



# ARS at COSM 2015

April 23-24, 2015

Hynes Convention Center  
Sheraton Boston  
Boston, MA



[american-rhinologic.org](http://american-rhinologic.org)

WEB VERSION



save  
the  
date

**4th Annual Summer Sinus Symposium**  
**July 16-18, 2015**  
Westin Michigan Avenue  
**Chicago, Illinois**

Engage the experts: ask them your questions and debate the answers!

- Hear the experts discuss the pearls and pitfalls of managing sinusitis
- Watch seasoned surgeons dissect cadavers & answer your questions
- Participate in breakout sessions that are geared towards your practice
- Ancillary Events, Cadaver Workshops and more!
- **Become an ARS Member and enjoy FREE SSS registration!**

**ARS at COSM 2016**  
**May 19-20, 2016**  
Hyatt Regency Chicago  
**Chicago, Illinois**

**5th Annual Summer Sinus Symposium**  
**July 2016**  
Location: TBD

**ARS at AAO 61st Annual Meeting**  
**September 25-26, 2015**  
Sheraton Dallas  
**Dallas, Texas**

Guest Countries: China • Japan • Korea • Taiwan • Thailand

11th Annual David W. Kennedy Lectureship

Guest Speaker: James Stankiewicz, MD

"Complications of ESS: 30 Years Later"

find

**MEMBERSHIP & MEETING**  
**information online at:**  
[american-rhinologic.org](http://american-rhinologic.org)

A wide-angle photograph of the San Diego skyline across a body of water. The skyline is filled with various skyscrapers and buildings under a blue sky with scattered clouds. In the foreground, there's a rocky shoreline and a small wooden structure on the left.

**ARS at AAO 62nd Annual Meeting**  
**September 16-17, 2016**  
Manchester Grand Hyatt San Diego  
**San Diego, California**



Roy Casiano, MD

## Presidential Welcome to the ARS at COSM 2015

On behalf of the Board of Directors, it is my great honor and pleasure to welcome you to the American Rhinologic Society meeting at COSM in Boston! Under the direction of Program Chair, Peter Hwang, MD, and his program committee, we once again hope to offer an exciting, valuable and enjoyable program. It is our sincere goal to provide program content that is broad and timely as we recognize the wide array of interests and needs amongst our membership. On display during this program will be unparalleled scientific research and clinically relevant panel discussions. It is our sincere goal for the ARS to become a society that appeals to all otolaryngologists and health professionals with interest in the field of rhinology, whether you are at a community practice, or at an academic medical center.

We greatly appreciate the generosity of our corporate partners in support of our organization and its endeavors. It is only through these strong partnerships that we are able to realize our lofty goals of excellence in education, training, research, and patient advocacy. On behalf of the entire Board of Directors, I am proud to say that these partnerships are stronger than ever with aligned strategic goals. Please join me in thanking our corporate partners by exploring the exhibits and visiting with them.

Finally, if you're not currently a member of the ARS, please enquire about the many benefits of being a member, including a FREE subscription to our official journal (IFAR; within the top 4 highest ranked clinical ENT journals and now with a great iPhone app), FREE access to online patient and physician educational materials, and FREE registration to our popular Summer Sinus Symposium Conference in July, to name a few.

I believe this COSM will prove to be our finest yet as an organization. Please enjoy your time in Boston and welcome to the ARS.

Roy R Casiano MD, FACS, FARS  
*President, American Rhinologic Society*

## How to obtain your CME certificate:

1. Go to [ARS.CmeCertificateOnline.com](http://ARS.CmeCertificateOnline.com)
2. Click on the “ARS at COSM 2015” 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](mailto:Certificate@AmedcoEmail.com)



## American Rhinologic Society Executives - 2015



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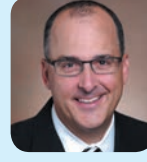
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## ARS Mission Statement

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 10.50 *AMA PRA Category 1 Credits<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.



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

## Thursday, April 23

12:55 pm

### Welcome

ARS President and President-Elect  
Roy Casiano, MD & Peter Hwang, MD

1:00 pm

### ARS-AAFPRS Joint Panel: Surgical Management of Complex Septal Pathology

**Moderator:** Douglas Reh, MD

**Panelists:** Stephen Bansberg, MD; Travis Tollefson, MD, MPH

*Note: Complimentary Registration for all AAFPRS members*

### Session: Office-Based Rhinology

**Moderators:** Bozena Wrobel, MD and Amin Javer, MD

1:33 pm

### Endoscopic Polypectomy in the Clinic Versus Formal Endoscopic Sinus Surgery for Select Patients with Nasal Polyposis: A Pilot Cost-effectiveness Analysis

Kristine Smith, MD

1:40 pm

### Strategies for Decreasing Contamination of Homemade Nasal Saline Irrigation Solutions

Elliot Hardy, MD

1:47 pm

### Treatment of Aspirin Exacerbated Respiratory Disease with a Low Salicylate Diet – A Multi-center Randomized Control Cross-over Trial

Smriti Nayan, MD

1:54 pm

### Effectiveness of Leukotriene Receptor Antagonism in The Post-operative Management of Chronic Rhinosinusitis

Joshua Yelverton, MD

2:01 pm

### Antibiotic Prescriptions by Physicians Compared To Nurse Practitioners for Upper Respiratory Tract Infections In Children

Elisabeth Ference, MD

2:08 pm

### Discussion

2:15 pm

### Panel: Endoscopic Orbital Surgery: State of the Art

**Moderator:** Jayakar Nayak, MD, PhD

**Panelists:** Todd Kingdom, MD; Raymond Sacks, MD; Bing Zhou, MD;

2:55 pm

### Break with Exhibitors

### Session: Discerning CRS Phenotypes

**Moderators:** Amber Luong, MD, PhD and Noam Cohen, MD, PhD

3:15 pm

### A Pilot Study Comparing Symptom Profiles of a Polyp Versus an Eosinophilic-based Classification of Chronic Rhinosinusitis

Christopher Thompson, MD

3:22 pm

### Identification of Chronic Rhinosinusitis Phenotypes using Cluster Analysis

Zachary Soler, MD

3:29 pm

### Familial Risk of Eosinophilic Esophagitis and Chronic Rhinosinusitis

Reema Padia, MD

3:36 pm

### Volumetric Computed Tomography Analysis of the Olfactory Cleft in Patients with Chronic Rhinosinusitis

Zachary Soler, MD

3:43 pm

### Discussion

### Session: New Technologies

**Moderators:** Jeffrey Suh, MD and Lori Lemonnier, MD

3:48 pm

### Enhanced Irrigant Delivery and Ventilation to the Ethmoid Sinus Complex Through Novel Anterior and Posterior Ethmoid Sinusotomy Procedures using a Spiral Ethmoid Punch

Jayakar Nayak, MD, PhD

3:55 pm

### Post-operative Mucosal Effects of Antibiotic-impregnated Middle Meatus Spacers in Endoscopic Sinus Surgery: A Randomized, Controlled Trial

Derrick Randall, MD

4:02 pm

### Measurement of Ciliary Beat Frequency Using Fourier Domain Optical Coherence Tomography

Bryan Lemieux, BS

4:09 pm

### High-resolution Microendoscope Imaging of Inverted Papilloma and Normal Sinonasal Mucosa: Evaluation of Interobserver Concordance

Arjun Parasher, MD

4:16 pm

### Discussion

4:20 pm

**Panel: International Consensus Statement on Rhinosinusitis (ICOS): Sneak Preview of Coming Attractions****Moderator:** Richard Orlandi, MD**Panelists:** Neil Bhattacharyya, MD; Luke Rudmik, MD, MSc; Rodney Schlosser, MD; Elina Toskala, MD, PhD

5:00 pm

**Closing Remarks and Adjournment**

## Friday, April 24

7:55 am

**Welcome****Session: Psychosocial Impact of Chronic Rhinosinusitis****Moderators:** Zara Patel, MD and Bruce Tan, MD

8:00 am

**Does Comorbid Anxiety Predict Quality of Life Outcomes in Patients with Chronic Rhinosinusitis Following Endoscopic Sinus Surgery?**

Toby Steele, MD

8:07 am

**Depression and Anxiety in Chronic Rhinosinusitis**

Cristine Klatt-Cromwell, MD, Presented by Anthony del Signore, MD)

8:14 am

**Cognitive Dysfunction Associated to Pain and Quality of Life in Chronic Rhinosinusitis**

George Tarasidis, MD

8:21 am

**Cognitive Function in Chronic Rhinosinusitis: A Controlled Clinical Study**

Zachary Soler, MD

8:28 am

**Discussion**

8:33 am

**Presidential Address**

Roy Casiano, MD

**Session: Surgical Therapies****Moderators:** Vijay Ramakrishnan, MD and Parul Goyal, MD

8:43 am

**Paranasal Sinus Balloon Catheter Dilation for the Treatment of Chronic Rhinosinusitis: A Systematic Review and Meta-analysis**

Joshua Levy, MD

8:50 am

**Outcomes of Complete Versus Targeted Approaches to Endoscopic Sinus Surgery**

Adam DeConde, MD

8:57 am

**Gender-specific Differences in Chronic Rhinosinusitis (CRS) Patients Electing Endoscopic Sinus Surgery (ESS)**

Devyani Lal, MD

9:04 am

**Medial Flap Inferior Turbinoplasty - Five Year Results Compared to Submucosal Electrocautery and Submucosal Powered Turbinoplasty**

Henry Barham, MD

9:11 am

**Discussion**

9:18 am

**Panel: Great Debate: Stents and Balloons—Worth the cost or not?****Moderator:** Pete Batra, MD**Panelists:** Nadim Bikhazi, MD; Richard Harvey, MD; Robert Kern, MD; Eugenia Vining, MD

9:58 am

**Break with Industry Partners****Session: Microbial Aspects of CRS****Moderators:** Benjamin Bleier, MD and Justin Turner, MD, PhD

10:18 am

**The Fungal Microbiome of the Paranasal Sinuses in Health and In Chronic Rhinosinusitis**

Nivedita Sahu, MD

10:25 am

**Investigation of Bacterial Repopulation after Sinus Surgery and Perioperative Antibiotics**

Leah Hauser, MD

10:32 am

**Bactericidal Antibiotics Promote Reactive Oxygen Species Formation in Human Sinonasal Epithelial Cells**

Michael Kohanski, MD

10:39 am

**Bacterial Transmission through Sinus Irrigation: Is Irrigation Water Really a Reservoir for Bacterial Colonization of The Human Paranasal Sinuses?**

Leah Hauser, MD

10:46 am

**Discussion****Session: Pathophysiology, Part 1****Moderators:** Zach Soler, MD, MSc and Jean Kim, MD, PhD

10:53 am

**CFTR Activation By The Solvent Ethanol: Implications for Topical Drug Delivery**

Do-Yeon Cho, MD

11:00 am

**Does Nasal Irrigation Solution Formulation Affect the Antimicrobial Activity of Nasal Secretions?**

A. Simon Carney, FRACS

11:07 am

**P-glycoprotein Regulates SEb Stimulated Il-5 and TSLP Secretion in Organotypic Mucosal Explants**  
Benjamin Bleier, MD

11:14 am

**Discussion**

11:20 am

**Panel: Cystic Fibrosis: State of the Art**

**Moderator:** Hassan Ramadan, MD

**Panelists:** Eugene Chang, MD; Gregory Sawicki, MD, MPH; Bradford Woodworth, MD

12:00 pm

**Lunch Break with Exhibitors**

12:15 pm

**Panel: Billing and Coding in Rhinology: Strategies for Success**

**Moderator:** Abtin Tabaei, MD

**Panelists:** Jivianne Lee, MD; Kim Pollock, RN, MBA, CPC; Michael Setzen, MD

*Sponsored by the ARS Mentorship Program*

**Session: Outcome Measures in CRS**

**Moderators:** Jivianne Lee, MD and Stella Lee, MD

1:00 pm

**Health Utility Outcomes in Patients Undergoing Medical Management for Chronic Rhinosinusitis**

Lauren Luk, MD

1:07 pm

**Development and Validation of a CRS QOL Comorbidity Index**

Corinna Levine, MD

1:14 pm

**Qualitative Development of the Sinus Control Test**

Sarfraz Banglawala, MD

1:21 pm

**Clinical and Economic Burden of Patients Admitted Emergently for Cerebrospinal Fluid Rhinorrhea Treated with Meningeal Repair**

Jennifer Villwock, MD

1:28 pm

**Discussion**

**Session: Co-Morbidities in CRS**

**Moderators:** Marilene Wang, MD and Adam Folbe, MD

1:36 pm

**The Role of Obstructive Sleep Apnea in Quality of Life and Sleep Outcomes in Patients with Chronic Rhinosinusitis Undergoing Endoscopic Sinus Surgery**

Jeremiah Alt, MD, PhD

1:43 pm

**Impact of Unresolved Chronic Sinusitis on Incidence of Asthma**

Michael Benninger, MD

1:50 pm

**Does Comorbid Obesity Impact Quality of Life Outcomes in Patients Undergoing Endoscopic Sinus Surgery?**

Toby Steele, MD

1:57 pm

**Discussion**

2:04 pm

**Panel: Great Debate: Maximal Medical Therapy-- Does the ARS Membership have it wrong?**

**Moderator:** Ralph Metson, MD;

**Panelists:** Devyani Lal, MD; James Palmer, MD; David Poetker, MD; Sarah Wise, MD

2:44 pm

**Break with Exhibitors**

**Session: Pathophysiology, Part 2**

**Moderators:** Jayant Pinto, MD and Murray Ramanathan, MD

3:05 pm

**Nasal Nitric Oxide as Marker of Sinus Mucosal Health in Patients with Nasal Polyposis**

John Lee, MD

3:12 pm

**Staphylococcus Aureus Triggers Nitric Oxide Production in Human Upper Airway Epithelium**

Ryan Carey, BSE

3:19 pm

**Cathelicidin (Il-37): an Innate Immune Peptide that Induces Sinonasal Inflammation**

Jeremiah Alt, MD, PhD

3:26 pm

**CALHM1-mediated ATP release and CBF Modulation in Airway Epithelial Cells**

Alan Workman, BSE

3:33 pm

**Sinonasal 1 $\alpha$ -hydroxylase, But Not 25(OH)D<sub>3</sub>, is Associated with More Severe Chronic Rhinosinusitis**

Lauren Lawrence, MD

3:40 pm

**Discussion**

**Session: Surgical Morbidity and Complications**

**Moderators:** Jean Anderson Eloy, MD and Eric Wang, MD

3:48 pm

**Prevalence and Factors Associated with Revision Endoscopic Sinus Surgery**

Andres Finkelstein, MD

3:55 pm

**Predictors of 30-day Morbidity and Mortality in Pituitary Tumor Excision**

Lauren Lawrence, MD

4:02 pm

**A Multi-institutional Study of Risk Factors for Perioperative Morbidity Following Endoscopic Pituitary Surgery**

Caitlin Boling, BS

4:09 pm

**Rhinology and Medical Malpractice: An Update of the Medicolegal Landscape of the Last Ten Years**

Anthony Tolisano, MD

4:16 pm

**Discussion/Q&A**

4:23 pm

**Panel: "I've Just Had a Complication!": Navigating the Aftermath****Moderator:** Andrew Murr, MD  
**Panelists:** Michael Setzen, MD; James Stankiewicz, MD; Winston Vaughan, MD; Adam Zanation, MD

5:00 pm

**Closing Remarks & Meeting Adjourned – President and President-Elect**

Roy Casiano, MD; Peter Hwang, MD

## POSTERS At-A-Glance

Abstract ID# 1067

**A Case Report of a Rare Intracellular Epidermoid Tumor**Enrique Perez, MD  
New York, NY

Abstract ID# 1111

**A Comparison of Silastic and Gloved Meroceal Middle Meatal Spacers in Prevention of Postoperative Sequelae Following Fess: A Randomized Controlled Trial**Jamil Manji, MSc  
Vancouver, BC

Abstract ID# 1043

**A Systematic Review of the Sinonasal Microbiome**Janalee Stokken, MD  
Cleveland, OH

Abstract ID# 1012

**Adequacy Of The Nasoseptal Flap for Reconstruction of Pediatric Skull Base Defects**Reza Ehsanian, MD, DPhil  
Nashville, TN

Abstract ID# 934

**Allergic Sensitization and Chronic Sinusitis do not Predict Chronic Otitis Media**Christopher Brook, MD  
Boston, MA

Abstract ID# 931

**An Unusual Cause of Nasal Obstruction**Karuna Dewan, MD  
Memphis, TN

Abstract ID# 1095

**Analysis of Viral Etiologies in Adults with Symptomatic Upper Respiratory Infections in an Outpatient Setting**Valeria Silva Merea, MD  
New York, NY

Abstract ID# 940

**Antibiotics, Steroids, and Combination Therapy in the Treatment of Chronic Rhinosinusitis without Nasal Polyps In Adults**Yuan Liu, MD  
Loma Linda, CA

Abstract ID# 1019

**Anti-pseudomonal Activity of Taste Receptor Agonists and Antagonists.**Sakeena Payne, MD  
Hershey, PA

Abstract ID# 987

**Augmented Reality in Endoscopic Sinus Surgery in a Cadaveric Model**Martin Citardi, MD  
Houston, TX

Abstract ID# 1107

**Bacterial Communities Vary Between Sinuses in Chronic Rhinosinusitis and Nasal Polyposis**Nicholas Stow, MD  
Frenchs Forest, Australia

Abstract ID# 923

**Bleeding Risk Associated with Resection of the Middle Turbinate During Functional Endoscopic Sinus Surgery**Anya Miller, MD  
Detroit, MI

Abstract ID# 955

**Calcified Chewing Gum as Rhinolith**Onuralp Kurt, MD  
Erzincan, Turkey

Abstract ID# 957

**Changes in Nasal Obstruction with Nasal Surgery in Patients with Obstructive Sleep Apnea**Ewa Olszewska, MD  
Bialystok, Poland

Abstract ID# 927

**Characterization of Facial Pain Associated with Chronic Rhinosinusitis using Validated Pain Evaluation Instruments**Adam DeConde, MD  
San Diego, CA

Abstract ID# 989

**Characterization of Transsphenoidal Complications in Patients with Acromegaly: An Analysis of Inpatient Data in the United States from 2002 To 2010**Milap Raikundalia, BS  
Newark, NJ

Abstract ID# 1092

**Chronic Invasive Fungal Sinusitis Associated with Intranasal Drug Use**Kelly Pekala, MS  
Nashville, TN

Abstract ID# 936

**Chronic Lymphocytic Leukemia of the Oropharyngeal Cavity and Paranasal Sinuses: A Case Series And Literature Review**Wesley Davison, BA  
New York, NY

Abstract ID# 919

**Clinical Features of Chronic Rhinosinusitis in Igg4-related Disease**Dai Takagi, PhD  
Sapporo, Japan

Abstract ID# 1034

**Comparison of Airflow and Rhinitis Outcomes Between Allergic and Non-allergic Rhinitis Patients from Septal and Turbinate Surgery**Krishnan Parthasarathi, BMed, BDS  
Darlinghurst, Australia

Abstract ID# 1114

**Comparison of Allergic Asthmatics with and without Chronic Rhinosinusitis Treated by Omalizumab**Matthew Clavenna, MD  
Nashville, TN

Abstract ID# 1061

**Comparison of the Paranasal Sinus Microbiome of Cystic Fibrosis Patients with and without Double-lung Transplantation**Jose Mattos, MD, MPH  
Pittsburgh, PA

Abstract ID# 1036

**Computational Fluid Dynamics Modeling of Sinus Irrigations Before and After Surgery**Kai Zhao, PhD  
Presented by John Craig, MD  
Philadelphia, PA

