimen that optimizes their own symptoms.

## #E122

**Unique clinical and prognostic behavior of patients diagnosed with exophytic and inverted papillomas**

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**Background:**

In the most recent update of the World Health Organization (WHO) classification of head and neck tumors, the term Schneiderian papilloma was eschewed in favor of the non-eponymous sinonasal papilloma. Three subcategories of this lesion have been described, inverting (IP), exophytic (EP) and oncocytic (OP) papillomas. We present a single institutional series of sinonasal papillomas with emphasis on the clinical differences between subcategories.

**Methods:**

Using a pathology-specific electronic medical record software, patients diagnosed with sinonasal papilloma were identified between the years 2001 and 2016. A retrospective chart review was then performed to review the demographic, clinical, and surgical details.

**Results:**

A total of 107 patients were identified with unique sinonasal papilloma diagnoses (Table 1). Of these, the majority was diagnosed with IP (92, 85.9%). The subpopulation of patients co-diagnosed with IP and EP was unique with respect to clinical presentation and prognosis relative to both the IP and EP alone populations. The patients who presented with both of these diagnoses were older with an average age of 75.25 compared to 45 (EP) and 55.26 (IP). These patients were more likely to present with epistaxis (60%) compared to 33.3% (EP) and 4.6% (IP). Finally, 100% of these patients had at least one recurrence of their disease, compared to 33.3% (EP) and 28.5% (IP).

Subcategories of sinonasal papillomas have different clinical features. Those diagnosed with both EP and IP tend to be older, more likely to present with epistaxis, and more likely to recur.

## #E123

**Unusual anatomic locations of inverted papilloma: Management and outcomes**

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 Nithin D. Adappa, MD, FARS  
 Michael D. Feldman, MD, PhD  
 James N. Palmer, MD, FARS  
 Philadelphia, PA

**Introduction:**

Inverted papilloma (IP) is a benign sinonasal neoplasm with potential for recurrence and malignant transformation. Extra-sinonasal IPs in the head and neck are rare and present unique challenges in management. The goal of this study is to identify the anatomic subsites and to describe their clinical outcomes.

**Methods:**

A retrospective chart review was performed from 2008 to 2017 treated at a tertiary referral center. Pertinent clinical data was obtained, and selected cases of IP outside of the sinonasal cavity were included in the study. Final diagnosis was confirmed by a single pathologist with head and neck subspecialty training. A review of the literature was also completed.

**Results:**

Six cases were identified with specimen appropriate for review. The anatomic locations included were true vocal fold, nasopharynx, soft palate, and the middle ear. The mean age of diagnosis was 59.6 years, and 83% were male. Four patients (67%) had a history of sinonasal IP prior to presentation with an extra-sinonasal lesion. On pathology review, two patients (33%) displayed no dysplastic changes, but the remaining patients (67%) had carcinoma in situ. The patient with vocal fold lesion subsequently developed laryngeal carcinoma that was treated with definitive chemoradiation. With a median follow-up of 15 months, two patients recurred with multifocal disease at the time of diagnosis.

**Conclusions:**

Extra-sinonasal IP is a rare entity that presents unique surgical challenges. They are often multifocal and display dysplastic changes. Clinicians should balance maximal disease control with minimal functional impairment in the management of these lesions.

## #E124

**Utilization of prophylactic antibiotics after nasal packing for epistaxis**

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 Tina Wu, MD, MBA  
 Richard Lebowitz, MD, FARS  
 Seth Lieberman, MD  
 New York, NY

**Introduction:**

The use of systemic antibiotics after nasal packing for epistaxis to prevent the development of toxic shock syndrome (TSS) or acute sinusitis is commonly employed. However, there is little evidence to support such a practice. The purpose of this study was to assess both rates of utilization and evidence of benefit for using prophylactic antibiotics in patients with nasal packing for epistaxis.

**Methods:**

A single-center retrospective review of 278 cases of anterior nasal packing in an urban emergency room between September 2013 and April 2017. Patients age ranged from 13 to 93. Chi square statistical analysis was used to evaluate results with a p value < 0.05 considered significant.

**Results:**

There were no instances of toxic shock syndrome. Of the 127 patients who received non-absorbable packing, 91 received prophylactic antibiotics while 38 did not. There was only one (1.09%) case of sinusitis among the non-absorbable packing with prophylaxis group zero cases in the non-prophylaxis group. Of the 151 patients who received absorbable nasal packing, 7 cases received prophylactic antibiotics. There were no reported instances of sinusitis among the absorbable packing with prophylaxis group but there was one (0.69%) case reported in the absorbable packing without prophylaxis group. Considering prophylactic antibiotic use without regard to packing type, 0.95% of patients with prophylactic antibiotics developed sinusitis versus 0.55% in those without antibiotics (p = 0.692).