Abstract ID# 1076

**Contralateral Transmaxillary Corridor as an Extension to the Endoscopic Endonasal Approach to the Petrous Apex**Chirag Patel, MD  
Pittsburgh, PA

Abstract ID# 961

**Deafness and the Sense of Smell**Engin Dursun, MD  
Istanbul, Turkey

Abstract ID# 1102

**Delayed Wound Healing in Primary Undifferentiated Epithelial CRS Cell Cultures**Badr Ibrahim, MD  
Montréal, Québec

Abstract ID# 998

**Development of a Potential Platform for Isolation of Circulating Tumor Cells of Nasopharyngeal Carcinoma**Ming-Ying Lan, MD  
Taipei, Taiwan

Abstract ID# 1010

**Diagnosis and Management of Cerebrospinal Fluid Rhinorrhea: an Evidence-based Review with Recommendations**Gretchen Oakley, MD  
Salt Lake City, UT

Abstract ID# 1101

**Diagnosis and Treatment of Sinonasal Mucous Membrane Pemphigoid**Paul Neubauer, MD  
New Haven, CT

Abstract ID# 971

**Ectopic Pituitary Adenomas Presenting as Isolated Parasellar or Clival Lesions: Case Series and Management Recommendations**Bobby Tajudeen, MD  
Los Angeles, CA

Abstract ID# 1081

**Educational Utility of Advanced 3-dimensional Virtual Imaging in Evaluating the Anatomical Configuration of the Frontal Recess**Abib Agbetoba, MD  
Houston, TX

Abstract ID# 938

**Effects of Nasal Vestibule Morphology on Airway Resistance**Vaibhav Ramprasad, BA  
Durham, NC

Abstract ID# 1097

**Efficacy of Laser Photocoagulation and Cautery as Temporizing Interventions in HHT**Benjamin Hunter, MS3  
Salt Lake City, UT

Abstract ID# 1006

**Electronic Medical Record as Chronic Rhinosinusitis Patient Database**Matthew Leach, MD  
St. Louis, MO

Abstract ID# 1060

**Endoscopic Modified Subtotal Lothrop Procedure for the Management of Frontal Sinus Cholesterol Granuloma**Oliver Chin, BS  
Newark, NJ

Abstract ID# 1031

**Endoscopic Repair of Meningoencephalocele with Nasoseptal Flap in a Patient with Crouzon Syndrome after Frontofacial Advancement**Kimberly Atiyeh, MD  
New York, NY

Abstract ID# 1105

**Endoscopic Sinus Surgery in a Low-resource Setting**Leigh Sowerby, MD  
London, ON

Abstract ID# 1002

**Epidemiological Survey of Non-emergent Sinus and Rhinologic Complaints in United States Emergency Rooms**Rosh Sethi, MD, MPH  
Boston, MA

Abstract ID# 941

**Exploring Knowledge and Expectations Regarding Sinusitis and Surgery in Patients Presenting to Otolaryngology Clinic**Lauren Roland, MD  
St Louis, MO

Abstract ID# 1087

**Factors Predicting the Need for Endoscopic Sinus Surgery in Patients with Odontogenic Sinusitis**Jose Mattos, MD  
Pittsburgh, PA

Abstract ID# 1085

**Frontal Lobe Epidural Abscess and Cerebritis: A Case Report and Literature Review of Intracranial Complications of Pediatric Sinusitis**Saurin Sanghvi, MD  
Newark, NJ

Abstract ID# 1024

**Fronto-orbital Mucocele Management with Steroid Eluting Stent**Jamie Funamura, MD  
Sacramento, CA

Abstract ID# 1015

**Genealogical Databases as a Tool for Extending Follow-up in Clinical Reviews**Thuy-Van Ho, MD  
Kansas City, KS

Abstract ID# 1077

**Glubran-2: A New Alternative for Nasal Packing**Enver ÇESMECI, MD  
Diyarbakir, Turkey

Abstract ID# 1074

**Identification of Potential Risk Factors Associated with Development of Synechiae Following Functional Endoscopic Sinus Surgery: A Retrospective Review**Jamil Manji, MSc  
Vancouver, BC

Abstract ID# 966

**Image-guided Balloon Dilatation of Sinus Ostia in the Office Setting**Abib Agbetoba, MD  
Houston, TX

Abstract ID# 1098

**Improving Reliability in Stereotactic Imaging for Endonasal Surgery with use Granular Jamming**Raul Wirz, PhD  
Nashville, TN

Abstract ID# 995

**Incidental Finding of Lymphoma Following Septoplasty**Edward Kuan, MD, MBA  
Los Angeles, CA

Abstract ID# 943

**In-office Balloon Sinus Dilatation vs Medical Therapy for Recurrent Acute Rhinosinusitis: Interim Results From a Randomized, Placebo-controlled Multi-institutional Study**Ashley Sikand, MD  
Henderson, NV

Abstract ID# 935

**Intracranial Complications of Sinusitis: A 17-year Review of 48 Cases**Ming-Ying Lan, MD, PhD  
Taipei, Taiwan

Abstract ID# 1104

**Intranasal Cross-sectional Area and Quality-of-life Changes Following Endoscopic Transsphenoidal Skull Base Surgery**Edward McCoull, MD  
New Orleans, LA

Abstract ID# 970

**Iphone-adapted Endoscopy Technology Provides Adequate Image Quality for Diagnostic Nasal Endoscopy**Keely Chevallier, MD  
Salt Lake City, UT

Abstract ID# 1063

**Isolated Chronic Nasopharyngitis: Clinical Presentation, Treatment, and Outcomes**Alla Solyar, MD  
St. Petersburg, FL

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**Isolated Orbital Wall Fractures - Distribution, Mechanism, and Clinical Significance**Ruchir Chaudhari, MD  
Presented by Ashutosh Shelat, MS  
Sacramento, CA

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**Lateral Recess Sphenoid Sinus Inverted Papilloma with Dehiscent Carotid Artery**Stephanie Austin, MD  
Oakland, CA

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**Lobular Capillary Hemangioma Formation: An Unusual Late Complication of Submucous Resection With Power Instrumentation of the Inferior Turbinate**Luciano Gregorio, MD  
Boston, MA

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**Management of Rhinosinusitis During Pregnancy: Systematic Review and Expert Panel Recommendations**Devyani Lal, MD  
Phoenix, AZ

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**Metastatic Squamous Cell Carcinoma of the Maxillary Sinus: A Population-based Analysis**Pariket Dubal, BA  
Newark, NJ

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**Microbial Flora of the Paranasal Sinuses in Chronic Rhinosinusitis: Which Sinus is Most Representative?**Nicholas Stow, MD  
Frenchs Forest, Australia

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**Midline Nasal Destructive Lesion and Skin Lesion Induced by Nasal Cocaine**David Timme, MD  
Springfield, IL

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**Nasal Epithelial Myoepithelial Carcinoma: An Unusual Cause of Epiphora, A Case Report and Review of the Literature**Juliette Flam, BS  
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**Nasal Septal Abscess in Association with Pediatric Acute Rhinosinusitis**Duc Tien, MD  
Cleveland, OH

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**Nasal Septal Perforations: Physiologic Modeling With Computational Fluid Dynamics**Zainab Farzal, BS  
Chapel Hill, NC

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**Nasolabial Cyst: A Case Report**Adem Cakmak, MD  
Istanbul, Turkey

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**Not Your Typical Lymphoma- A Rare Presentation of Primary Extranodal Hodgkin Disease of the Maxillary Sinus**Joshua Weiss, MD  
Gainesville, FL

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**Novel Approach to Choanal Atresia with Steroid Drug Alluding Stents**Scott Rickert, MD  
New York, NY

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**Novel Surgical Approach for Cavernous Hemangioma in Nasal Bone and Systematic Review of Literature**Daniel O'Brien, MD  
Sacramento, CA

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**Objective Sinonasal Functional Outcomes in Endoscopic Anterior Skull Base Surgery: An Evidence Based Review with Recommendations.**Greig Samuel, MBChB, FRACS  
Edmonton, AB

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**Obstructing Pediatric Nasopharyngeal Lobular Capillary Hemangioma after Adenoidectomy**John Sims, MD  
Rochester, MN

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**Ossifying Fibroma of the Maxilla and Sinonasal Tract: Case Series**Jack Liu, MD  
Irvine, CA

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**Otorhinolaryngology Residency Applicant Self-assessment of Workload And Performance During Simulation Tasks**Ernest Gomez, MD, MTR  
Philadelphia, PA

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**Outcomes Analysis of the Surgical Management of Frontal Sinusitis in Cystic Fibrosis Patients**Smriti Nayan, MD, FRCSC  
Toronto, Ontario

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**Outcomes and Technical Nuances of Nasoseptal Flap Skull Base Reconstruction in Patients with Prior Septal Surgery**Anthony Del Signore, MD  
Chapel Hill, NC

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**Outcomes of Chronic Frontal Sinusitis Treated with Ethmoidectomy Alone: A Prospective Study**Waleed Abuzeid, MD  
Bronx, NY

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**Outcomes of Endoscopic Repair of Cerebrospinal Fluid Rhinorrhea Without Lumbar Drains**Austin Adams, MD  
Nashville, TN

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**Pediatric FESS & Endoscopic Skull Base Surgery**Ali Almomen, MD  
Dammam, Eastern Province

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**Pediatric Orbito-ethmoidal Osteoid Osteoma**Jamie Funamura, MD  
Sacramento, CA

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**Pendant Drop Tensiometry for Measuring Surface Tension Effects of Sinus Rinses on Rhinosinusitis Mucus: A Pilot Study**Jo-Lawrence Bigcas, MD  
Houston, TX

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**Pepsin Induces Mitochondrial Damage and Cytokine Expression in Human Nasal Epithelial Cells in Vitro**Craig Hoekzema, MD  
Milwaukee, WI

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**Podoplanin, a Novel Cell Surface Marker for Human Nasal Basal Cells**Ming-Ying Lan, MD, PhD  
Taipei, Taiwan

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**Primary Immune Deficiency and Recalcitrant Chronic Sinusitis: a systematic review**Jill Mazza, MD  
Baltimore, MD

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**Prognosis of Upper Airway Remodeling in Chronic Rhinosinusitis**Henry Barham, MD  
Darlinghurst, NSW

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**Purely Endoscopic Endonasal Surgery of the Craniovertebral Junction: A Systematic Review**Christina Fang, BS  
Newark, NJ

Abstract ID# 960

**Quantification of Maxillary Sinus Accessibility via a Middle Meatal Antrostomy**Daniel Beswick, MD  
Stanford, CA

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**Rare Spindle Cell Carcinoma of the Nasal Cavity Initially Presenting as Leiomyosarcoma**Terrell Bibb, MS  
Lubbock, TX

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**Results of Primary Septorhinoplasty from Beginners**Onuralp Kurt, MD  
Erzincan, Turkey

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**Retrospective Review of Nasolacrimal Fossa Anatomical Relationships in Dacryocystorhinostomy**Wonsuk Kim, MD  
Sacramento, CA

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**Rhinolithiasis: An Unusual Mass In Nasal Cavity - A Case Report**Salim Dogru, MD  
Istanbul, Turkey

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**Secondary Rhinoplasty of Unilateral Cleft Lip Patient: Case Report**Onuralp Kurt, MD  
Erzincan, Turkey

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**Significance of Residual Retromaxillary Air Cells as a Risk Factor for Revision Endoscopic Sinus Surgery**Jon Mallen-St. Clair, MD, PhD  
Los Angeles, CA

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**Single Stage Surgery for Silent Sinus Syndrome: A Case Series**Alan Tate, MD  
Gainesville, FL

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**Sinonasal Extramedullary Plasmacytoma: A Population-based Incidence and Survival Analysis**Alejandro Vazquez, MD  
Newark, NJ

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**Sinonasal Neuroendocrine Carcinoma: A Population-based Analysis of Incidence And Survival**Pariket Dubal, BA  
Newark, NJ

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**Sinusitis in Patients Concurrently on Tumor Necrosis Factor Alpha Inhibitors: A Case Series**Cynthia Wang, BS  
Calgary, Alberta

Abstract ID# 969

**Solitary Fibrous Tumor of the Sinonasal Cavity**Ross Shockley, MD  
Nashville, TN

Abstract ID# 1022

**Spontaneous Ventilation of the Frontal Sinus after Fractures Involving the Frontal Recess**Aria Jafari, MD  
San Diego, CA

Abstract ID# 1108

**Steroid Eluting Stents Effective for Complex Frontal Sinus Disease**Maheep Sohal, MD  
Farmington, CT

Abstract ID# 1079

**Symptomatic Nasal Obstruction, Sleep, and Quality of Life in Patients with Chronic Rhinosinusitis**Andrew Thomas, MD  
Salt Lake City, UT

Abstract ID# 1089

**Systematic Review of Risk Factors for Revision Sinus Surgery**Fatemeh Mohammadi, MD  
Stanford, CA

Abstract ID# 1112

**The Clinical Relevance of Isolated Sphenoid Sinus Opacification**Anna Knisely, MD  
Sydney, NSW

Abstract ID# 978

**The Effect of Mygind's Position On Endoscopy and Snot-22 Scores in Patients With Chronic Rhinosinusitis**Paul Koors, MD  
Charlottesville, VA

Abstract ID# 1008

**The Effect of Nsaid-based Post-tonsillectomy Pain Management on Post-tonsillectomy Hemorrhage Rate: A Retrospective Institutional Review**Julia Pfaff, DO, MPH  
Philadelphia, PA

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**The Mixed Fungal Sinusitis**Ali Almomen, MD  
Damman, Eastern Province

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**The Presentation and Palliative Management of Metastatic Hepatocellular Carcinoma to the Nasal Cavity: A Case Report**Stephanie Teng, MD  
New York, NY

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**The Prognosis for Idiopathic Olfactory Loss and its Possible Relationship to Cognitive Dysfunction**Erica Ross, BA, BM  
Cleveland Heights, OH

Abstract ID# 929

**The Relationship Between Allergic Sensitization and Sinonasal Inflammation in Patients with Nasal Polyposis**Christopher Brook, MD  
Boston, MA

Abstract ID# 1106

**Theoretical Thermal Energy Transfer From Nasal Endoscopes and its Potential**Scott Schwartz, BS  
Detroit, MI

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**Transorbital Endoscopic Identification of Supernumerary Ethmoid Arteries**Angelique Berens, MD  
Seattle, WA

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**Transsphenoidal Surgery for Malignant Pituitary Lesions: An Analysis of Inpatient Complications**Peter Svider, MD  
Newark, NJ

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**Two Cases of Nasal Amyloidosis Secondary to Lymphoma**Ian Humphreys, DO  
Stanford, CA

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**Vd3 Does not Correlate with Th-2 Interleukins in  
Chronic Rhinosinusitis With Nasal Polyposis**

E. Ritter Sansoni, MD  
Portland, OR

Abstract ID# 973

**Viral Infection and Biofilm Induction in Patients with  
Cystic Fibrosis**

Nicholas Rowan, MD  
Pittsburgh, PA

Abstract ID# 1091

**When do we Operate for Chronic Rhinosinusitis?: A  
Systematic Review of Maximal Medical Therapy Prior to  
Endoscopic Sinus Surgery**

Jonathan Dautremont, MD  
Calgary, Alberta



# Oral Presentations

Thursday, April 23, 2015

**12:55pm**

## Welcome

ARS President and President-Elect  
Roy Casiano, MD & Peter Hwang, MD

**1:00pm**

## ARS-AAFPRS Joint Panel

### Surgical Management of Complex Septal Pathology

Moderator: Douglas Reh, MD  
Panelists: Stephen Bansberg, MD; Travis Tollefson, MD, PhD. **Note: Complimentary Registration for all AAFPRS Members**

## Session: Office-Based Rhinology

Moderators: Bozena Wrobel, MD & Amin Javer, MD

**1:33pm**

### Endoscopic polypectomy in the clinic (epic) versus formal endoscopic sinus surgery for select patients with nasal polyposis: A pilot cost-effectiveness analysis

Kristine Smith, MD  
Luke Rudmik, MD, MSc  
Shaun Kilty, MD  
Calgary, AB  
Canada

**Background:** This economic evaluation assesses the cost-effectiveness of performing endoscopic polypectomy in-the-clinic (EPIC) procedures compared to formal endoscopic sinus surgery (ESS) for the treatment of patients with chronic rhinosinusitis with nasal polyposis (CRSwNP) with predominant symptoms of nasal obstruction with or without olfactory loss.

**Methods:** Cost-effectiveness analysis using a Markov decision tree model with a 30-year time horizon. The economic perspective was the Canadian government third party payer. Costs and effects were discounted at a rate of 3.5%. A probabilistic sensitivity analysis (PSA) was performed to account for inherent uncertainty surrounding the mean values. The patient population included CRSwNP patients with predominantly isolated symptoms of nasal obstruction and olfactory dysfunction. The comparative treatment groups were: 1) EPIC and 2) ESS. Primary outcome was the incremental cost per quality adjusted life year (QALY).

**Results:** Over a time period of 30 years, the reference case demonstrated that the ESS strategy cost a total of \$16,048 and produced 15.17 QALYs while the EPIC strategy cost \$4,662 and produced 14.95 QALYs. The ESS vs. EPIC incremental cost effectiveness ratio was \$51,741/QALY suggesting that the EPIC strategy is more cost-effective given a willingness to pay threshold of \$30,000/QALY. The PSA demonstrated that the economic conclusion is correct with 64% certainty.

**Conclusion:** Results from this pilot economic evaluation suggests that the EPIC treatment strategy is more cost-effective compared to ESS in select CRSwNP patients whose symptoms are predominantly nasal obstruction and olfactory loss. A future randomized controlled trial should be performed to strengthen this study's outcomes.

**1:40pm**

### Strategies for decreasing contamination of home-made nasal saline irrigation solutions

Elliot Hardy, MD  
Scott Stringer, MD  
Richard O'Callaghan, PhD  
Michael Bierdeman, BS  
Warren May, PhD  
Jackson, MS  
USA

**Objectives:** To determine whether homemade nasal saline irrigation preparations become contaminated with pathogenic bacteria and over what time period this occurs. To determine whether water type, storage method, tonicity, and pH impact contamination rates.

**Study design:** Translational research

**Methods:** Stock solutions of various tonicities and pH were prepared using boiled, bottled, and distilled water. The solutions were stored at ambient temperature on a kitchen countertop for one week. Each day, 50cc of the solutions were poured out to simulate transferring the stock solution into an irrigation vector. Cultures of the stock solutions were taken on Day #3 and Day #7. Refrigeration of solutions was also performed to determine if this is a valid preservation method.

**Results:** The boiled water solutions were more likely to demonstrate bacterial growth ( $p < 0.001$ ), as were those that were hypotonic ( $p = 0.046$ ). pH had no significant effect. Growth occurred as early as 24 hours after solution preparation. Pathogenic species isolated were *S. aureus*, *Sphingomonas paucimobilis*, *Acinetobacter junii*, *Moraxella* sp, *Methylobacterium* sp, and *Brevundimonas diminuta*. No bacterial growth occurred in refrigerated solutions ( $p = 0.008$ ).

**Conclusions:** Pathogenic bacterial growth can occur in a short period of time in homemade nasal saline irrigation solutions with routine handling. Solutions should be refrigerated if at all possible. If solutions are to be stored at ambient temperature, they should be hypertonic and prepared from bottled or distilled water.

**1:47pm**

### Treatment of aspirin exacerbated respiratory disease (AERD) with a low salicylate diet for – a multi-center randomized control cross-over trial

Smriti Nayan, MD, FRCSC  
Doron Sommer, MD, FRCSC  
Leigh Sowerby, MD, FRCSC  
Brian Rotenberg, MD, MPH, FRCSC  
Arif Janjua, MD, FRCSC  
Michael Gupta, MD, MSc, FRCSC  
Toronto, Ontario  
Canada

**Background:** Aspirin Exacerbated Respiratory Disease (AERD) is comprised of aspirin/acetysalicylic acid (ASA) sensitivity, bronchial asthma and nasal polyposis. Treatment of AERD remains challenging, and may include topical/sys-

temic steroids, endoscopic sinus surgery and/or aspirin desensitization.

**Study Design:** A prospective crossover multi-center study involving 4 tertiary rhinology centers (n=26) was conducted. Patients were randomized to start with either six weeks of a regular diet (R) or six weeks of a low salicylate diet (LS) and then cross-over for a total study duration of 12 weeks.

**Methods:** Subjective (Sino-nasal Outcome Test-22 (SNOT-22), Nasal Sinus Symptom Scale (NSSS) and the Asthma Control Questionnaire) and objective outcome instruments (Peri-Operative Sinus Evaluation (POSE) and Lund-Kennedy Endoscopic Score (LKES)) were used to evaluate patients at baseline, six weeks (at cross-over) and twelve weeks.

**Results:** Twenty-six patients completed the study (average age 53 years (24-77)). Patients had a reduction in their median scores when on the low-salicylate diet for the 4 sino-nasal assessment scores. Wilcoxon rank sum tests demonstrated that statistically significant differences when patients were on the low-salicylate diet compared to their regular diet scores: (SNOT-22: -15.5 (CI = 9.75 to 23.25),  $p < 0.001$ , NSSS: -2 (CI = -3.5 to -1),  $p < 0.001$ , LKES: -2.5 (CI = -3.5 to -1.5),  $p < 0.001$ , POSE: -6.25 (CI = -9 to -4),  $p < 0.001$ ).

**Conclusion:** Implementation of a low salicylate diet appears to improve the nasal symptoms and nasal endoscopy findings of individuals with AERD.

### 1:54pm

#### **Effectiveness of leukotriene receptor antagonism in the post-operative management of chronic rhinosinusitis**

Joshua Yelverton, MD  
Thomas Holmes, BS  
Camilo Gelves, MD  
Stilianos Kountakis, MD, PhD  
Augusta, GA  
USA

**Introduction:** Montelukast is used in the treatment of allergic rhinitis and asthma. It has been used as an adjuvant therapy in patients with chronic rhinosinusitis (CRS) but its effectiveness has not been evaluated. This study evaluates the efficacy of adjuvant leukotriene receptor antagonism in CRS and subtypes.

**Methods:** Review of a prospectively collected data at a tertiary-referral institution. We identified all patients who were prescribed montelukast post-operatively and had a lapse in therapy for at least one month, so that the patients themselves serve as their own control group. Sino-Nasal Outcomes Test (SNOT-20) scores and Lund-Kennedy endoscopy scores were obtained for each patient. Scores were compared with and without montelukast using Student's paired t-test. The analysis was controlled for changes in other medications.

**Results:** Fifty-five therapy lapses were identified in 53 patients. Twenty-seven patients had eosinophilic CRS with polyps (eCRScNP), 3 had eosinophilic CRS without polyps (eCRSsNP), 8 had Samter's Triad (ST), and 15 had allergic fungal sinusitis (AFS). Overall mean follow-up was 46 months. Overall, SNOT-20 scores and endoscopy scores were significantly lower with montelukast ( $p < 0.005$  for both). On subgroup analysis, SNOT-20 scores were significantly improved for patients with eCRScNP and AFS ( $p < 0.005$  and

$p < 0.05$ , respectively). Endoscopy scores were significantly improved for patients with eCRScNP and AFS ( $p < 0.05$  for both). Outcomes approached, but did not reach, significance for patients with ST ( $p = 0.09$  for SNOT-20 and  $p = 0.11$  for endoscopy).

**Conclusion:** The addition of montelukast as post-operative therapy is beneficial for patients with eCRScNP and AFS.

### 2:01pm

#### **Antibiotic prescriptions by physicians compared to nurse practitioners for upper respiratory tract infections in children**

Elisabeth Ference, MD, MPH  
Rakesh Chandra, MD  
James Schroeder, MD  
Stephanie Shintani Smith, MD, MS  
Chicago, IL  
USA

**Introduction:** Medical and surgical subspecialties are increasingly relying on mid-level providers to meet the needs of their patients. This study investigates differences between physicians and mid-level providers with respect to antibiotic prescribing for pediatric upper respiratory infections (URIs).

**Methods:** Data from the 2006-2009 National Ambulatory Medical Care Survey and National Hospital Ambulatory Care Survey, from the National Center for Health Statistics, were analyzed using logistic regression to identify variation in antibiotic prescribing by patient and clinician characteristics.

**Results:** From 2006-2009, antibiotics were prescribed at 53.6% of 9,687 unweighted pediatric office visits for URIs. Adjusting for specialty, age, sex, race and total number of chronic diseases, nurse practitioner (NP) visits for any type of URI were associated with higher rates of antibiotic prescription compared to MD visits, OR 1.85 (1.04-3.30),  $P < 0.05$ . The increased rates of antibiotic prescribing was also seen specifically for acute rhinosinusitis (OR 22.5,  $P = 0.03$ ) and acute tonsillitis (OR 12.8,  $p = 0.04$ ). There was no significant difference between MD and NP prescription rates for nonsuppurative otitis media (OM), chronic and acute OM, nasopharyngitis, and acute pharyngitis.

**Conclusion:** Our preliminary results show that antibiotic use continues to be prevalent for pediatric URIs. Moreover, NPs were more likely than MDs to prescribe antibiotics in general and for a variety of specific URIs during this time period. As an increasing number of patients, even within otolaryngology, are being seen by nonphysician clinicians examining comparative antibiotic prescribing patterns is important to direct future education campaigns and shape clinical guidelines.

### 2:08pm

#### **Discussion**

### 2:15pm

#### **Panel: Endoscopic orbital surgery: state of the art**

Moderator: Jayakar Nayak, MD  
Panelists: Todd Kingdom, MD, Raymond Sacks, MD & Bing Zhou, MD

### 2:55pm

#### **Break with Exhibitors**

**Session: Discerning CRS Phenotypes**

Moderator: Amber Luong, MD, PhD & Noam Cohen, MD, PhD

**3:15pm****A pilot study comparing symptom profiles of a polyp versus an eosinophilic-based classification of chronic rhinosinusitis**

Christopher Thompson, MD  
Caroline Price, BA  
Julia He Huang, DDS  
David Conley, MD  
Robert Kern, MD  
Bruce Tan, MD  
Chicago, IL  
USA

**Introduction:** Chronic rhinosinusitis (CRS) is likely a biologically heterogeneous disease process. Current guidelines propose sub-classification using polyp status while others propose using mucosal eosinophilia. We hypothesized that appropriate CRS sub-classification would increase homogeneity of baseline symptoms, and identify symptoms that identify CRS subtypes.

**Methods:** Normalized eosinophilic cationic protein (ECP) was measured on archived sinus tissue homogenates from 78 control patients without CRS using ELISA. CRS patients undergoing surgery prospectively completed a preoperative battery of 62 questions relating to medical history, symptoms including SNOT-22, and PROMIS-29 general quality of life (QOL) measures. ECP levels were determined from ethmoid, uncinate, and polyp tissue homogenates and normalized to total protein. Patients were classified as eosinophilic or non-eosinophilic using a 95-percentile threshold established from control tissue (294.5 ng/mg total protein). Separate pairwise comparisons were performed on individual patient-reported symptoms using polyp and eosinophilic status.

**Results:** 42 CRS patients were enrolled; 17 patients had CRS with polyps (CRSwNP). 16 were eosinophilic (n=11 CRSwNP, n=5 CRSsNP). CRSwNP patients had increased nasal blockage, difficulty breathing through nose and need to blow nose, and decreased cough compared to CRSsNP patients (p<0.05). Eosinophilic CRS patients had decreased taste/smell and more ear pain compared to non-eosinophilic CRS patients (p<0.05). All other demographic, medical history, symptom and QOL measures were similar between groups.

**Conclusion:** On pilot analysis, a polyp-status based classification demonstrated more symptomatic differences than an eosinophil-based classification although the individual items differed. Further validation and evaluation of prognosis following treatment is required to evaluate appropriate means of subclassifying CRS.

**3:22pm****Identification of chronic rhinosinusitis phenotypes using cluster analysis**

Zachary Soler, MD  
J Hyer, MS  
Timothy Smith, MD  
Jess Mace, MPH  
Luke Rudmik, MD  
Rodney Schlosser, MD  
Charleston, SC  
USA

**Introduction:** Current clinical classifications of chronic rhinosinusitis (CRS) have been largely defined based upon preconceived notions of factors thought to be important, such as polyp or eosinophil status. Unfortunately, these classification systems have little correlation with symptom severity or treatment outcomes. Unsupervised clustering can be used to identify phenotypic subgroups of CRS patients, describe clinical differences in these clusters and define simple algorithms for classification.

**Methods:** A multi-institutional, prospective study of 382 patients with CRS who had failed initial medical therapy completed the SinoNasal Outcome Test (SNOT-22), Rhinosinusitis Disability Index (RSDI), Short Form-12 (SF-12), Pittsburgh Sleep Quality Index (PSQI), and Patient Health Questionnaire (PHQ-2). Objective measures of CRS severity included Brief Smell Identification Test (B-SIT), CT and endoscopy scoring. All variables were reduced and unsupervised hierarchical clustering was performed. After clusters were defined, variations in medication usage were analyzed. Discriminant analysis was performed to develop a simplified, clinically useful algorithm for clustering.

**Results:** Clustering was largely determined by age, severity of patient reported outcome measures, depression and fibromyalgia. CT and endoscopy varied somewhat among clusters. Traditional clinical measures including polyp/atopic status, prior surgery, B-SIT and asthma did not vary among clusters. A simplified algorithm based upon productivity loss, SNOT-22 score and age predicted clustering with 89% accuracy. Medication usage among clusters did vary significantly.

**Discussion:** A simplified algorithm based upon hierarchical clustering is able to classify CRS patients and predict medication usage. Further studies are warranted to determine if such clustering predicts treatment outcomes.

**3:29pm****Familial risk of eosinophilic esophagitis and chronic rhinosinusitis**

Reema Padia, MD  
Karen Curtin, PhD  
Justin Berger, BS  
Richard Orlandi, MD  
Jeremiah Alt, MD, PhD  
Salt Lake City, UT  
USA

**Objective:** To determine the relative risk of having eosinophilic esophagitis (EoE) in chronic rhinosinusitis (CRS) probands and their families using the Utah Population Database (UPDB).

**Study Design:** Retrospective observational cohort study with population-based matched controls

**Methods:** The UPDB, a genealogical database linked to medical records, was used to identify CRS and EoE patients diagnosed at any age between 2008 and 2012. The familial risks of an EoE diagnosis (ICD-9-CM code 530.13) in CRS probands and their first-through-fifth-degree relatives and spouses were calculated using Cox models in comparison to controls randomly selected from the UPDB and individually matched 10:1 on sex and birth year.

**Results:** Probands with CRS demonstrated a 3.4-fold increased risk of having EoE themselves ( $p < 10^{-15}$ ). First-degree relatives (e.g., parents and children) of CRS probands had a 1.5-fold increased risk of having EoE ( $p < 10^{-4}$ ) while more distant relatives did not show a significant increased risk. Spouses of probands exhibited a borderline significant 1.4-fold increased risk of having EoE ( $p < 0.06$ ). Conversely, risks of having CRS in EoE probands were consistent.

**Conclusion:** These relative risks of comorbid EoE in patients with CRS and their families indicate an increased relative risk. These results point to an association between CRS and EoE as comorbid conditions and suggest an environmental component contributing to the etiology of EoE, given a shared household. Further analyses regarding genetic or environmental factors that could jointly contribute to these diseases will lead to better understanding of both disease processes, and help to target therapy.

### 3:36pm

#### **Volumetric computed tomography analysis of the olfactory cleft in patients with chronic rhinosinusitis**

Zachary Soler, MD, MSc  
John Pallanch, MD  
E. Ritter Sansoni, MD  
Lauren Lawrence, MD  
Rodney Schlosser, MD  
Timothy Smith, MD, MPH  
Charleston, SC  
USA

**Introduction:** Commonly used computed tomography (CT) staging systems for chronic rhinosinusitis (CRS) focus on the sinuses and do not quantify disease in the olfactory cleft. The goal of the current study was to determine whether precise measurements of olfactory cleft opacification better correlate with olfaction in patients with CRS.

**Methods:** Olfaction was assessed using the 40-item Smell Identification Test (SIT-40) before and after sinus surgery in adult patients. Olfactory cleft opacification was quantified precisely using three-dimensional, computerized volumetric analysis, as well as via a semi-quantitative Likert scale estimations at predetermined anatomic sites. Sinus opacification was also quantified using the Lund-Mackay staging system.

**Results:** The overall cohort ( $n=199$ ) included 89 (44.7%) patients with CRS with nasal polyposis (CRSwNP) and 110 (55.3%) with CRS without nasal polyposis (CRSsNP). The olfactory cleft opacified volume correlated with objective olfaction as determined by the SIT-40 ( $R_s = -0.461$ ;  $p < 0.001$ ). The correlation was significantly stronger in the CRSwNP subgroup ( $R_s = -0.573$ ;  $p < 0.001$ ), whereas no appreciable correlation was found in the CRSsNP group ( $R_s = -0.141$ ;  $p = 0.141$ ). Correlations between sinus-specific Lund-Mackay CT scoring and SIT-40 scores were weaker in the CRSwNP ( $R_s = -0.377$ ;  $p < 0.001$ ) subgroup but stronger in the CRSsNP

( $R_s = -0.225$ ;  $p = 0.018$ ) group when compared to olfactory cleft correlations. Greater intra-class correlations (ICC) were found between quantitative volumetric measures of olfactory cleft opacification (ICC=0.844;  $p < 0.001$ ) as compared with semi-quantitative Likert grading (ICC=0.627;  $p < 0.001$ ).

**Conclusion:** Quantitative measures of olfactory cleft opacification correlate with objective olfaction, with the strongest correlations seen in patients with nasal polyps.

### 3:43pm

#### **Discussion**

#### **Session: New Technologies**

Moderators: Jeffrey Suh, MD & Lori Lemonnier, MD

### 3:48pm

#### **Enhanced irrigant delivery and ventilation to the ethmoid sinus complex through novel anterior and posterior ethmoid sinusotomy procedures using a spiral ethmoid punch**

Jayakar Nayak, MD, PhD  
Waleed Abuzeid, MD  
Asa Peterson, MS  
Ali Rashan, MD  
Jordan Xu, BA  
Stanford, CA  
USA

**Introduction:** Office-based rhinology is devoid of effective procedures to address ethmoid sinusitis. We introduce a minimally invasive tool for performing two novel surgical procedures: "anterior ethmoidotomy" through the ethmoid bulla and "lamellar fenestration" through the basal lamella. We hypothesize that these procedures will enhance irrigant delivery into the ethmoid sinuses.

**Methods:** The sinonasal cavities of ten human cadaver heads (20 sides) were irrigated with a saline-based labeling solution containing methylene blue and a radio-opaque contrast agent. Irrigations were performed prior to and following ethmoidotomy and lamellar fenestration using a novel spiral ethmoid punch (Circa). Procedure characteristics and distribution of the labeling solution were assessed by endoscopy and computed tomography.

**Results:** Forty surgical procedures were performed on 20 sides using Circa. Thirty-eight of 40 (95%) procedures were easily performed with 28/40 (70%) ethmoid windows created in a single pass of the Circa. Compared to pre-procedure baseline controls, ethmoidotomy and lamellar fenestration significantly enhanced methylene blue distribution into the anterior (90% vs 35%,  $p < 0.003$ ) and posterior (90% vs 35%,  $p < 0.001$ ) ethmoid sinuses. Compared to pre-procedure controls, contrast was detected in a significantly higher proportion of anterior (65% vs 5%,  $p < 0.0001$ ) and posterior (60% vs 0%,  $p < 0.0001$ ) ethmoid sinuses. Direct catheter instillation of contrast through the ethmoidotomy and lamellar fenestration windows under endoscopic guidance achieved broad distribution throughout the ethmoid complex.

**Conclusions:** These novel, limited surgical procedures provide reliable access for topical irrigation and ventilation of the ethmoid complex, representing a potential bridge between maximal medical therapy and endoscopic surgery for ethmoid sinusitis.

**3:55pm****Post-operative mucosal effects of antibiotic-impregnated middle meatus spacers in endoscopic sinus surgery: a randomized, controlled trial**

Derrick Randall, MD, MSc  
 Brad Mechor, MD  
 Calgary, AB  
 Canada

**Introduction:** Chronic rhinosinusitis (CRS) is a disabling inflammatory condition of the sinonasal mucosa that affects up to 10% of the population. Management of CRS is focused on reducing mucosal inflammation and improving sinonasal function, primarily through topical and systemic medical therapy, with endoscopic sinus surgery (ESS) used for medical failures. Post-operative systemic antibiotics improve post-operative endoscopic scores following ESS but are variably used out of concern for their side-effect profiles. The ability to provide reliable topical application to the sinus cavity would reduce the potential for systemic antibiotic side effects and complications.

**Methods:** Randomized, double-blind, placebo-controlled study in a tertiary academic center. Eighteen medically refractory CRS patients to undergo ESS were randomized to receive drug-eluting spacers containing triamcinolone and bacitracin in one ethmoid cavity and triamcinolone only in the contralateral ethmoid cavity. Endoscopic mucosal staging scores were determined pre-operatively; one, three, eight, and twenty-four weeks post-operatively.

**Results:** Pre-operative radiologic and mucosal staging scores were equivalent between sinonasal cavities. Post-operatively, endoscopic staging scores improved in both the experimental ( $p = 0.0003$ ) and control groups ( $p = 0.0016$ ). Though the absolute reduction in mucosal score was greater for the experimental group during the study period, no statistically significant difference was detected between experimental and control groups at any time-matched point.

**Conclusion:** Perioperative topical antibiotic therapy delivered to the paranasal sinuses by a drug-eluting spacer provided no benefit to endoscopic mucosal staging scores.

**4:02pm****Measurement of ciliary beat frequency using fourier domain optical coherence tomography**

Bryan Lemieux, BS  
 Jason Chen, BS  
 Joe Jing, MS  
 Zhongping Chen, PhD  
 Brian Wong, MD PhD  
 Irvine, CA  
 USA

**Introduction:** Measuring ciliary beat frequency (CBF) is a technical challenge and difficult to perform in vivo. Optical coherence tomography (OCT) is a mesoscopic non-contact imaging modality that provides high resolution structural images of living tissues without the use of exogenous dyes. Here we use OCT to image airway epithelial structure and measure CBF in ex vivo tissue as the first step toward translating this technology to clinical use.

**Methods:** Fresh ex vivo samples of rabbit tracheal mucosa were imaged using both OCT and light microscopy (LM). The OCT system was designed and built to specification in our lab (1310 nm swept source, 105 nm bandwidth, 100 kHz A line

rate, 8  $\mu$ m axial resolution) The samples were placed in culture, incubated at various temperatures, and treated with agents known to alter CBF. OCT recorded variations in speckle intensity at the surface of the samples were used to gauge the CBF. High Speed digital video of the ciliated epithelium recorded via LM were analyzed using algorithms written in MatLab to confirm the CBF measurements.

**Results:** Frequency of speckle intensity variation recorded with OCT accurately measured CBF as confirmed by LM. Using OCT, we identified the known correlation between CBF, temperature, and exposure to chemical agents.