**Conclusion:**

There was no observed advantage or disadvantage to using prophylactic antibiotics in anterior nasal packing regardless of whether patients received absorbable or non-absorbable packing.

## #E125

**Vascular endothelial growth factor expression in inverted papilloma**

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Andrew Fong, MD  
Adrian J. Correa, MD  
Bozena Wrobel, MD, FARS  
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**Background:**

Inverted papilloma (IP) is an aggressive benign sinonasal tumor where the standard treatment is surgical resection. However, IP occasionally extends into areas that are unresectable. Vascular endothelial growth factor (VEGF) has been reported as a possible therapeutic target in the literature. The goal of this study is to evaluate VEGF expression in IP compared to chronic rhinosinusitis controls.

**Methods:**

Immunohistochemistry for VEGF was performed on IP samples and middle turbinates from chronic rhinosinusitis controls obtained during surgical resection between 2009-2017. Two head and neck pathologists blinded to clinical features and outcomes graded the intensity of staining. A positive stain was defined as having 10% or more of cells exhibiting immunoreactivity. Statistical analysis was performed using two-tailed t-tests and Fisher exact tests.

**Results:**

The study includes 17 tumor samples and 9 controls. Mean ages of the IP and control patients were 54.5 (range 31-77) and 53.2 (range 25-68) respectively ( $P = 0.82$ ). There were no significant differences in gender ( $P = 1.0$ ) and smoking history ( $P = 1.0$ ) between cases and control groups. IP tumor locations included: ethmoid (4), frontal (4), and maxillary (9) sinuses. No tumors demonstrated malignancy or dysplasia. Four (23.5%) of the 17 IP samples stained weakly positive for VEGF compared to 1 (11.1%) of the 9 controls ( $P = 0.63$ ). None of the samples had a strong positive staining for VEGF.

**Conclusion:**

Despite reports of VEGF overexpression in inverted papilloma, no significant difference in immunohistochemical VEGF expression was identified between IP samples and controls.

## #E126

**Virtual reality FESS with 3d-printed instruments for high-fidelity simulation**

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Young-Jun Son, PhD  
Eugene H. Chang, MD, FARS  
Tucson, AZ

**Objectives:**

Surgery of the skull base requires rigorous preoperative planning and careful dissection of intricate anatomy. As procedures become increasingly complex, learning curves steepen for trainees. Simulation has been shown to decrease operative time and increase safety, but cost and practicality limit options. Recently, Virtual Reality (VR) technology is more accessible than ever. Combined with 3-Dimensional (3D)-printed instruments, consumer-grade VR can simulate surgical procedures using optically-based tracking comparable to commercial navigation. Herein, we propose a VR-based simulator for functional endoscopic sinus surgery (FESS) with navigation using 3D-printed objects for haptic feedback.

**Methods:**

Segmentations of soft tissue and bone were created from axial computed-tomography (CT) images using 0.625mm slices. An endoscope model was designed in CAD. A virtual operating room was designed in the Unity game engine incorporating 3D models. Real-time positional data was achieved using an HTC VIVE and trackers coupled to 3D-printed head and endoscope models. The endoscope tip position was displayed on a navigation workstation in VR using DICOM images.

**Results:**

VR FESS created an experience that synchronized interaction between virtual and physical objects. Trainees utilized the endoscope to identify common anatomic landmarks in VR, and 3D-printed objects facilitated true haptic feedback. Tracking accuracy was confirmed by comparing virtual and physical positions of the endoscope tip at the nasion, superior orbital rim, and multiple foramina.

**Conclusions:**

Virtual FESS using consumer VR equipment provides a novel and cost-effective approach to high-fidelity simulation with haptic feedback. Any training program with a modern PC has accessibility to this technology.

**#E127****When is a transoral approach necessary for accessing clivus and craniocervical junction pathology?**

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 Ivy W. Maina, BA  
 Frederick Yoo, MD  
 James N. Palmer, MD, FARS  
 Nithin D. Adappa, MD, FARS  
 Philadelphia, PA

**Introduction:**

The clivus and craniocervical junction are challenging areas to access. Pathology located in these areas may be approached via transnasal or transoral routes. We review cases where transoral approaches were necessary for adequate exposure of the lesion and discuss anatomic factors and outcomes.

**Methods:**

Retrospective chart review of all patients who underwent endoscopic transnasal, endoscopic transoral, or robotic transoral approaches to the clivus and craniocervical junction at two tertiary academic medical centers. Review of patient demographic, clinicopathologic, and anatomic factors was performed.