**Conclusions:** OCT allows for the quantitative measurement of CBF without the need to resolve individual cilia. Furthermore, OCT technology can be incorporated into endoscopic platforms that allow clinicians to readily measure CBF in the office and provide a direct cellular measurement of mucosal physiology and health.

**4:09pm****High-resolution microendoscope imaging of inverted papilloma and normal sinonasal mucosa: evaluation of interobserver concordance**

Arjun Parasher, MD  
 Sarah Kidwai, BS  
 Victor Schorn, MD  
 Andrew Sikora, MD, PhD  
 Satish Govindaraj, MD  
 Brett Miles, MD, DDS  
 New York, NY  
 USA

**Introduction:** High-resolution microendoscopy (HRME) enables real-time imaging of epithelial tissue and the structures within. The utility of this novel imaging modality for inverted papilloma has not been previously described. This study examines the ability of otolaryngologists to differentiate between images of inverted papilloma and normal sinonasal mucosa obtained with HRME.

**Methods:** Resected inverted papilloma and normal sinonasal mucosa specimens were stained with a contrast agent, proflavine. HRME images were subsequently captured. Histopathological diagnoses were obtained for each sample. Quality-controlled images were used to assemble a training set of images. After reviewing the training images, five otolaryngologists without prior HRME experience reviewed and classified test images.

**Results:** Five samples of inverted papilloma and two normal sinonasal mucosa samples were collected. Four representative images from each specimen were used for the twenty-eight image test set. The mean accuracy among all reviewers was 89.3% (95% CI: 83%-94%). The sensitivity to correctly identify inverted papilloma was 86% (95% CI: 79%-92%), and the specificity was 100% (95% CI: 91%-100%). The Fleiss kappa interrater reliability score was 0.77, which is considered excellent.

**Conclusion:** Inverted papilloma and normal sinonasal mucosa have distinct imaging characteristics with HRME. Otolaryngologists can be successfully trained to distinguish between inverted papilloma and normal sinonasal mucosa. As a result, HRME may potentially enable real-time surgical margin differentiation during surgical excision of inverted papilloma.

**4:16pm****Discussion****4:20pm****Panel: International consensus statement on rhinosinusitis (ICOS): Sneak preview of coming attractions**

Moderator: Richard Orlandi, MD

Panelists: Neil Bhattacharyya, MD; Luke Rudmik, MD, MSc; Rodney Schlosser, MD; Elina Toskala, MD, PhD

**5:00pm****Closing Remarks and Adjournment**

## Friday, April 24, 2015

**7:55am****Welcome****Session: Psychosocial impact of chronic rhinosinusitis**

Moderators: Zara Patel, MD &amp; Bruce Tan, MD

**8:00am****Does comorbid anxiety predict quality of life outcomes in patients with chronic rhinosinusitis following endoscopic sinus surgery?**

Toby Steele, MD

Jess Mace, MPH

Timothy Smith, MD, MPH

Portland, Oregon

USA

**Introduction:** Approximately 25% of patients with chronic rhinosinusitis (CRS) have comorbid anxiety and both conditions independently decrease quality-of-life (QOL). Outcomes for CRS and depression have garnered the majority of research attention but efforts to better understand the impact of anxiety disorders on QOL are increasing. We evaluated the role of comorbid anxiety in patients with CRS undergoing endoscopic sinus surgery (ESS).

**Methods:** Adult patients (n=148) with CRS with and without comorbid anxiety were prospectively enrolled into a treatment outcomes investigation. History of comorbid anxiety was retrospectively identified (n=30; 20.3%) and preoperative and postoperative QOL (RhinoSinusitis Disability Index; RSDI, and 22-item SinoNasal Outcome Test; SNOT-22) scores were compared to patients without comorbid anxiety.

**Results:** Compared to patients without anxiety, patients with anxiety were found to be younger (p=0.021) and have a higher prevalence of female gender (p=0.050), diabetes mellitus (p<0.001), depression (p<0.001), and tobacco use (p=0.031). Participants with comorbid anxiety reported significantly worse preoperative mean psychological dysfunction as measured by SNOT-22 subdomain scores (p= 0.015), as well as worse preoperative functional (p=0.035) and emotional (p=0.001) impairment as evaluated by RSDI subdomain scores. After adjustment for other cofactors, patients with anxiety improved significantly less on SNOT-22 total scores compared to participants without anxiety after ESS (p=0.021).

**Conclusion:** Anxiety occurs with increased prevalence in patients with CRS and the presence of comorbid anxiety is associated with worse preoperative QOL and reduced QOL improvement following ESS. These findings warrant improvement in screening, diagnosis, and treatment for patients with CRS and comorbid anxiety.

**8:07am****Depression and anxiety in chronic rhinosinusitis**

Cristine Klatt-Cromwell, MD

Mohamed Tomoum, MD

Anthony del Signore, MD

Brent Senior, MD

Chapel Hill, NC

*This talk will be presented by Anthony del Signore, MD*

USA

**Background:** Both depression and anxiety have been suspected to impact quality of life adversely in patients with chronic rhinosinusitis (CRS).

**Objective:** To assess for the presence of anxiety and/or depression in the setting of CRS and to assess their impact on disease related quality of life by analyzing the correlation between the Rhinosinusitis Disability Index (RSDI) and the Hospital Anxiety and Depression score (HADS), as well as the Lund-Kennedy nasal endoscopic scores.

**Methods:** One hundred twenty-four patients with CRS were prospectively evaluated in the outpatient setting using the RSDI and HADS questionnaires as well as the Lund-Kennedy nasal endoscopy scoring system.

**Results:** The total RSDI and its subscale scores had moderate to very strong correlation with the HADS total score and each of its subscale scores in comparison to their poor correlation with Lund-Kennedy endoscopic score. CRS patients with depression or anxiety scores 8-10 (possible case of clinically significant depression or anxiety) and 11-21 (probable case) reported worse total RSDI and subscale scores when compared with those with normal scores (0-7). There was no significant difference in the Lund-Kennedy endoscopic scores between the different groups of anxiety and depression scores.

**Conclusion:** Depression and anxiety are prevalent in CRS. The total RSDI and its different subscale scores exhibit moderate to very strong correlation with depression/anxiety scores as determined by HADS, while poor correlation was seen with the Lund-Kennedy endoscopic score.

**8:14am****Cognitive dysfunction associated to pain and quality of life in chronic rhinosinusitis**

George Tarasidis, MD

Adam DeConde, MD

Shaelene Ashby, PhD

Timothy Smith, MD, MPH

Richard Orlandi, MD

Jeremiah Alt, MD, PhD

Salt Lake City, UT

USA

**Introduction:** Cognitive dysfunction and its relationship to both pain and disease-specific quality of life (QOL) in chronic rhinosinusitis (CRS) have not been investigated previously.

We sought to analyze the correlations of pain and disease-specific QOL with cognitive function in CRS.

**Methods:** Adults with CRS were prospectively enrolled in a cross-sectional study. Participants' cognitive function was assessed using the Cognitive Failures Questionnaire. Pain was characterized using the Short-Form McGill Pain Questionnaire (SF-MPQ) and the Brief Pain Inventory Short Form. Disease-specific QOL was ascertained using the Rhinosinusitis Disability Index (RSDI) and Sinonasal Outcome Test-22 (SNOT-22). Disease severity was assessed using nasal endoscopy and computed tomography. Bivariate correlations of pain and cognitive dysfunction, disease-specific QOL, and clinical measures of disease severity were ascertained.

**Results:** In patients with CRS (n=70), there was a significant correlation between cognitive dysfunction and pain severity scores (R=0.321, p<0.01). A similar correlation was identified with pain interference (R=0.317, p<0.01) and cognitive dysfunction scores. This is mirrored by a significant correlation between another measure of pain severity, the SF-MPQ and cognitive dysfunction (R=0.498, p<0.01). In patients with CRS there was a significant correlation between disease-specific QOL scores and cognitive function scores as measured by the SNOT-22 (R=0.395, p<0.01) and the RSDI (R=0.528, p<0.01).

**Conclusion:** In patients with CRS, increasing pain and worse QOL are associated with cognitive dysfunction. Possible mechanisms for this cognitive dysfunction include differential neural activation secondary to chronic pain and/or the sequela of a chronic inflammatory state.

### 8:21am

#### **Cognitive function in chronic rhinosinusitis: a controlled clinical study**

Zachary Soler, MD, MSc  
Kristina Storck, MS  
Rodney Schlosser, MD  
Charleston, SC  
USA

**Introduction:** Cognitive dysfunction in patients with chronic rhinosinusitis (CRS) has previously received little attention. Studies which do report cognitive data generally include only subjective measures and lack appropriate controls. The purpose of this study was to evaluate measures of both subjective and objective cognitive function in patients with CRS and compare findings to a control population without sinusitis.

**Methods:** Patients fulfilling diagnostic criteria for CRS and non-CRS controls were recruited from the same source population. Patient-reported cognitive dysfunction was assessed using the Cognitive Failures Questionnaire (CFQ) and fatigue via the Fatigue Severity Scale (FSS). Objective cognitive function was assessed using a battery of tests from the Automated Neuropsychological Assessment Metrics (ANAM) computerized platform.

**Results:** A total of 100 subjects were enrolled, including 50 patients with CRS and 50 control subjects. Patients with CRS scored significantly worse in subjective cognition as measured by total CFQ scores (38.3±16.5 vs 30.9±12.5; p=0.009) and the FSS (4.2±1.6 vs 3.0±1.5; p=0.001). Patients with CRS were also found to have worse Simple Reaction Time scores compared to controls without CRS (162.4±56.2 vs 193.0±44.6; p=0.003). These differences

persisted regardless of polyp status. Differences in each measure remained significant on multivariate regression after controlling for age, gender, race/ethnicity, education, allergic rhinitis, asthma, obstructive sleep apnea, depression, and antihistamine usage.

**Conclusion:** Patients with CRS report significantly more cognitive dysfunction on validated instruments and had worse reaction times on computerized testing. Further study is necessary to determine whether available treatments impact these measures.

### 8:28am

#### **Discussion**

### 8:33am

#### **Presidential Address**

Roy Casiano, MD

#### **Session: Surgical therapies**

Moderators: Vijay Ramakrishnan, MD & Parul Goyal, MD

### 8:43am

#### **Paranasal sinus balloon catheter dilation for the treatment of chronic rhinosinusitis: A systematic review and meta-analysis**

Joshua Levy, MD, MPH  
Michael Marino, MD  
Edward McCoul, MD  
New Orleans, LA  
USA

**Introduction:** Paranasal sinus balloon catheter dilation (BCD) represents a tool in the management of chronic rhinosinusitis (CRS) for which the indications, utilization and outcomes have not been well established. A systematic review was undertaken to evaluate change in quality of life and sinus opacification following paranasal sinus BCD versus endoscopic sinus surgery (ESS) in the treatment of CRS. Subgroup analysis was conducted of subjects with nasal polyposis, prior surgery and office-based procedures.

**Methods:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were utilized to query MEDLINE and EMBASE for all English language studies that discussed sinus BCD and CRS. An itemized assessment of the risk of bias was performed and quantitative data was meta-analyzed.

**Results:** Of 92 studies identified during systematic review, 17 met criteria for analysis. The level of evidence and freedom from bias were generally moderate. Eight studies contained extractable data for change in Sinonasal Outcome Test (SNOT-20) one year following BCD, with significant improvement in self-reported symptoms (p=0.001). Five studies reported a significant change in paranasal sinus opacification following BCD (p=0.01). Three studies directly compared change in SNOT-20 between BCD and ESS, without demonstration of significant difference in outcome (p=0.06).

**Conclusion:** Current evidence supporting the role of BCD in CRS remains incomplete. Grade A evidence demonstrates long-term improvement in SNOT-20 and sinus opacification among a heterogeneous adult population with CRS. However, evidence regarding the role of BCD in unique patient populations, such as failed ESS, nasal polyposis and office-based procedures remains grade C.

**8:50am****Outcomes of complete versus targeted approaches to endoscopic sinus surgery**

Adam DeConde, MD  
 Jeffrey Suh, MD  
 Jess Mace, MPH  
 Jeremiah Alt, MD, PhD  
 Timothy Smith, MD, MPH  
 La Jolla, CA  
 USA

**Introduction:** Endoscopic sinus surgery (ESS) was historically predicated on targeted widening of narrow anatomic structures that caused post-obstructive persistent sinus inflammation. It is now clear that chronic rhinosinusitis (CRS) is a multi-factorial disease with subsets of patients which may require a more extensive surgical approach. This study compares quality-of-life (QOL) and disease severity outcomes after ESS based on the extent of surgical intervention.

**Methods:** Participants with CRS were prospectively enrolled into an on-going, multi-institutional, observational, cohort study. Surgical extent was determined by physician discretion. Participants undergoing bilateral frontal sinusotomy, ethmoidectomy, maxillary antrostomy, and sphenoidotomy were considered to have undergone 'complete' surgery, while all other participants were categorized as receiving 'targeted' surgery. Improvement was evaluated between surgical subgroups with at least 6-month follow-up using the 22-item Sinonasal Outcome Test (SNOT-22) and the Brief Smell Inventory Test (BSIT).

**Results:** 311 participants met inclusion criteria with 147 subjects undergoing complete surgery and 164 targeted surgery. A higher prevalence of asthma, ASA sensitivity, nasal polypoidosis, and a history of prior sinus surgery ( $p < 0.002$ ) was present in participants undergoing complete surgery. Mean improvement in SNOT-22 (28.1[21.9] vs. 21.9[20.6];  $p = 0.011$ ) and BSIT (0.8[3.1] vs 0.2[2.4];  $p = 0.005$ ) was greater in subjects undergoing complete surgery. Regression models demonstrated a 5.9[2.5] greater relative mean improvement on SNOT-22 total scores with complete surgery over targeted approaches ( $p = 0.016$ ).

**Conclusion:** Complete surgery, as defined in this study, was an independent predictor of greater postoperative SNOT-22 score improvement compared to targeted ESS. Further study is needed to determine the surgical extent which optimizes QOL outcomes.

**8:57am****Gender-specific differences in chronic rhinosinusitis (CRS) patients electing endoscopic sinus surgery (ESS)**

Devyani Lal, MD  
 Rohit Divekar, MD  
 Phoenix, AZ  
 USA

**Objectives:** Study gender-specific differences in CRS patients electing ESS.

**Methods:** Retrospective review of CRS patients electing ESS (2011-2013) at a tertiary-care center.

**Results:** ESS was elected by 272 patients (mean age 54.6 years; 48.5% female). Mean Lund-Mackay CT score was 10.9; total SNOT-22 score was 41.8. Compared to men,

women electing ESS had lower CT score (10.1 vs. 11.7;  $p = 0.01$ ) but higher total SNOT-22 score (44.9 vs. 39;  $p = 0.02$ ). Women scored higher on each SNOT-22 item, most significantly with postnasal drainage ( $p < 0.0001$ ) and embarrassment ( $p < 0.0021$ ).

SNOT-22 scores declined with advancing age (women,  $p = 0.003$ ; men,  $p = 0.0005$ ). Stratifying by age, 18-40 years-old females had lower CT score (10.6 vs. 13.5;  $p = 0.054$ ) but higher SNOT-22 scores (53 vs. 42.4;  $p = 0.059$ ) than male contemporaries; females aged 61-80 years had CT scores similar to men but higher SNOT-22 scores (42.5 vs. 33.9;  $p = 0.04$ ).

The majority (54.5%) of women underwent surgery for CRSsNP; men for CRSwNP (57.8%). This difference was statistically significant ( $p = 0.052$ ). Women with CRSwNP had higher SNOT-22 scores than men (47.2 vs 39.6,  $p = 0.02$ ) for similar CT scores. Men electing ESS for CRSsNP had higher CT scores than women (9 vs. 7.38;  $p = 0.02$ ). Females had higher SNOT-22 scores for CRSsNP in the 18-40 years group (56.3 vs. 31.5;  $p = 0.003$ ).

**Conclusion:** Differences exist between male and females electing ESS for CRS. For CT scores similar/lower than men, women electing ESS may have more symptom-burden. Men had ESS for CRSwNP more than CRSsNP. Women were more likely than men to have ESS for CRSsNP.

**9:04am****Medial flap inferior turbinoplasty - five year results compared to submucosal electrocautery and submucosal powered turbinoplasty**

Henry Barham, MD  
 Mona Thornton, MD  
 Richard Harvey, MD  
 Raymond Sacks, MD  
 Darlinghurst, NSW  
 Australia

**Introduction:** Techniques for inferior turbinate reduction vary from complete turbinectomy to limited cauterization. Surgical methods differ on the degree of tissue reduction and reliance on surgical modification versus tissue ablation for outcome. The outcome and morbidity from three techniques are compared.

**Methods:** A randomized double blinded study was performed. Patients were in two groups with the nasal cavities randomized to different intervention on each side within the same patient. One group had a combination of submucosal powered turbinate reduction and submucosal electrocautery, and the second group submucosal powered turbinate reduction and medial flap turbinoplasty. Patient rated nasal obstruction and rhinorrhoea (0-5) and 2. blinded nasal airway ratings (1-4) were assessed at 1, 4, 12 and 60 months post-operatively. Pain requiring additional analgesia and complications were also sought.

**Results:** 100 patients or 200 turbinates were assessed (age 32 years, range 9 – 64, 39% female). Turbinoplasty was superior to both submucosal and electrocautery in achieving grade 4 or 5 subjective scores 60mths. (79% turbinoplasty, 22% submucosal and 6.5% electrocautery). No patients complained of worsening of their obstruction. Bleeding occurred in 9 patients (7% submucosal, 4% turbinoplasty and 0% electrocautery). Crusting was recorded for 31 patients, of which 29/50 = electrocautery (58%). Pain was reported by



27 patients (22% electrocautery, 9% submucosal and 14% turbinoplasty).

Conclusion: The medial flap turbinoplasty provided consistent, robust results. Long-term relief of obstructive symptoms without additional risk of complication was observed in the turbinoplasty group.

#### 9:11am Discussion

#### 9:18am

#### Panel: Great debate: Stents and balloons-worth the cost or not?

Moderator: Pete Batra, MD

Panelists: Nadim Bikhazi, MD; Richard Harvey, MD; Robert Kern, MD & Eugenia Vining, MD

#### 9:58am

#### Break with Exhibitors

#### Session: Microbial aspects of CRS

Moderators: Benjamin Bleier, MD & Justin Turner, MD, PhD

#### 10:18am

#### The fungal microbiome of the paranasal sinuses in health and in chronic rhinosinusitis

Nivedita Sahu, MD  
Nicholas Rowan, MD  
Jose Mattos, MD  
Caleb Phillips, PhD  
Eric Wang, MD  
Stella Lee, MD  
Pittsburgh, PA  
USA

Background: Chronic rhinosinusitis (CRS) is a multifactorial inflammatory disorder of unknown etiology. Specifically, the role of fungi in the development of CRS has been controversial and poorly understood. These organisms have been implicated as potential inflammatory triggers or disease modifiers in CRS. Fungi, however, have been shown to be present in both healthy sinuses as well as in those with CRS. The objective of this study was to determine differences in the fungal microbiome between patients with CRS and in healthy control patients.

Methods: Seven patients with CRS (five with nasal polyps, two without nasal polyps) and twelve healthy controls were prospectively enrolled in this study. Specimens were obtained from the ethmoid sinuses and analyzed via 18S ribosomal RNA sequencing.

Results: 35 unique fungal organisms were identified, thirty to the species level and five to the genus level. There were no significant differences in fungal Chao1 richness ( $p = 0.0811$ ) and fungal Shannon diversity ( $p = 0.7987$ ) indices between healthy controls and CRS samples. Overwhelmingly, the most common isolates in both groups were *Malassezia restricta*, *Malassezia sp.*, and *Glomus versiforme*.

Conclusion: These results suggest that there are no significant taxonomical or hierarchical differences among fungi in CRS patients in comparison to healthy controls. Furthermore, richness and diversity appear to be similar between the two groups.

#### 10:25am

#### Investigation of bacterial repopulation after sinus surgery and perioperative antibiotics

Leah Hauser, MD  
Daniel Frank, PhD  
Vijay Ramakrishnan, MD  
Aurora, CO  
USA

Introduction: Endoscopic sinus surgery (ESS) enjoys high success rates, however, repopulation with pathogenic bacteria is one of the hallmarks of poorer outcomes. The source of re-populating bacteria may include the anterior nasal cavity or nasopharynx, biofilms, intramucosal reservoirs, or de novo infection. The goals of this study were to examine changes in the sinus microbiome following ESS and medical therapies in order to identify potential sources for post-surgical microbial repopulation.

Methods: Samples from the anterior nares, ethmoid region, and nasopharynx were taken at the time of surgery from 13 subjects undergoing ESS for CRS. Patients were treated postoperatively with two weeks of broad-spectrum oral antibiotics and continued saline rinses. The ethmoid cavity was sampled at 2 and 6 weeks postoperatively; microbiota were characterized using qPCR and 16S rRNA gene sequencing. The Morisita-Horn beta-diversity index (M-H) was used to compare similarity between samples.

#### Results

Interestingly, the bacterial burden of the ethmoid swab was higher at the 2-week time point (immediately after antibiotics) than at 6-weeks ( $p=0.01$ ). The 6-week samples most closely represented the anterior nares and ethmoid samples taken at surgery (M-H = 0.68 and 0.65, respectively), and were least similar to the nasopharynx (M-H = 0.2).

Conclusion: Bacterial communities colonizing the ethmoid at 6-weeks postoperatively were most similar to anterior nasal cavity and pre-treatment sinus microbial profiles. The anterior nares appear to contribute to the postoperative sinus microbiome more than the nasopharynx. Interestingly, postoperative antibiotic therapy did not reduce the bacterial burden, but merely shifted the microbial consortia.

#### 10:32am

#### Bactericidal antibiotics promote reactive oxygen species formation in human sinonasal epithelial cells

Michael Kohanski, MD PhD  
Anuj Tharakan, BS  
Andrew Lane, MD  
Murugappan Ramanathan, MD  
Baltimore, MD  
USA

Background: Bactericidal antibiotics have been shown to stimulate reactive oxygen species (ROS) formation in mammalian cells through mitochondrial dysfunction. This results in oxidative tissue damage that may have negative consequences for long-term antibiotic use. Antibiotics are widely and heavily used in the treatment of acute and chronic sinusitis, however the relationship between antibiotics and ROS formation in sinonasal epithelial cells (SNECs) has not yet been demonstrated.

Methods: Human SNECs were collected from patients during endoscopic sinus surgery and grown in culture at the air-liquid interface. Differentiated SNECs were stimulated

with therapeutic doses of the bactericidal antibiotics amoxicillin or levofloxacin for 24-hours. Reactive oxygen species were quantified via fluorescence. Expression of mRNA for inflammatory markers, including TNF- $\alpha$ , and Nrf2-mediated antioxidants were measured by real-time PCR.

Results: Cultured SNECs treated with the bactericidal antibiotics amoxicillin and levofloxacin resulted in a significant increase in production of ROS. The increase in ROS formation correlated with an increase in expression of Nrf2 mediated antioxidant genes as well as the pro-inflammatory cytokine TNF- $\alpha$  ( $p < 0.05$ ).

Discussion: In this study, we demonstrate that treatment of cultured human SNECs with bactericidal antibiotics leads to formation of ROS with an associated increase in inflammatory and antioxidant gene expression. This suggests that long-term or inappropriate antibiotic use in the treatment of sinusitis, may result in oxidative tissue damage to the sinonasal epithelium. Future studies will explore the clinical implications of such damage to the sinonasal epithelium.

#### 10:39am

##### **Bacterial transmission through sinus irrigation: Is irrigation water really a reservoir for bacterial colonization of the human paranasal sinuses?**

Leah Hauser, MD  
Daniel Frank, PhD  
Vijay Ramakrishnan, MD  
Aurora, CO  
USA

Introduction: Saline nasal irrigation is highly effective in the treatment of sinonasal disorders, including chronic rhinosinusitis (CRS). Despite high rates of bacterial contamination in rinse bottles and case reports of amebic infections from contaminated irrigation water, tap water is still used by ~50% of irrigation users, raising a potential public health concern. The objective of this study was to determine whether bacteria from the water supply and sinus irrigations result in paranasal sinus colonization.

Methods: Samples taken from: (1) water used for irrigation, (2) the faucet or container the water originated from, (3) the rinse bottle, and (4) the postoperative ethmoid cavity were obtained from 13 subjects with CRS. Microbiota were characterized using qPCR, and 16S rRNA gene sequencing. The Morisita-Horn index was used to assess similarity between samples.

Results: 5/13 subjects used distilled water, 7 used tap water, and 1 used well water in this IRB-approved observational study. Well-water had markedly more bacteria than tap water, and both contained more bacteria than distilled water (Ct 19.53, 25.10, 29.57, respectively). The sinus sample was notably dissimilar to the irrigation, faucet, and bottle (M-H = 0.15, 0.08, and 0.17, respectively). There was no difference in postoperative microbiome alterations between distilled and tap water users.

Conclusion: The current study suggests that irrigation plays little role in establishing the sinus microbiome. Although rinsing with tap water may never be formally recommended, these data are useful to counsel patients who prefer to do so in nonendemic areas where municipal water supply is appropriately treated.

#### 10:46am

##### **Discussion**

##### **Session: Pathophysiology, Part 1**

Moderators: Zachary Soler, MD, MSc & Jean Kim, MD, PhD

#### 10:53am

##### **Cftr activation by the solvent ethanol: Implications for topical drug delivery**

Do-Yeon Cho, MD  
Daniel Skinner, BS  
Shaoyan Zhang, PhD  
Eric Sorscher, MD  
Bradford Woodworth, MD  
Birmingham, AL  
USA

Introduction: Decreased CFTR-mediated chloride (Cl) secretion across the mucosal surface may contribute to the development of airway disease by depletion of air-surface liquid and hindering effective mucociliary clearance by increasing viscosity and mucus adhesion. We serendipitously discovered during testing of drugs solubilized in low concentrations of ethanol that the control vehicle produced robust activation of CFTR-mediated Cl<sup>-</sup> transport. The objective of the current study is to investigate low concentrations of ethanol for effects on Cl secretion and ciliary beat frequency (CBF).

Methods: Wild type (WT) and transgenic CFTR<sup>-/-</sup> primary murine nasoseptal epithelial (MNSE) and WT and F508del/F508del human sinonasal epithelial (HSNE) cultures were subjected to transepithelial ion transport measurements using pharmacologic manipulation in Ussing chambers. CBF activation was also monitored. Murine nasal potential difference (NPD) was measured in vivo.

Results: Ussing chamber tracings revealed ethanol activated CFTR-mediated Cl transport in a dose-dependent fashion in WT MNSE ( $n=5$ ,  $p < 0.05$ ) and HSNE ( $n=5$ ,  $p < 0.05$ ). Ethanol also significantly increased CBF (fold-change) in WT MNSE cultures in a dose dependent fashion [PBS, 1.33 $\pm$ 0.04; 0.25% Ethanol, 1.37 $\pm$ 0.09; 0.5% Ethanol, 1.53 $\pm$ 0.06 ( $p < 0.05$ ), 1% Ethanol, 1.62 $\pm$ 0.1 ( $p < 0.05$ )]. Lack of stimulation in CFTR<sup>-/-</sup> and F508del/F508del cultures indicated activity was dependent on the presence of intact functional CFTR. Ethanol perfusion (0.5%) resulted in a significant -3.5mV mean NPD polarization when compared to control solution ( $p < 0.05$ ).

Conclusion: The observation that low concentration ethanol stimulated Cl secretion via CFTR indicates possible use as topical aerosol delivered alone or in combination with other CFTR activators for diseases of dysfunctional MCC in CRS.

**11:00am****Does nasal irrigation solution formulation affect the antimicrobial activity of nasal secretions?**

A. Simon Carney, FRACS  
 Charmaine Woods, PhD  
 Sophia Tan, PhD  
 Shahid Ullah, BSc  
 Claire Fraunfelder, MD  
 Eng Ooi, PhD  
 Bedford Park, SA  
 Australia

**Introduction:** Saline-based irrigation solutions are recommended for the management of several rhinological conditions. The formulation of these solutions could theoretically alter innate antimicrobial peptide functionality. The aim of this study was to determine if the antimicrobial activity of nasal secretions in vivo is altered by commercially available large volume irrigation solutions.

**Methods:** Minimally manipulated sinonasal secretions were collected in 10 healthy individuals before and 1, 6, and 24 hours following nasal irrigation with 4 commercial irrigation solutions. Levels of lysozyme and lactoferrin were measured and the antimicrobial activity of nasal secretions was determined utilising a colony-inhibition assay.

**Results:** Nasal irrigation reduced lysozyme and lactoferrin levels which returned to baseline levels by 6h. Low salt solution stimulated peptide secretion by approximately 40% at 6 and 24h ( $p < 0.05$ ). Hypertonic solution stimulated peptide secretion by approximately 30% at 24h. Very different profiles were observed for antimicrobial activity. Low salt solution produced a transient decrease in antimicrobial activity, returning to baseline levels by 6h. Isotonic solutions resulted in a sustained decrease in antimicrobial activity, approaching baseline levels by 24hr despite lysozyme and lactoferrin levels normalising at 6hr. Hypertonic solution maintained baseline levels of antimicrobial activity, despite the initial decrease in lysozyme and lactoferrin levels.

**Conclusion:** The formulation of nasal irrigation solutions significantly affects the functionality of sinonasal antimicrobial peptides.

**11:07am****P-glycoprotein regulates seb stimulated IL-5 and TSLP secretion in organotypic mucosal explants**

Benjamin Bleier, MD  
 Amy Singleton, BS  
 Angela Nocera, MS  
 Armine Kocharyan, MD  
 Xue Han, PhD  
 Boston, MA  
 USA

**Background:** T-helper 2(Th2) inflammation is a hallmark of CRSwNP although the pathogenesis is poorly understood. P-glycoprotein(P-gp) is an efflux pump which is capable of regulating cytokine transport and is expressed within sinonasal mucosa.

**Objective:** The purpose of this study was to examine if the oversecretion of IL-5 and TSLP in CRSwNP could be explained through P-gp mediated secretory pathways.

**Methods:** Three hundred ethmoid mucosal explants were harvested from patients with CRS and CRSwNP and stimu-

lated with Staphylococcus aureus enterotoxin B(SEB). P-gp was inhibited using Zosuquidar. P-gp expression was measured using RT-PCR and ELISA. IL-5, IL-8, and TSLP secretion were quantified using ELISA.

**Results:** P-gp protein was overexpressed in CRSwNP (28.32 $\pm$ 25.94 ng/ml per mg explant) as compared to CRS(10.74 $\pm$ 8.61;  $p = 0.01$ , 2-tailed Mann-Whitney U). There was no difference in mRNA expression. SEB induced a significant increase in IL-5 and TSLP but not IL-8 secretion relative to control in the CRSwNP explants only. Subsequent P-gp inhibition significantly reduced IL-5 and TSLP secretion( $p = 0.04$  for both, 2-tailed Student's t-test) to control levels. The concentration of IL-5 and TSLP secretion were strongly and significantly correlated to the concentration of P-gp within the same explant(IL-5:  $r = 0.791$ ,  $p = 0.001$ ; TSLP:  $r = 0.687$ ,  $p = 0.003$ ; 2-tailed Spearman's rank-order correlation).

**Conclusion:** P-gp protein is expressed at higher concentrations in CRSwNP as compared to CRS. This overexpression directly contributes to the relative hypersecretion of IL-5 and TSLP. These findings suggest a novel mechanism for Th2 skewing in CRSwNP.

**11:14am****Discussion****11:20am****Panel: Cystic Fibrosis: State of the Art**

Moderator: Hassan Ramadan, MD  
 Panelists: Eugene Chang, MD; Gregory Sawicki, MD, MPH & Bradford Woodworth, MD

**12:00pm****Break with Exhibitors****Session: Outcome Measures in CRS**

Moderators: Jivianne Lee, MD & Stella Lee, MD

**1:00pm****Health utility outcomes in patients undergoing medical management for chronic rhinosinusitis**

Lauren Luk, MD  
 Toby Steele, MD  
 Jess Mace, MPH  
 Luke Rudmik, MD, MSc  
 Timothy Smith, MD, MPH  
 Portland, OR  
 USA

**Introduction:** A health utility score value represents an individual's preference for living in a specific health state and is used in cost-utility analyses and identifying optimal, cost-effective treatments for the management of chronic disease. This study investigates the impact of continuing medical therapy on health utility outcomes in patients with chronic rhinosinusitis (CRS).

**Methods:** The Medical Outcomes Study Short Form-12 (SF-12) was administered to patients prospectively enrolled in a longitudinal study examining treatment outcomes for CRS. Patients were prescribed robust, initial medical therapy and then elected to continue with medical therapy ( $n=40$ ) or undergo endoscopic sinus surgery (ESS), followed by medical therapy ( $n=152$ ). Interpretation of health utility score was further aided by comparing responses in patients with CRS to other medically managed chronic disease states. Health utility scores (SF-6D) were generated from SF-12 evaluations at

baseline, 6-months, and 12-months follow-up for both cohorts and evaluated using repeated measures ANOVA.

Results: There were no significant differences in baseline patient characteristics between treatment arms. Mean baseline health utility scores for the medical therapy cohort was significantly better compared to the ESS cohort (0.76[0.12] versus 0.70[0.015];  $p=0.023$ ). Significant improvement in utility scores was reported in the ESS cohort ( $F(2)=37.69$ ;  $p<0.001$ ), while utility scores remained stable without significant improvement in the medical therapy cohort ( $F(2)=0.03$ ;  $p=0.967$ ).

Conclusion: Patients electing continued medical management report better baseline health utility compared to patients electing ESS. Patients electing ESS demonstrate significant improvement in health utility while those electing continued medical management demonstrate stable health utility over 12 months.

### 1:07pm

#### Development and validation of a crs qol comorbidity index

Corinna Levine, MD, MPH  
Greg Davis, MD, MPH  
Edward Weaver, MD, MPH  
Seattle, WA  
USA

Introduction: Quality of life (QOL) research must adjust for comorbid diseases that impact QOL (comorbidity confounding). Disease specific measures of QOL do not account for comorbidity confounding. Comorbidity indexes adjust for this using comorbidities that impact (predict) the specific outcome, independent of the disease of interest. There is paucity of comorbidity indices designed for QOL outcomes. The Functional Comorbidity Index (FCI) predicts QOL in some chronic diseases and could be useful in chronic rhinosinusitis (CRS). Study goals: 1. Develop a CRS QOL Comorbidity Index (SQOLCI) designed specifically for QOL (measured by SF-36). 2. Compare ability to predict QOL between SQOLCI, FCI, and the Charlson Comorbidity Index.

Methods: We prospectively enrolled 99 CRS subjects between 2012-2013. 96 met eligibility criteria. This group was split into a model-development cohort ( $n=58$ ) and a validation cohort ( $n=38$ ). Relevant comorbidities expected to impact QOL were added as candidate variables to the FCI. Multivariate linear regression with predictive stepwise modeling determined which candidate variables maximized prediction of QOL (adjusted  $R^2$ ). The resultant SQOLCI was then tested in the validation cohort, and the ability to predict QOL compared to other comorbidity indexes.

Results: The SQOLCI model added smoking, illicit drug use, and sleep apnea to the FCI. The ability to predict QOL (adjusted  $R^2$ ) is better in the SQOLCI by 16% compared to the FCI and by 47% compared to the Charlson Comorbidity Index.

Conclusion: The SQOLCI is useful to predict QOL, and is a more robust predictor of QOL than other comorbidity indexes in CRS patients.

### 1:14pm

#### Qualitative development of the sinus control test

Sarfraz Banglawala, MD, MPH  
Rodney Schlosser, MD  
Tina Storck, MSc  
Kristen Morella, MSc  
Zachary Soler, MD, MSc  
Charleston, SC  
USA

Introduction: Ideal management of chronic rhinosinusitis (CRS) requires ongoing monitoring of disease and its control. Existing control instruments are limited in their correlation to patient reported outcomes, the need for endoscopy or lack of validation from a multi-disciplinary group. The goal of this study was to develop a patient based Sinus Control Test (SCT) for determining CRS control.

Methods: A systematic literature review and focus groups consisting of 20 patients and 11 medical experts in CRS from various medical specialties were used to generate items. A draft 13 item questionnaire was administered to 50 patients with CRS in a prospective fashion. Each patient was evaluated using the SNOT-22 instrument, Lund Mackay CT Score, and Lund-Kennedy endoscopy score. A rhinologist blinded to the questionnaire results also provided an overall control of the disease for each patient. A regression model was generated to identify which subset of items showed the greatest discriminate ability in relation to specialist's and patient's global rating of disease.

Results: Four questions were included in the final questionnaire ( $p<0.05$ ), each with a scale of 0 to 4, with an overall total score ranging from 0 to 16. Optimal classification resulted in patients with a score less than 4 (well controlled), 4 to 11 (partially controlled) and scores over 12 (uncontrolled). SCT scores correctly classified control levels 72% of the time when compared to physician's assessment.

Conclusion: The SCT is a simple, patient generated questionnaire that can measure the control of CRS without requirement of endoscopy or CT evaluation.

### 1:21pm

#### Clinical and economic burden of patients admitted emergently for cerebrospinal fluid rhinorrhea treated with meningeal repair

Jennifer Villwock, MD  
Mark Villwock, MS  
Parul Goyal, MBA, MD  
Syracuse, NY  
USA

Objective: Cerebrospinal fluid (CSF) leaks may be spontaneous, congenital, or secondary to iatrogenic injury or trauma. If conservative management fails, surgical repair is indicated to prevent severe complications.

Study Design: Retrospective review of the 2002-2011 Nationwide Inpatient Sample for patients admitted for CSF rhinorrhea and treated with meningeal repair.

Methods: Hospital and patient demographics and outcomes of patients undergoing meningeal repair for CSF rhinorrhea were analyzed.

Results: 1,012 emergent admissions for CSF rhinorrhea and repair of meninges were analyzed. On average, patients

underwent surgical repair between the second and fourth day of admission. Rates of meningitis increased in a relatively linear fashion with increasing time to repair. Lowest rates were in patients treated on the day of admission (6.4%); treatment at two weeks had a 36.4% incidence ( $R^2=0.91$ ). There was a similar linear increase in length of stay (LOS) and hospital costs as time to repair increased ( $R^2 = 0.98$  and  $0.95$ , respectively). Of note, the use of image guidance has steadily increased from 4.8% of cases in 2005 to 13.6% in 2011. Rates of conservative (performed prior to surgery) spinal-taps were highest in those undergoing surgery between days 8 -14 of admission (22.4%), versus days 1-3 (6.9%).

Conclusion: Multiple factors influence outcomes in patients with CSF rhinorrhea. Expedient surgical repair was significantly associated with decreased rates of meningitis, LOS, and hospital costs. Given the potentially devastating sequelae of meningitis, more rapid treatment of patients admitted for CSF rhinorrhea may prove to be both a cost- and morbidity- saving measure.