**Results:**

Four patients required transoral access, including 1 endoscopic and 3 robotic approaches. Mean lesion size was 25±12 mm. Two lesions, both C2 chordomas, were completely below the hard palate plane (HPP). One patient, a 17-month-old male, had a clival atypical teratoid/rhabdoid tumor of the inferior clivus and C1; he had a thin flexible soft palate facilitating superior retraction. Another patient had a locally recurrent clival chordoma involving the prevertebral musculature, and the robot was used for soft tissue dissection. Four other lesions that were accessed completely transnasally had extension below the HPP (inferior extension 4-18 mm).

**Conclusion:**

Though uncommon, transoral access to clival and craniocervical junction pathologies should be part of the skull base surgeon's arsenal. Careful review of anatomic factors, including lesion location relative to the HPP and potential need for extensive soft tissue dissection, are determinants for selecting the appropriate approach. Many lesions, even with extension below the hard palate, may be pulled up into the nasopharynx and accessed transnasally.

**#E128****Yellow nail syndrome: Rhinologic manifestations, case series and review of the literature**

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 Michael A. Kohanski, MD, PhD  
 Charles C.L. Tong, MD  
 Christine Reger, CRNP  
 David W. Kennedy, MD, FARS  
 Philadelphia, PA

**Introduction:**

Yellow nail syndrome (YNS) is a rare clinical diagnosis defined by the triad of yellow nail discoloration, respiratory manifestations including chronic rhinosinusitis (CRS), pulmonary manifestations, and lower limb lymphedema. The pathogenesis of YNS is unknown but titanium dioxide exposure and lymphatic dysfunction are implicated. Given the rarity of this condition, limited information regarding management strategies is available, though management of YNS-associated CRS parallels that of CRS in general. We report a case series of CRS associated with YNS and discuss patient characteristics, treatment, and outcomes.

**Methods:**

Retrospective case series with literature review (Pubmed, Ovid Medline, Web of Science).

**Results:**

Three patients with YNS are presented. All 3 patients presented following previous FESS, and initial SNOT-22 scores were 37, 44 and 50. The first and second patient had undergone revision FESS followed by daily nasal steroid irrigations and most recent SNOT-22 scores were 3 & 16 at 11 and 5 years follow-up, respectively. All 3 patients had bronchiectasis and yellow nails; 1 had lymphedema of the lower extremities and another had recurrent pericardial effusions.

**Conclusion:**

YNS is a rare disease entity that should be acknowledged by otolaryngologists, particularly if CRS is the presenting symptom. The literature is sparse with regards to rhinologic-specific implications of CRS and YNS.

#E129

**Zoonotic staphylococcus pseudintermedius sinonasal infections: Risk factors and resistance patterns**

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 Han Wool Kim, BA  
 Frederick Yoo, MD  
 Edward C. Kuan, MD, MBA  
 Jeffrey Suh, MD  
 Los Angeles, CA

**Introduction:**

Staphylococcus pseudintermedius is a gram-positive bacterium that colonizes the skin and orifices of healthy canines and felines. Although *S. pseudintermedius* commonly causes opportunistic ear and soft tissue infections in dogs and cats, it only recently was identified as a cause of infections in humans. This study is a follow up of Kuan et al.'s 2015 study, which described 4 cases of *S. pseudintermedius*-mediated sinonasal infections and reports an additional 29 cases.

**Methods:**

Retrospective review of chronic rhinosinusitis patients with *S. Pseudintermeidus* positive sinonasal cultures and comparison to a prospectively collected control sample of patients with cultures collected due to active sinusitis.

**Results:**

Thirty-three patients with CRS had nasal cultures positive for *S. pseudintermedius*. Of the positive cultures, 82% demonstrated resistance to penicillin, 58% to clindamycin, 33% to doxycycline, and 27% to oxacillin. 52% of patients had a *S. pseudintermedius* infection within 8 weeks of endoscopic sinus surgery, and 36% had either immunosuppression due to common variable immunodeficiency, diabetes, history of transplantation, or an autoimmune condition. 97% of patients with *S. pseudintermedius* owned a dog, 3% owned a cat, and 3% had no pets.

**Conclusion:**

Although a rare cause of infection in humans, *S. pseudintermedius* should be considered in post-operative sinonasal infections or those refractory to standard medical management, especially if the patient has regular contact with dogs. *S. pseudintermedius* is not readily identified with routine laboratory diagnostic testing and often demonstrates multi-drug resistance, making it a pathogen that is commonly misdiagnosed and difficult to treat.





Registration & Housing Opened 3/1/18!