### 1:28pm Discussion

#### Session: Co-Morbidities in CRS

Moderators: Marilene Wang, MD & Adam Folbe, MD

### 1:36pm

#### The role of obstructive sleep apnea in quality of life and sleep outcomes in patients with chronic rhinosinusitis undergoing endoscopic sinus surgery

Jeremiah Alt, MD, PhD  
Adam DeConde, MD  
Jess Mace, MPH  
Toby Steele, MD  
Richard Orlandi, MD  
Timothy Smith, MD, MPH  
Salt Lake City, UT  
USA

Introduction: Patients with chronic rhinosinusitis (CRS) have reduced sleep quality that has been linked to their overall well-being and disease-specific quality-of-life (QOL). Obstructive sleep apnea (OSA) is a prevalent sleep disorder that has significant impacts on QOL. We sought to assess the impact OSA has on both disease-specific QOL and sleep dysfunction in patients with CRS after endoscopic sinus surgery (ESS).

Methods: Adult patients with medically refractory CRS with and without OSA ( $n=405$ ) were prospectively enrolled into a multi-institutional, observational, treatment outcomes investigation. History of comorbid OSA was identified ( $n=60$ ) and preoperative and postoperative QOL (Rhinosinusitis Disability Index; RSDI, and the 22-item Sinonasal Outcome Test; SNOT-22) and sleep dysfunction (Pittsburgh Sleep Quality Index; PSQI) were compared to patients without comorbid OSA.

Results: Mean postoperative scores significantly improved after surgery for disease-specific QOL outcome measures in those with and without OSA. Patients without comorbid OSA had significantly greater QOL gains, improved overall mean PSQI global scores (1.9 points), and in all 7 subdomain scores of the PSQI. Regression modeling found comorbid OSA was associated with significantly less improvement on RSDI functional domain ( $p=0.038$ ), SNOT-22 rhinologic

symptoms ( $p=0.050$ ), and PSQI sleep dysfunction scores.

Conclusion: Patients with CRS and comorbid OSA have substantial disease-specific QOL improvement but not in reported sleep. Patients with OSA should be managed concurrently for both CRS and OSA to improve sleep dysfunction. Future investigations are needed to further elucidate the discordance and underlying mechanisms of sleep improvement between those patients with and without OSA.

### 1:43pm Impact of unresolved chronic sinusitis on incidence of asthma

Michael Benninger, MD  
Raj Sindwani, MD  
Chantal Holy, PhD  
Claire Hopkins, MD FRCS(ORL-HNS)  
Cleveland, OH  
USA

Rationale: The long-term impact of chronic rhinosinusitis (CRS) with or without allergic rhinitis (AR) on asthma is poorly documented. This study analyzed associations of ongoing CRS and AR on asthma.

Methods: Using the MarketScan claims database, patients with CRS and endoscopic sinus surgery (ESS) in 2010 were identified. The date of first sinusitis was determined for all. Patients with asthma at time of first sinusitis diagnosis were excluded. Remaining patients were grouped based on duration of CRS, from first diagnosis to surgery: Group 1: 1 to <2 years ( $n=211$ ); Group 2: 2 to <3 years ( $n=228$ ); Group 3: 3 to <4 years ( $n=314$ ); Group 4: 4 to <5 years ( $n=543$ ). Yearly incidence and prevalence of newly diagnosed asthmatics was analyzed for all groups. A secondary analysis evaluated the association between AR and asthma.

Results: Preoperatively, yearly incidence of patients with new asthma diagnoses averaged 4.40% [95% CI: 4.36%-4.45%] and was significantly greater for patients with AR (5.30% [95%CI: 4.4%-7.5%]) versus non-AR (3.9% [95%CI: 3.3%-4.4%],  $p<0.01$ ). Prevalence of patients with asthma increased from 0% at time of first diagnosis to 8.1%, 11.0%, 16.9% and 22.10% at time of surgery, in Groups 1 through 4 respectively. Post-operatively, yearly incidence of asthma was 0.18% (95% CI: 0.17%-0.19%).

Conclusion: CRS, particularly in patients with AR, was associated with high incidences of asthma. Following ESS, this rate declined to 0.2%. This finding supports the one airway hypothesis and suggests an association between chronic upper respiratory diseases and asthma.

### 1:50pm Does comorbid obesity impact quality of life outcomes in patients undergoing endoscopic sinus surgery?

Toby Steele, MD  
Jess Mace, MPH  
Adam DeConde, MD  
Timothy Smith, MD, MPH  
Portland, OR  
USA

Introduction: Both obesity and chronic rhinosinusitis (CRS) are characterized by inflammation. Furthermore, both disease processes are independently associated with decreas-

es in quality-of-life (QOL). We sought to investigate the role of comorbid obesity in QOL outcomes in CRS patients undergoing endoscopic sinus surgery (ESS).

**Methods:** Adult patients with medically refractory CRS (n=144) were prospectively enrolled into a multi-institutional treatment outcomes investigation. Body mass index (BMI) calculations were used to differentiate patient weight groups (normal weight; BMI: 18.5-24.9, overweight; BMI: 25.0-29.9; and obese; BMI: >30.0). Preoperative and postoperative QOL (Rhinosinusitis Disability Index (RSDI) and the 22-item Sinonasal Outcome Test (SNOT-22) were evaluated compared across BMI groups and obesity subclasses.

**Results:** The prevalence of comorbid obesity was 43.1% (n=62). Higher prevalence of comorbid disease was found across increasing BMI groups including diabetes mellitus, asthma, and depression. No significant differences were found in mean preoperative QOL measures between any BMI groups. Significant improvement between preoperative and postoperative QOL mean scores ( $p < 0.050$ ) was found for all BMI groups. Despite no significant difference in mean QOL improvement between BMI groups ( $p > 0.124$ ), obese patients reported reduced relative percent (%) improvement compared to normal weight and overweight participants on the RSDI total score (43.6% vs. 51.7% and 56.5%, respectively) and SNOT-22 total score (42.8% vs. 49.9% and 52.1%, respectively).

**Conclusion:** Patients with comorbid obesity experience significant improvement in average QOL gains following ESS though the percentage of relative improvement in QOL may be decreased in patients with comorbid obesity and CRS as compared to those without.

### 1:57pm Discussion

### 2:04pm

**Panel:** Great debate: Maximal medical therapy-does the ARS membership have it wrong?  
**Moderator:** Ralph Metson, MD  
**Panelists:** Devyani Lal, MD; James Palmer, MD; David Poetker, MD; Sarah Wise, MD

### 2:44pm Break with Exhibitors

### Session: Pathophysiology, Part 2

**Moderators:** Jayant Pinto, MD & Murray Ramanathan, MD

### 3:05pm

#### Nasal nitric oxide as marker of sinus mucosal health in patients with nasal polyposis

John Lee, MD, FRCSC  
Carmen McKnight, MASc  
Theresa Aves, BSc  
Samir Gupta, MD, FRCPC  
Toronto, Ontario  
Canada

**Background:** Reduced nasal nitric oxide (nNO) has been shown in patients with chronic rhinosinusitis (CRS) but its clinical significance remains uncertain.

**Objectives:** 1) To measure nNO changes in patients undergoing endoscopic sinus surgery (ESS) for CRS and to explore its relationship to clinical measures of sinus mucosal health post-operatively.

**Methods:** This was a prospective study of CRS patients undergoing ESS. Patients had the following measurements at baseline and at 1 and 6 months post-ESS: nNO levels, Lund-Kennedy Endoscopy Score (LKES) and the SNOT-22. Statistical analysis was performed using Graphpad Prism 6.

**Results:** Forty patients were enrolled with 85% having CRSwNP. Baseline Lund-Mackay CT Score was  $17.0 \pm 5.1$ . There was a statistically significant increase in nNO from baseline to 1 month post-operatively which was sustained at 6 months ( $p < 0.0001$ ). The SNOT-22 and LKES followed a similar trend with a significant and sustained improvement at 1 and 6 months post-ESS ( $p < 0.0001$ ). No correlation was found between nNO and SNOT-22; however, a significant negative correlation was found between nNO and LKES at all time points ( $p < 0.0001$ ), suggesting healthier sinus mucosa was associated with higher nNO levels. Subgroup analysis revealed that changes in nNO were driven by the polyp cohort as non-polyp patients had no significant changes in their nNO post-operatively.

**Conclusion:** This is the first study to demonstrate that nNO levels may be a marker of sinus mucosal health following ESS in patients with nasal polyps. This has important implications for nNO in its potential etiologic role in mediating ongoing sinus inflammation.

### 3:12pm Staphylococcus aureus triggers nitric oxide production in human upper airway epithelium

Ryan Carey, BSE  
Alan Workman, BS  
Bei Chen, MD  
Robert Lee, PhD  
Noam Cohen, MD, PhD  
Philadelphia, PA  
USA

**Introduction:** Nitric oxide (NO) is an important antibacterial defense molecule produced by upper airway (sinonasal) epithelial cells. We previously showed that a bitter taste receptor expressed in airway epithelium detects quorum-sensing molecules secreted by gram-negative bacteria and subsequently triggers bactericidal NO production. We hypothesized that the upper airway epithelium may also be able to detect the gram-positive aerobic *Staphylococcus aureus* and mount an NO response.

**Methods:** Sinonasal ALI cultures were treated with methicillin-resistant *Staphylococcus aureus* (MRSA)-conditioned medium (CM), and NO production was measured using fluorescence imaging. Inhibitors of bitter taste receptor signaling were used to pharmacologically determine if this pathway was involved in the production of NO.

**Results:** A low molecular weight, heat, and protease-stable product found in MRSA CM induced differential, NO synthase (NOS)-mediated NO production. This response varied markedly between individual patients. The MRSA-stimulated NO production was not dependent on two important components of bitter taste signaling, phospholipase C isoform  $\beta$ -2 or the TRPM5 ion channel.

**Conclusion:** The present study demonstrates that a *S. aureus* product elicits an NO-mediated innate defense response in upper airway epithelium. The active bacterial product is likely a small, non-peptide molecule that triggers a

pathway independent of bitter taste receptors. Patient variation in the NO response to MRSA product(s), potentially due to genetic differences, might play a role in pathophysiology of gram-positive upper respiratory infections and/or pathogenesis of chronic rhinosinusitis.

### 3:19pm

#### **Cathelicidin (LL-37): An innate immune peptide that induces sinonasal inflammation**

Jeremiah Alt, MD, PhD  
Xuan Qin, MS  
Richard Orlandi, MD  
Glenn Prestwich, PhD  
Siam Oottamasathien, MD  
Salt Lake City, UT  
USA

**Introduction:** Cathelicidin (LL-37) is an endogenous innate immune peptide that is elevated in patients with chronic rhinosinusitis. The role of LL-37 in sinonasal inflammation remains unknown. We hypothesized that 1) LL-37 delivered to the sinonasal mucosa would elicit profound inflammation, and 2) LL-37 induced sinusitis is associated with increased propagation of neutrophils and mast cells.

**Methods:** To test our first hypothesis, we challenged C57BL/6 mice intranasally with increasing concentrations of LL-37. At 24 hours tissues were examined histologically and scored for inflammatory cell infiltrate, edema, and secretory hyperplasia. In separate experiments, fluorescently labeled LL-37 was instilled and tissues were examined at 0.5 and 24 h. To test our second hypothesis, we performed tissue myeloperoxidase (MPO) assays for neutrophil activity and immunohistochemistry to determine the mean number of mast cells per mm<sup>2</sup>.

**Results:** LL-37 caused increased inflammatory cell infiltrate, edema, and secretory cell hyperplasia of the sinonasal mucosa with higher LL-37 concentrations yielding significantly more inflammatory changes ( $p < 0.01$ ). Fluorescent LL-37 demonstrated global sinonasal epithelial binding and tissue distribution. Further, higher concentrations of LL-37 led to significantly greater MPO levels ( $p < 0.01$ ) with dose-dependent increases in mast cell infiltration.

**Conclusion:** LL-37 has dramatic inflammatory effects in the sinonasal mucosa that appear to be dose-dependent. The dramatic inflammatory changes in the sinonasal mucosa were associated with the propagation of both neutrophils and mast cells. Our biologic model represents an innovative and physiologically relevant model to further investigate chronic rhinosinusitis.

### 3:26pm

#### **Calhm1-mediated atp release and cbf modulation in airway epithelial cells**

Alan Workman, BSE  
Cecil Saunders, PhD  
Ryan Carey, BSE  
Bei Chen, MD  
Robert Lee, PhD  
Noam Cohen, MD, PhD  
Philadelphia, PA  
USA

**Introduction:** Mechanical stimulation of airway epithelial cells causes apical release of ATP, which increases ciliary beat

frequency (CBF) and speeds up mucociliary clearance. This dynamic regulation of ciliary beat frequency and mucociliary clearance is a critical component of respiratory innate defense. However, the mechanisms through which this ATP release occurs are poorly understood. CALHM1, a transmembrane protein similar to connexins and pannexins, has recently been implicated in ATP release in type II taste buds, but has not yet been evaluated for a functional role in the airway.

**Methods:** CALHM1 knockout and wild type mouse nasal septal epithelial cells were grown at an air-liquid interface (ALI) and subjected to a mechanical stimulation (air puff). Changes in CBF and apical ATP concentrations were determined pre- and post- mechanical stimulation.

**Results:** A robust increase in CBF was observed in wild type ALI's following mechanical stimulation, and this increase was significantly lower ( $p=0.01$ ) in CALHM1 knockout cultures at a stimulation pressure of 55 mmHg for 50mSec. Apical ATP release following mechanical stimulation was also attenuated in knockout cultures ( $p=0.05$ ). Doubling the strength of the air puff increased CBF similarly in both wild type and knockout cultures, but the increase was sustained for a shorter period of time in the knockout ALI ( $p=0.05$ ).

**Conclusion:** ATP release through the CALHM1 channel is a critical component of dynamic modulation of CBF following mechanical stimulation in airway epithelial cells and thus the CALHM1 protein represents a novel candidate for further studies in Rhinosinusitis pathophysiology.

### 3:33pm

#### **Sinonasal 1a-hydroxylase, but not 25(OH)D3, is associated with more severe chronic rhinosinusitis**

Lauren Lawrence, M.D.  
William Carroll, MD  
Whitney Pasquini, BA  
Rodney Schlosser, MD  
Jennifer Mulligan, PhD  
Charleston, SC  
USA

**Introduction:** Previously, we have shown that patients with chronic rhinosinusitis with nasal polyps (CRSwNP) have systemic deficiencies in 25-hydroxyvitamin D3 (25(OH)D3) as well as reduced sinonasal tissue 25(OH)D3 and CYP27B1 expression. In the current study, we examined the role of sinonasal tissue 1a-hydroxylase, the enzyme which converts 25(OH)D3 to its active form, on disease severity in patients with CRS.

**Methods:** Blood and sinus tissue explants were collected at the time of surgery from control, chronic rhinosinusitis without nasal polyps (CRSsNP), and CRSwNP patients. Expression of 1a-hydroxylase was measured by immunostaining with flow cytometric analysis. Objective disease severity was measured by Lund-Mackay CT scoring and subjective disease severity by the SinoNasal Outcomes Test-22 (SNOT22) questionnaire.

**Results:** We observed that CRSwNP patients had decreased sinonasal 1a-hydroxylase compared to control or CRSsNP patients. Expression of 1a-hydroxylase was found to inversely correlate with subjective, but not objective CT-based disease severity. Interestingly, there was no association between circulating 25(OH)D3 and subjective patient disease severity. There was no association between 1a-hydroxylase and age,

race or gender. Studies utilizing a murine model of CRS also demonstrated a decreased sinonasal 1 $\alpha$ -hydroxylase compared to control mice.

Conclusion: The major finding of the present study is that the chronic inflammation associated with CRSwNP causes a decrease in sinonasal tissue 1 $\alpha$ -hydroxylase. Furthermore, reduced 1 $\alpha$ -hydroxylase, but not 25(OH)D<sub>3</sub>, is associated with more severe subjective disease in patients with CRSwNP.

3:40pm

### Discussion

#### Session: Surgical Morbidity and Complications

Moderators: Jean Anderson Eloy, MD & Eric Wang, MD

3:48pm

#### Prevalence and factors associated with revision endoscopic sinus surgery

Andres Finkelstein, MD  
Luis Macias Macis-Valle, MD  
Jamil Manji, MSc  
Al-Rahim Habib, MSc  
Saad Alsaleh, MD  
Amin Javer, MD, FRCSC, FARS  
Vancouver, BC  
Canada

Background: Revision sinus surgery may be indicated when patients continue to manifest severe symptoms of chronic rhinosinusitis (CRS) following their first surgery despite post-operative medical management. Our objectives were 1) To determine the prevalence of revision functional endoscopic sinus surgery (FESS) cases presenting at a tertiary rhinology centre and 2) To identify the most common factors associated with failure of primary FESS in cases requiring revision.

Methods: A retrospective review was conducted of FESS cases performed between January 2011 and June 2014 (n=619). Case files and preoperative computed tomography (CT) scans of patients that underwent revision FESS were evaluated for the presence of potential variables contributing to failure of primary FESS based on literature and expert opinion.

Results: Of six hundred nineteen cases included, 39.7% (95%CI: 36.0 – 43.7%) were revision cases. Findings associated with failure of primary FESS were frontal sinus & recess residual bony partitions (FRBP, 91.8%), remnant ethmoid sinus shelves (RES, 88.2%) and unopened pneumatized ethmoid cells (UPEC, 77.7%). The original surgeon was fellowship trained (rhinology) in 19% (95%CI: 14.4 – 25.3%) of cases requiring revision. The likelihood of presenting with FRBP and UPEC was significantly greater among cases previously performed by otolaryngologists without fellowship training compared to counterparts with fellowship training (OR: 3.0, 95% CI: 1.1 – 8.4; OR: 2.5, 95% CI: 1.2 – 5.2).

Conclusion: Anatomic landmarks most associated with failure in primary FESS were un-resected FRBP and UPEC. These findings were most likely to be present following surgery performed by non-fellowship trained otolaryngologists.

3:55pm

#### Predictors of 30-day morbidity and mortality in pituitary tumor excision

Lauren Lawrence, MD  
Andrew Baker, BS  
Shaun Nguyen, MD  
Tom Karnezis, MD  
Zachary Soler, MD, MSc  
Rodney Schlosser, MD  
Charleston, SC  
USA

Introduction: There is a lack of population-based, multi-institutional analyses of factors associated with morbidity and mortality following pituitary tumor excision.

Methods: The American College of Surgeons National Surgical Quality Improvement Project files were used to compile information on patients that had undergone pituitary tumor resection from 2006-2012. Patient demographics, comorbidities, operative characteristics, and morbidity and mortality in the 30 days following surgery were included. Multivariate logistic regression was used for categorical variables and multivariate linear regression was used for continuous variables to evaluate factors leading to adverse events.

Results: 658 patients were included, of which 58 (8.81%) experienced a complication, reoperation or death in the 30 days following surgery. The most common complications were reoperation (3.37%), followed by unplanned re-intubation (1.99%), urinary tract infection (1.68%), and transfusion (1.68%). Predictors of any complication, reoperation, or death include pre-operative sepsis (odds ratio (OR)=7.596) and lower pre-operative serum albumin (OR=0.150). Younger age predicted surgical complications (OR=0.905). Predictors of medical complications include higher body mass index (OR=1.112), chronic steroid use (OR=6.568), pre-operative sepsis (OR=15.297), and lower pre-operative serum hematocrit (OR=0.816). Predictors of increased total length of hospital stay were older age ( $\beta$ =0.147), higher body mass index ( $\beta$ =0.189), chronic steroid use ( $\beta$ =0.146), pre-operative sepsis ( $\beta$ =0.484), and lower pre-operative serum albumin ( $\beta$ =-0.214).

Conclusion: While adverse events following pituitary tumor excision are low, awareness of factors associated with morbidity and mortality in the early post-operative period may allow for improved patient monitoring and outcomes.

4:02pm

#### A multi-institutional study of risk factors for perioperative morbidity following endoscopic pituitary surgery

Caitlin Boling, BS  
Tom Karnezis, MD  
Andrew Baker, BS  
Lauren Lawrence, MD  
Zachary Soler, MD  
Rodney Schlosser, MD  
Charleston, SC  
USA

Objectives: The goal of this study is to identify risk factors for increased perioperative morbidity following endoscopic pituitary surgery.

Methods: A retrospective review of patients undergoing endoscopic pituitary surgery between 2002 and 2014 at 6



international centers was performed. Standard demographic and co-morbidity data, as well as information regarding tumor extent and treatment were collected. Logistic regression was used to examine risk factors for the following 30 day outcomes: systemic complications, intracranial complications, postoperative cerebrospinal fluid (CSF) leaks, length of hospital stay, readmission, and reoperation.

Results: Data was collected on 982 patients with a mean age of 52 years. Mean BMI was 30.9 and 55.8% were female. The average hospital stay was 6 days and 37.9% of patients suffered a postoperative complication. Systemic complications occurred in 3.2% of patients and risk factors included dementia (Odds Ratio (OR)=16.0) and diabetes (OR=2.7). Intracranial complications occurred in 7.3% of patients and risk factors included previous radiation (OR=8.6) and intraventricular extension (OR=27.1). Readmission within 30 days occurred in 15.4% of patients and cerebrovascular disease was a risk factor (OR=3.2). Reoperation occurred in 6.5% of patients and intraventricular extension was a risk factor (OR=12.1). Postoperative CSF leaks occurred in 5.5% of patients and risk factors included female gender (OR=3.3) and intraventricular extension (OR=20.4).

Conclusion: More aggressive pituitary tumors with intraventricular extension or requiring preoperative radiation result in increased complications. Other patient factors, including a number of common co-morbidities, predict higher complication rates. Identification of these factors may permit implementation of strategies to reduce postoperative complications.

#### 4:09pm

##### **Rhinology and medical malpractice: An update of the medicolegal landscape of the last ten years**

Anthony Tolisano, MD  
Grant Justin, BS  
Douglas Ruhl, MD, MSPH  
Benjamin Cable, MD  
Honolulu, HI  
USA

Introduction: Malpractice claims pertaining to rhinological procedures are a potentially important source of information which could be used to minimize the risk of future litigation and to improve patient care.

Methods: The LexisNexis "Jury Verdicts and Settlements" database was reviewed for all lawsuits and out of court adjudications related to the practice of rhinology. Data including patient demographics, type of surgery performed, plaintiff allegation, nature of injury, outcomes, and indemnities were collected and analyzed.

Results: Of 85 cases meeting inclusion criteria, 42 were decided by a jury and 43 were adjudicated out of court. Endoscopic sinus surgery was the most commonly litigated surgery. The plaintiff was favored when the eye was injured ( $p = 0.0196$ ), but the defendant was favored when neuropsychological injuries ( $p = 0.0137$ ) or recurrent/worsened symptoms ( $p = 0.0050$ ) were cited. No difference was found when death or skull base injuries occurred. When lack of informed consent was an allegation, the defendant was favored ( $p = 0.0001$ ). A payout was made in two-thirds of cases overall, but the defendant was favored in two-thirds of cases decided by a jury. Payments were significant for both out of court settlements (\$1.3 million) and jury verdicts (\$2 million).

Conclusions: Endoscopic sinus surgery remains the most commonly litigated rhinology procedure and has the potential to result in large payouts. Meticulous dissection, recognition of complications, and documentation of informed consent remain paramount for providing optimal patient care.

#### 4:16pm

##### **Discussion**

#### 4:23pm

##### **Panel: "I've just had a complication!" navigating the aftermath**

Moderator: Andrew Murr, MD  
Panelists: Michael Setzen, MD; James Stankiewicz, MD; Winston Vaughan, MD & Adam Zanation, MD

#### 5:00pm

##### **Closing Remarks and Meeting Adjourned-**

President and President-Elect  
Roy Casiano, MD & Peter Hwang, MD

## Posters

Abstract ID# 1067

### **A case report of a rare intrasellar epidermoid tumor**

Enrique Perez, MD  
Mohammed Khan, MD  
Alfred-Marc Ilorete, MD  
New York, NY  
USA

**Background:** The purpose of this case report is to describe an unusual presentation of an intrasellar epidermoid tumor. We also review the literature on imaging and histological characteristics as well as the skull base surgical approach used to manage these lesions.

**Methods:** Analysis of the case through medical records and review of the literature.

**Results:** A 48 year old man presenting with panhypopituitarism was taken to the operating room for resection of a large intrasellar mass via an endoscopic transphenoidal approach. Initially diagnosed as a pituitary macroadenoma based on pre-operative imaging, it was determined to be a large intrasellar epidermoid cyst on final pathology. Because of its adherence to the surrounding structures the cyst was only debulked and the cavity left open to drain into the sphenoid sinus. No cerebrospinal fluid was encountered during the operation and a second stage procedure was planned to obliterate the cavity and repair the defect.

**Conclusion:** We present this case of an intrasellar epidermoid cyst mimicking a macroadenoma. We review the literature and discuss case management.

Abstract ID# 1111

### **A comparison of silastic and gloved merocel middle meatal spacers in prevention of postoperative sequelae following fess: a randomized controlled trial**

Jamil Manji, MSc  
Luis Macias-Valle, MD  
Andres Finkelstein, MD  
Saad Alsaleh, MD  
Al-Rahim Habib, MD  
Amin Javer, MD, FRCSC, FARS  
Vancouver, BC  
Canada

**Background:** Spacers are commonly inserted into the middle meatal space following functional endoscopic surgery (FESS). Our objective was to determine whether the Silastic or Gloved Merocel spacer was more effective at preventing postoperative complications and better tolerated by patients.

**Methods:** A double-blind randomized controlled trial was conducted at a tertiary rhinology centre. Patients were treated as their own controls. Gloved Merocel and Silastic spacers were inserted into the sinuses of subjects during FESS (one on each side) and left in situ for 6 days. Postoperative follow-up took place after 1 week, 5 weeks and 12 weeks. The level of discomfort experienced while in situ and the pain upon removal was assessed via VAS scale. Unpaired student's t-tests were used to test differences between both spacers.

**Results:** Forty-eight patients were recruited to this study (96 nostrils) and data was available for all patients up to 5 weeks postoperatively. The Silastic spacer (n=1.4, SD: 1.0) caused significantly greater pain upon removal compared to the Gloved Merocel spacer (n=2.2, SD: 1.3) (t:2.719, 95% CI: 0.1917-1.237, p-value: 0.008). Up to 5 weeks postoperatively there were no cases of synechiae between the middle turbinate and lateral nasal wall in either treatment arm.

**Conclusion:** This data suggests that the Gloved Merocel spacer was better tolerated by patients compared to the Silastic spacer. Long-term data will be collected on these patients and should provide better insight as to the efficacy of these spacers for preventing synechiae.

Abstract ID# 1043

### **A systematic review of the sinonasal microbiome**

Janalee Stokken, MD  
Martin Anderson, MD  
Thomas Sandford, MD  
Rajeev Aurora, PhD  
Raj Sindwani, MD  
Cleveland, OH  
USA

**Background:** The interactions between host and microorganisms in chronic rhinosinusitis (CRS) are poorly understood and an area of growing interest. More recently, methodologies have been developed to assess the microbiome without the use of culture by analyzing bacterial 16s RNA. We reviewed the microbiome literature to better understand the role of microbes in CRS.

**Methods:** Systematic review of studies utilizing 16s RNA deep-sequencing.

**Results:** Eight publications met criteria. All studies evaluated the microbiome in control patients (total of 83 patients, range 3-28 per study) while five of the studies included CRS patients (total 78 patients, range 7-30 per study). Pyrosequencing was utilized in 6 studies and Phylochip analysis in 2 studies. Of the papers specifying number of species in control patients, an average of 1587 species were identified (range 911-2330). Significant heterogeneity was noted between studies, however Firmicutes, Actinobacteria, and Bacteroides phyla were identified in every sample of control and CRS patients. Three studies showed enrichment to some degree of Staphylococcus aureus in CRS patients. The total bacterial burden in CRS was similar to controls. One study demonstrated a decrease in diversity while other studies did not show any changes in diversity in CRS when compared to controls.

**Conclusion:** While there are common phyla present in both healthy and CRS patients, no consistent enrichment of any particular species was identified. Our findings suggest that there is no clear single causative species in CRS. More work is needed to better understand the significance of the host interaction with the microbiome.

Abstract ID# 1012

**Adequacy of the nasoseptal flap for reconstruction of pediatric skull base defects**

Reza Ehsanian, MD, DPhil  
Jesada Kanajanaumporn, MD  
Peter Hwang, MD  
Justin Turner, MD, PhD  
Nashville, TN  
USA

**Introduction:** The pedicled nasoseptal flap is now commonly used in endoscopic skull base surgery and is widely credited with reductions in postoperative CSF leaks and other complications. Outcomes have been extensively reported for adult patients. However, differences in craniofacial anatomy and growth patterns in children have resulted in questions regarding the adequacy of the nasoseptal flap for reconstruction of pediatric skull base defects

**Methods:** A retrospective review was performed to identify all pediatric patients undergoing endoscopic skull base surgery with use of a nasoseptal flap at two different academic medical centers. Demographic information, pathologic diagnosis, and postoperative complications were extracted and the adequacy of flap coverage was characterized for each patient.

**Results:** A total of 14 patients underwent an endoscopic endonasal approach with nasoseptal flap reconstruction between 2009 and 2014. Mean patient age was 10.4 years (range 4-16 years). Craniopharyngioma was the most common pathology (11 patients), with additional lesions including adenocarcinoma, chordoma, and pilocytic astrocytoma. Flap coverage was adequate with circumferential overlap of the defect in all patients. Three patients developed postoperative CSF leaks, two of which were due to persistent hydrocephalus and elevated intracranial pressure that ultimately required ventriculoperitoneal shunt placement.

**Conclusion:** Despite differences in craniofacial anatomy and septal length in pediatric patients, the nasoseptal flap appears to be adequate for the reconstruction of most pediatric skull base defects.

Abstract ID# 934

**Allergic sensitization and chronic sinusitis do not predict chronic otitis media**

Christopher Brook, MD  
Atur Patel, BS  
Michael Platt, MD  
Boston, MA  
USA

**Introduction:** Allergic rhinitis and chronic sinusitis are often postulated to be causative factors in chronic serous otitis media. This study aimed to determine the relationship between middle ear status, allergic sensitization, and degree of sinusitis.

**Methods:** A retrospective review was performed for patients who had undergone sinus CT scan, tympanometry, and allergy testing. There were 114 patients who met inclusion criteria and had sufficient data for analysis. Clinical data, Lund-Mackay Score, middle ear status, and results of allergy testing were recorded.

**Results:** Middle ear opacification did not correlate with atopic status ( $p=0.99$ ) and correlation coefficients between

middle ear opacification and LMS were poor ( $R<0.2$ ). The only moderate correlation was found between left and right middle ear opacification ( $R=0.62$ ).

**Conclusion:** Middle ear opacification on CT does not predict atopic disease or correlate with the degree of sinusitis on imaging. The pathogenesis of middle ear dysfunction in chronic otitis media may be a distinct process unrelated to sinonasal inflammation.

Abstract ID# 931

**An unusual cause of nasal obstruction**

Karuna Dewan, MD  
Courtney Shires, MD  
Memphis, TN  
USA

Fewer than 30 cases of breast cancer metastases to the paranasal sinuses have been reported in the last 100 years.

A 60-year-old female presented with 3 months of right nasal congestion, intermittent epistaxis and chronic right eye tearing. She had a history of triple negative infiltrating ductal carcinoma of the left breast, metastatic to the brain and lung. CT scan of the sinuses demonstrated a 6cm soft tissue mass in the right nasopharynx obstructing the right maxillary, sphenoid and ethmoid sinuses. Endoscopic image guided biopsy of the exophytic, friable right nasal sinus mass demonstrated pathology identical to her breast cancer.

The incidence of breast cancer metastases to the paranasal sinus is unknown as many cases go undetected. The diagnosis of a nasopharyngeal lesion begins with clinical history and examination as well as tissue biopsy. CT is the imaging modality of choice and should include chest, abdomen and pelvis in the setting of suspected advanced disease. When intracranial spread is suspected MRI provides better delineation and higher resolution.

Rhinosinusitis may be the first indication of disseminated metastatic breast cancer. Regardless of grade, metastasis to the paranasal sinuses and orbit carries a very poor prognosis. It does not respond well to traditional therapies and most patients will already have widespread disease.

Otolaryngologists must be vigilant in the work up of nasal congestion and any nasal mass. Patient history, as in this case, is the key to determining the etiology and treatment of the nasal symptoms.

Abstract ID# 1095

**Analysis of viral etiologies in adults with symptomatic upper respiratory infections in an outpatient setting**

Valeria Silva Merea, MD  
Ashutosh Kacker, MD  
New York, NY  
USA

**Objective:** To determine the frequency of viral agents causing symptomatic upper respiratory infections not requiring hospitalization in adults presenting to a private ENT office in an academic center in New York City.

**Methods:** Retrospective chart review of patients who had

respiratory nasopharyngeal samples for viral PCR analysis collected between October 2013 and October 2014.

Results: Viruses were detected in 46.3% (19/41) of samples from 38 patients. The most common viruses isolated as single infections were coronavirus and rhinovirus which were each found in 26.3% (5/19) of the positive samples. Overall, however, coronavirus was found in 36.8% (7/19) of positive panels vs. 31.6%(6/19) for rhinovirus. Influenza B was detected in 15.8% (3/19) of positive tests, followed by influenza A with 10.5% (2/19) and RSV with 5.3% (1/19). Co-infections were detected in 4.5% (3/19) of positive samples, either as coronavirus and influenza B (2/3) or parainfluenza and rhinovirus (1/3). Most positive tests occurred in February and March with 26.3% (5/19) of positive tests each.

Conclusion: The most common viral pathogen detected in adults with URI symptoms presenting to a private ENT office was coronavirus, closely followed by rhinovirus. Viral infections were most commonly detected during the winter season.

Abstract ID# 940

#### **Antibiotics, steroids, and combination therapy in the treatment of chronic rhinosinusitis without nasal polyps in adults**

Yuan Liu, MD  
Clare Richardson, BS  
Stewart Bernard, BS  
Christopher Church, MD  
Kristin Seiberling, MD  
Loma Linda, CA  
USA

Introduction: Despite a lack of robust data regarding efficacy, antibiotics and oral steroids remain as two of the most common treatments for chronic rhinosinusitis without nasal polyps (CRSsNP). We sought to objectively compare the efficacy of antibiotics, steroids, and both together in the initial treatment for CRSsNP.

Methods:

This is a retrospective chart review of patients seen for CRSsNP between 2010 and 2014. All patients had a pre and post-treatment CT scan. Lund-MacKay CT scores were compared among the treatment groups.

Results: The mean age of 100 patients included in the study was 49 years. About half were female. Seventeen patients were treated with antibiotics, 30 with steroids, and 53 with both. The average time between the pre and post-treatment visits was 4.4±1.8 weeks. The mean Lund-MacKay CT score for all patients was significantly lower post compared to pre-treatment (5.8±4.5 versus 8.6±4.5, p<0.001). However, the change in Lund-MacKay score did not differ significantly between the groups. Overall, 39% underwent surgery, the rate of which also did not differ significantly between the groups.

Conclusion: Lund-MacKay CT scores decreased significantly after all treatments, but we found no evidence that any treatment type is superior to any other.

Abstract ID# 1019

#### **Anti-pseudomonal activity of taste receptor agonists and antagonists**

Sakeena Payne, MD  
Robert Lee, PhD  
Noam Cohen, MD, PhD  
Hershey, PA  
USA

Introduction: Bacterial biofilms have been implicated as a disease modifier for chronic rhinosinusitis (CRS). CRS patients with biofilms have increased antibiotic use and worse therapeutic outcomes. Concerns of antibiotic resistance are rising, necessitating new treatment modalities. Bitter and sweet taste receptors have recently been shown to contribute to upper airway innate immunity. We investigated the effects of several bitter receptor agonists and sweet receptor antagonists on *Pseudomonas aeruginosa* viability and biofilm formation, as potential novel therapies for CRS.

Methods: Calgary biofilm assays were performed with *Pseudomonas aeruginosa* (PAO1) with varying concentrations of gymnemic acid, lactisole, delphinidin, keracyanin, quinine, salicin, and turmeric. After 48 hours of incubation, biofilms were stained with crystal violet and quantified with OD595 absorbance. Additionally, three-fold serial dilutions of PAO1 bacterial cultures treated with the study compounds for 24 hours were analyzed for colony-forming units (CFUs).

Results: All substances tested resulted in reduction of PAO1 biofilm growth. Salicin was most successful at 59.9% followed by turmeric (58.8%), gymnemic acid (41.0%), keracyanin (37.9%), delphinidin (35.4%), quinine (27.2%), and lactisole (26.9%). Similarly, CFUs were reduced with treatment with all substances tested. Turmeric showed a reduction of 85% followed by lactisole (80%), quinine (70%), keracyanin (65%), delphinidin (50%), and salicin (40%).

Conclusion: Bitter receptor agonists and sweet receptor antagonists while modulating sinonasal innate immunity also display independent antibacterial and antibiofilm producing properties against *Pseudomonas aeruginosa*. With further studies, the implementation of these compounds into treatment regimens of selective CRS patients may prove beneficial.

Abstract ID# 987

#### **Augmented reality in endoscopic sinus surgery in a cadaveric model**

Martin Citardi, MD  
Abib Agbetoba, MD  
Amber Luong, MD, PhD  
Houston, TX  
USA

Introduction: In surgery, augmented reality (AR) fuses computer-generated images of preoperative imaging data with real-time views of the surgical field. Scopis Hybrid Navigation (Scopis, GmbH, Berlin, Germany) is a surgical navigation system with AR capabilities for endoscopic sinus surgery (ESS).

Methods: ESS dissection was performed on 4 fresh human specimens with conventional ESS instruments, plus Scopis Hybrid Navigation.

Results: For each dissection, pre-dissection planning included creating models of relevant frontal recess structures and the frontal sinus outflow pathway on orthogonal CT images,

which were also marked for the positions of the optic nerve and internal carotid artery. These models and annotations were displayed on the endoscopic images during the dissection, which was performed with standard surgical navigation. The accuracy of the AR images relative to underlying anatomy was better than 1.5-2.0 mm. The software's trajectory targeting tool was also used to guide instrument placement along the frontal sinus outflow pathway. AR imaging of the optic nerve and internal carotid artery served to mark the positions of these critical structures during the dissection.

**Conclusion:** Surgical navigation with AR was easily deployed in this cadaveric model of ESS. This technology builds upon the positive impacts of surgical navigation during ESS, particularly during frontal recess surgery. Instrument tracking with this technology facilitates identifying and cannulating the frontal sinus outflow pathway with intact frontal recess in anatomy. AR may serve to highlight anti-targets (i.e., structures to be avoided), such as the optic nerve and internal carotid artery, and thus reduce surgical complications and morbidity.

Abstract ID# 1107: **WITHDRAWN**  
**Bacterial communities vary between sinuses in chronic rhinosinusitis and nasal polyposis**

Nicholas Stow, MD  
 Tom Joss, MD  
 Catherine Burke, PhD  
 Bernard Hudson, MD  
 Ian Charles, PhD  
 Frenchs Forest, NSW  
 Australia

**Introduction:** Chronic rhinosinusitis is a common and potentially debilitating disease characterized by inflammation of the sinus mucosa for longer than 12 weeks. Bacterial colonization of the sinuses and its role in the pathogenesis of this disease is an ongoing area of research. Recent advances in culture-independent molecular techniques for bacterial identification have the potential to provide a more accurate and complete assessment of the sinus microbiome.