7<sup>TH</sup> Annual

# Summer Sinus Symposium

*The Best Sinus Course in the World: Improving Rhinology from Office to OR*



**July 12-14, 2018**

**The Westin Seattle, Seattle, WA**

**Course Directors:**  
Greg Davis, MD, FARS  
Marc Dubin, MD, FARS  
Douglas Reh, MD, FARS

## MEETING HIGHLIGHTS:

• **Keynote Speaker:** *Albert Merati, President Elect AAO*

• **Signature Social Event –**  
*Chihuly Glass Museum*

- Cadaver Prosections
- Primary frontal sinus surgery: To do, or not to do?
- Second chances: Finding success in revision sinus surgery
- Would you do this in your office?
- Nasal polyps, our nemesis
- Complications of endoscopic sinus surgery: Managing the worst-case scenario

- Surgical failures after a textbook surgery: The chronically infected sinus
- Coding controversies. How would I code this? A case based panel
- Cough, throat clearing, and postnasal drip; tips for treatment of these challenging symptoms
- I don't have migraines, Doc, I have sinus headaches
- Balloon Dilation: From sinuses to eustachian tubes
- Topical therapies for chronic rhinosinusitis
- Prednisone: Friend and foe
- Epistaxis, hemostasis and HHT
- Epiphora – I'm really not crying

- Technical tips for successful orbital decompression
- Defining Appropriate Medical Therapy for CRS
- Understanding the International Consensus on Allergy and Rhinology Statements...and the most recent Allergic Rhinitis installment
- Controversies in allergy testing and immunotherapy: Challenging traditional practice
- The functional nose: When to do more than septoplasty and turbinate reduction
- Contemporary approaches to the turbinates, nasal septum, and nasal obstruction

- Endotypes matter in CRS management
- Asthma update: What every ENT should know about state of the art asthma treatment
- Runny noses: A comprehensive approach to the medical and surgical treatment of pediatric sinusitis
- Management of CSF Rhinorrhea
- Frontal drill out: When, why and how
- Complex inflammatory sinusitis cases: Case presentations
- Pituitary surgery: Pearls and Pitfalls
- Skull base cases: Case presentations

## ANCILLARY NON-CME & Social Events

### THURSDAY, 7/12/18

**5:15 - 6:15 pm**  
**Acclarent Evening Symposium**  
Leveraging New Advancements in 3D ENT Navigation

### FRIDAY, 7/13/18

**7:30 - 8:30 am**  
**Intersect ENT Breakfast Symposium**  
Advancing Care for Recalcitrant Polypoid Patients with Evidence-based Innovation

**12:00 - 1:00 pm**  
**Arrinex Lunch Symposium**  
Chronic Rhinitis: Neurophysiology and New Treatment Paradigms

**12:00 - 1:00 pm**  
**Cook Medical Lunch Symposium**  
Nasoseptal Flap Donor Site Repair Using Biologic Grafts

**12:00 - 1:00 pm**  
**Entellus Medical Lunch Symposium**  
Enhanced Experiences for Sinusitis, Eustachian Tube Dysfunction, and Nasal Airway Obstruction Sufferers: Incorporating Less Invasive Technologies to Unlock Site of Service Flexibility

**1:00 - 5:00 pm**  
**Entellus Medical Cadaver Lab**  
Expanding Treatment Options for Sinusitis, Eustachian Tube Dysfunction and Nasal Airway Obstruction Sufferers; A Hands-On Lab

**1:00 - 3:00 pm & 4:00 - 6:00 pm**  
**Medtronic Cadaver Lab**  
Navigated In-Office Sinus Surgery

**1:00 - 5:00 pm**  
**Olympus Cadaveric Lab**  
Enhanced Visualization in Advanced Surgery Techniques for Practicing Rhinologists

**12:00 - 1:00 pm**  
**Stryker Lecture and Mobile Lab**  
Frontal Sinus Masterclass Using Building Blocks® Anatomy Planning and Target Guided Surgery Dissection

**6:30 - 8:00 pm**  
**Women in Rhinology Networking Event**

**SATURDAY, 7/14/18**  
**7:30 - 8:30 am**  
**OptiNose Breakfast Symposium**

**12:00 pm - 1:00 pm**  
**ALK, Inc. Lunch Symposium**  
New Advances in House Dust Mite Allergy Treatment – Expanding Use of Immunotherapy

Details at <http://www.american-rhinologic.org/ss>

Contact: Wendi Perez, Executive Administrator, ARS, PO Box 269, Oak Ridge, NJ 07438 | Tel: 973-545-2735 | Fax: 973-545-2736 | [wendi@amrhs.com](mailto:wendi@amrhs.com)

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