**Methods:** This study used high-throughput DNA sequencing of the bacterial 16S gene to compare the bacterial composition of both swab and tissue samples collected from multiple sinuses of 19 patients undergoing surgery for treatment of chronic sinusitis and nasal polyposis.

**Results:** *Corynebacterium* and *Staphylococcus* were the most abundant bacteria for the majority of patients. Three patients had high counts of *Haemophilus*, which was associated with a decreased phylogenetic diversity. The sequencing results correlated well with culture-based pathogen identification conducted in parallel, although the culturing missed many species detected by the sequencing, including moderate counts of anaerobic bacteria found in seven patients. Sequence analysis of a nostril swab was unable to detect all bacterial taxa detected in the sinus swabs from a patient.

**Conclusion:** Distinct microbiomes may exist simultaneously in the different sinuses of the same patient. This finding has implications for future research and may also be of clinical importance.

Abstract ID# 923

**Bleeding risk associated with resection of the middle turbinate during functional endoscopic sinus surgery**

Anya Miller, MD  
 Michael Bobian, BS  
 Ed Peterson, PhD  
 Robert Deeb, MD  
 Detroit, MI  
 USA

**Introduction:** The decision to resect the middle turbinate (MT) during functional endoscopic sinus surgery (FESS) is controversial. While there have been a variety of studies examining the functional outcome related to this maneuver, very few studies, exist evaluating the potential for complications. We sought to determine if resection of the MT during FESS leads to an increased risk for post-operative bleeding.

**Methods:** Patients who underwent FESS between 2004 and 2014, at a single institution were analyzed for bleeding and other complications following resection of the MT.

**Results:** Between 2004 and 2014, 1185 sinus surgeries were performed by 15 surgeons. A propensity matched set of 228 patients who underwent turbinate resection and 228 controls were selected based on predicted probabilities from a logistic regression predicting turbinate resection, adjusted for age, sex, and procedure. There were 89 patients with bilateral turbinates removed and 139 with unilateral turbinates removed. There was no significant difference in major bleed or other complication rates between the two groups. Patients who underwent resection of at least one MT were 3.95 times more likely to have a minor bleed compared to those who did not; this risk increased with more turbinates resected (trend  $p=0.008$ ). Patients with minor bleeds were significantly more likely to be on Coumadin ( $p=0.007$ ).

**Conclusion:** There was no increased risk of major bleeding or other complications associated with resection of the MT. There was an increased minor bleed rate associated with MT resection, though these patients were more likely to be on Coumadin.

Abstract ID# 955

**Calcified chewing gum as rhinolith**

Onuralp Kurt, MD  
 Enver Çemeci, MD  
 Erzincan  
 Turkey

Otolaryngologists usually encounter foreign bodies of nasal cavities. Mostly seen and treated at childhood however untreated rare cases could reach older ages. Our case is 21 years old male consulted to our clinic for bad nasal smell and purulent discharge. These complaints were also affecting him socially. Patient was coming from the rural region and has these complaints for over five years. It's his first time to consult an otolaryngologist. Evaluation of patient revealed he was mentally normal, has adenoid face and hyponasal speech. Endoscopy could not be performed at first visit because of inadaptation of patient. Paranasal Sinus Tomography was taken for to eliminate sinus neoplastic mass and revealed calcified body anterior to left choana in the left nasal cavity.

Patient has gone to office based endoscopic procedure for extraction. Under endoscopy, calcified body was stretching

with pulling force. Examination of extracted material was showed it was a calcified chewing gum which was the cause of patients symptoms and was not dropped to nasopharynx for years because of hypertrophic adenoid tissue obstructing choana. Patient went on a adenoidectomy after a while and hyponasalality were also recovered.

Obstructive effect of hypertrophic adenoid tissue would reach this level explicitly as in this case and adenoidectomy procedure would be vital to avoid some forms of rhinolithiasis.

Abstract ID# 957

**Changes in nasal obstruction with nasal surgery in patients with obstructive sleep apnea**

Ewa Olszewska, Professor, MD, PhD  
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Poland

**Introduction:** The role of nasal obstruction (NO) and impact of nasal surgery on obstructive sleep apnea syndrome (OSAS) is controversial. A study is conducted to compare the pre- and post-surgical craniofacial cephalometric parameters and OSAS after nasal surgery.

**Methods:** Patients with suspected OSAS were evaluated with history and physical exam, a questionnaire for OSAS, sleep study for apnea hypopnea index (AHI) and three dimensional (3-D) craniofacial computed tomography (CFCT) for cephalometry. Eleven subjects with OSAS and NO underwent septoplasty and lower turbinate reduction. Complete pre-operative evaluation was repeated 6-12 months after the surgery. In addition to standard cephalometric measurements nasal cavity area (NCA) was measured.

**Results:** Quality of sleep improved however there was no statistically significant improvement in AHI after the surgery. Cephalometric measurements after nasal surgery did not show statistically significant differences except for the subnasale-nasion-sella angle (80,48 ±5.28 vs 83.35±5.49, p:<0.005). The improvement in NCA (2212.83mm ±288.44 vs 2115mm ±236.85, p:0.314) was not statistically significant.

**Conclusion:** Cephalometry performed on 3-D CFCT provides precise assessment of specific distances, angles and areas concerning soft tissues and bone structure points within the airways. Small differences measured in cephalometry is expected due to functional septoplasty and conservative nasal turbinate reduction techniques. Limited improvement in NO and OSAS with nasal surgery is consistent with the literature, however, due to improvements in sleep quality and increased compliance with nasal positive airway pressure nasal surgery should be considered in the management of OSAS.

Abstract ID# 927

**Characterization of facial pain associated with chronic rhinosinusitis using validated pain evaluation instruments**

Adam DeConde, MD  
Jess Mace, MPH  
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Timothy Smith, MD, MPH  
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USA

**Introduction:** Prior investigations into facial pain associated with chronic rhinosinusitis (CRS) have yielded important results, but have yet to utilize pain-specific outcome measures. This study seeks to characterize facial pain associated with CRS using validated pain-specific instruments.

**Methods:** Adults with CRS were enrolled into a prospective, cross-sectional study along with control participants presenting with non-CRS diagnoses. Facial pain was characterized in both groups using the Brief Pain Inventory Short Form (BPI-SF) and the Short-Form McGill Pain Questionnaire (SF-MPQ). CRS-specific measures of disease were measured including the Sinonasal Outcome Test-22 (SNOT-22), nasal endoscopy, and computed tomography scoring.

**Results:** Patients were comprised of CRS with nasal polyposis (CRSwNP; n=25), CRS without nasal polyposis (CRSsNP; n=30), and control participants (n=8). Subjects with CRSwNP and CRSsNP were less likely to be pain free than controls (16.0%, 6.7% and 62.5% respectively, p=0.001) and carried greater burden of pain as measured by the BPI-SF and SF-MPQ than controls (p=0.002 and p=0.017, respectively). Pain in CRS was most commonly located around the eyes and characterized as 'throbbing' and 'aching'. Nasal polyp status was not associated with differences in character, severity, or location of pain.

**Conclusion:** Subjects with CRS have a greater burden of facial pain relative to control subjects across several standardized pain measures. Further, facial pain in CRS significantly correlated to QOL and CRS-specific disease severity measures. Study across larger cohorts using standardized pain measures is warranted to clarify the association of facial pain with chronic rhinosinusitis.

Abstract ID# 989

**Characterization of transsphenoidal complications in patients with acromegaly: an analysis of inpatient data in the united states from 2002 to 2010**

Milap Raikundalia, BS  
Morgan Pines, BS  
Peter Svider, MD  
Soly Baredes, MD  
James Liu, MD  
Jean Eloy, MD  
Newark, NJ  
USA

**Introduction:** Transsphenoidal surgery (TSS) is a common procedure for a variety of pituitary lesions. This procedure can be associated with complications related to the surgery or specific pathology. In this study, we evaluate inpatient postoperative complications among patients who underwent TSS for growth hormone adenomas using a nationally representative database, and compare patient characteristics and

complications to patients who underwent TSS for other benign pituitary neoplasms.

Methods: Analysis of the Nationwide Inpatient Sample revealed 13,070 TSS patients (including 892 with Acromegaly) between 2002 and 2010. Complication rates, outcomes, patient demographics, hospital stay, and total charges were evaluated among TSS patients with and without acromegaly.

Results: There was an increase in TSS performed in both cohorts from 2002-2010. Acromegaly patients were younger, had shorter hospital stays, and incurred fewer charges. Acromegaly patients had a lower incidence of postoperative urinary/renal complications (0.2% vs. 1.1%), thromboembolic events (0% vs. 0.4%), fluid/electrolyte abnormalities (5.7% vs. 9.1%), and iatrogenic hypopituitarism (0.3% vs. 1.1%) compared to other TSS patients (all  $p < 0.05$ ). After adjusting for age, acromegalic patients maintained a statistically lower incidence of fluid/electrolyte abnormalities ( $p = 0.007$ ).

Conclusion: Upon comparison of inpatient hospitalizations for patients undergoing TSS for growth hormone adenomas and other benign pituitary neoplasms, acromegaly patients had a significantly lower incidence of postoperative fluid/electrolyte abnormalities. Acromegaly patients had shorter hospitalizations and subsequently fewer total charges.

Abstract ID# 1092

#### **Chronic invasive fungal sinusitis associated with intranasal drug use**

Kelly Pekala, MS  
Matthew Clavenna, MD  
Ross Shockley, MD  
Justin Turner, MD, PhD  
Nashville, TN  
USA

Introduction: Chronic invasive fungal sinusitis (CIFS) is a rare but aggressive form of invasive fungal disease that typically occurs in immunocompetent patients. We report a case of CIFS in an otherwise healthy young adult associated with intranasal illicit drug abuse.

Methods: Case report and literature review.

Results: A 24 year-old male presented with a three month history of intractable nasal and palatal pain. He had a history of intranasal cocaine abuse with initial development of palatal erosions three years prior. Subsequent escalation of an erosive process resulted in near complete septal and hard palate perforation with extension to the paranasal sinuses. Intraoperative debridement and biopsies revealed numerous fungal hyphae within the mucosa, submucosa, bone, and vascular structures. Microbiology and fungal cultures demonstrated *Aspergillus flavus* and *Candida albicans*. The patient was initially treated with amphotericin and then transitioned to voriconazole prior to discharge. He subsequently experienced resolution of his nasal and palatal pain over a 6-week period but was subsequently lost to follow-up.

Conclusion: CIFS typically occurs secondary to inhalation of fungal organisms and subsequent invasion of the sinonasal mucosa. Invasive fungal species typically inhabit decomposing or necrotic organic matter, and in this case were associated with a necrotic palatal and septal defect due to intranasal cocaine use. Patients with mucosal ulceration or necrosis due to intranasal drug use may be at increased risk of invasive fungal sinusitis.

Abstract ID# 936

#### **Chronic lymphocytic leukemia of the oropharyngeal cavity and paranasal sinuses: a case series and literature review**

Wesley Davison, BA  
Myles Melton, BA  
Aaron Pearlman, MD  
New York, NY  
USA

Introduction: Chronic lymphocytic leukemia (CLL) is an indolent B-lineage neoplasm responsible for 30% of all leukemias. The median age of onset is 67 years with a male predominance of 2:1. Localized infiltration in the oropharynx and paranasal sinuses is exceptionally rare. The aims of this study were 1) to add an additional case series of CLL with involvement of the oropharynx and paranasal sinuses to the literature and 2) to determine incidence and demographic data.

Methods: Retrospective chart review from 1990 to 2014

Results: Five cases were found in our case series, representing 0.74% of the total number of cases analyzed (5 out of 680). 16 additional cases were identified through literature review, resulting in a total of twenty-one cases of CLL (13 men, 8 women) with involvement of the oropharynx ( $n = 16$ ) and paranasal sinuses ( $n = 5$ ). The average age of patients with CLL in the pharynx was 62 years while in the paranasal sinuses it was 52 years ( $p = 0.16$ ). 67% of cases involving the paranasal sinuses and 27% of cases involving the oropharynx occurred in women. 84.6% of men had oropharynx invasion vs. 50% of females, ( $p = 0.15$ ) which suggests a non-significant trend.

Conclusion: The results of our study indicate that CLL infiltrates the oropharynx or paranasal sinuses in less than 1% of CLL cases. While there seems to be no age bias between invasion in the oropharynx and the paranasal sinuses, there is a trend where women appear more likely to experience invasion of the paranasal sinuses.

Abstract ID# 919

#### **Clinical features of chronic rhinosinusitis in igg4-related disease**

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Objective: It has been reported that some patients with IgG4-related disease complain of nasal symptoms. However, there are few reports concerning the nasal manifestations of IgG4-related chronic rhinosinusitis. The purpose of this study is to investigate the clinical features of chronic rhinosinusitis in IgG4-related disease.

Methods: We recruited 37 patients diagnosed with IgG4-related disease. Symptoms, laboratory data, and computed tomography findings were examined, and mucosal tissues were obtained from all subjects. Laboratory data were compared among the IgG4-related disease patients, rhinosinusitis patients without IgG4-related disease and healthy subjects.

Results: Sixteen of the 37 cases had some nasal symptoms. Ten patients were diagnosed with rhinosinusitis and 6 with rhinitis. The level of serum IgG4 in those with rhinosinusitis was significantly higher than that in the rhinitis group. The proportion of eosinophils in the IgG4-related rhinosinusitis group was also higher than that in the rhinitis group. Infiltration of eosinophils in the IgG4-related rhinosinusitis group was higher than that in the rhinitis group. Oral prednisolone was effective in the treatment of IgG4-related rhinosinusitis patients and steroid nasal spray was also useful.

Conclusion: There are two clinical entities associated with the nasal manifestations of IgG4-related diseases; rhinosinusitis and rhinitis.

Abstract ID# 1034

**Comparison of airflow and rhinitis outcomes between allergic and non-allergic rhinitis patients from septal and turbinate surgery**

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Background: Turbinate and septal procedures are often applied to relieve nasal obstruction. However, the nature of congestion differs between allergic (AR) and non-allergic rhinitis (NAR). The impact of septal and turbinate surgery on airflow and rhinitis symptoms between these two groups is compared.

Methods: A case-control study of patients from a tertiary clinic undergoing nasal septum and turbinate surgery with rhinitis and nasal obstruction was performed. Allergic rhinitis (AR) was defined by positive allergen-specific serum IgE test and/or serum IgE > 100 kU/L. Patient outcomes were nasal obstruction, global nasal function (GNF), rhinological symptoms, sleep, sino-nasal outcome test (SNOT-22) and psychological scores. Nasal Peak Inspiratory Flow (NPIF) assessed breathing. Scores obtained pre-operatively and 3 months post-operatively were compared between AR and NAR groups.

Results: 190 patients (age 41.6±13yrs, 44% female) and 24% AR were assessed. Baseline GNF scores were higher in NAR (-2.65±2.34 v -3.77±1.66, p=0.001). All patient outcomes improved from treatment; nasal obstruction (3.45±1.21 v 1.45±1.26, p<0.001), rhinological symptom score (8.27±5.39 v 6.24±4.50, p<0.001), GNF score (-2.93±2.24 v 3.09±2.65, p<0.001), sleep-function score (7.19±4.11 v 3.75±3.79, p<0.001), SNOT-22 (39.07±19.04 v 23.75±17.42, p<0.001) and psychological-function score (10.08±6.59 v 6.18±6.32, p<0.001). NPIF improvement was 65.6±39.1L/min (101.65±37.38 v 167.23±44.31, p<0.001). GNF improvement was higher in AR (7.54±2.27 v 5.29±3.56, p<0.001). NPIF improvement was similar between groups.

Conclusion: AR and NAR patients demonstrate improvement from surgery. AR patients demonstrate greater improvement in GNF score compared to NAR patients following surgery in which relief of obstruction is the focus.

Abstract ID# 1114

**Comparison of allergic asthmatics with and without chronic rhinosinusitis treated by omalizumab**

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Background: Omalizumab, an anti-IgE monoclonal antibody, is FDA approved in the management of allergic asthmatics with refractory disease, and shown helpful in management of allergic chronic rhinosinusitis (CRS). The common airway model suggests patients with both allergic asthma and CRS may be more challenging to manage. This is the first study to evaluate the response of omalizumab on patients with asthma and CRS versus those with asthma alone.

Methods: This is a retrospective review at a tertiary university clinic. A total of 259 allergic asthmatics had been prescribed omalizumab for allergic asthma between 2007 and 2014. The primary outcome measure was percent change in pulmonary function test (PFT) results.

Results: Overall, 78 patients had serial PFT results available for evaluation, among which 57 (73%) had CRS and 21 (27%) did not. Average treatment was 27.2, 27.7 and 25.8 months for entire sample, asthma+CRS, and asthma-non-CRS, respectively. PFT metrics improved in both groups for all parameters, except FEF 25-75% in the non-CRS group. Mean improvements in FEV1 (13.9 v. 17.2, p=0.77), FVC (8.2 v. 5.4, p=0.62), and FEV1/FVC (2.8% v. 6.9%, p=0.52) were similar between groups.

Conclusion: Allergic asthmatics treated with omalizumab manifested some improvement in PFT scores. Changes were independent of comorbid CRS status. CRS may add to the overall symptom burden experienced by asthmatics, especially in those with increasing severity, but comorbid CRS did not adversely impact therapeutic potential of omalizumab in these patients.

Abstract ID# 1061

**Comparison of the paranasal sinus microbiome of cystic fibrosis patients with and without double-lung transplantation**

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Introduction: Cystic fibrosis (CF) patients present with therapeutically challenging chronic rhinosinusitis (CRS) often involving biofilm-producing organisms which are difficult to assess by conventional culture. Molecular analysis of microbes via pyrosequencing presents a non-growth dependent technique to evaluate the sinonasal. Differences in the microbiota of CF patients who have undergone double lung transplantation vs patients who have not undergone transplantation may provide insight into the mechanisms underlying



ing inflammation and infection in these patients with refractory CRS. The objective was to examine the impact of DLT on the paranasal sinus microbiome of CF patients.

**Methods:** Ethmoid sinus samples were obtained from 21 CF patients. 10 had undergone DLT and 11 had not. Specimens were analyzed via 16S ribosomal RNA sequencing. Diversity and relative abundance of different organisms was analyzed between the two groups.

**Results:** Patients who had undergone double-lung transplant had an increased relative abundance of *Pseudomonas*, while the non-transplant group demonstrated higher incidence of *Alicycloaceticus*, *Burkholderia*, *Ralstonia*, and *Streptotrophomas* (Benjamini-Hochberg adjusted p-values < 0.1). Additionally, transplanted patients demonstrated a decrease in overall richness (Chao 1 p-value = 0.03), and overall microbiome composition was significantly different between groups (UniFrac p-value = 0.04).

**Conclusion:** These findings suggest that there are significant differences in the paranasal sinus microbiota of CF patients who have undergone double-lung transplantation compared to those who have not. The transplanted patients showed increased relative abundance of *Pseudomonas* species and a decrease in both overall and OTU-specific richness. These findings may help elucidate and direct appropriate therapy for CF patients who have undergone transplantation.

Abstract ID# 1036

### **Computational fluid dynamics modeling of sinus irrigations before and after surgery**

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**Introduction:** Topical sinus irrigations play an integral role in the management of sinonasal disease, and the improvement of sinus irrigation is an important outcome of Endoscopic sinus surgery. However, previous investigations on post-surgery sinus irrigations have been limited to cadaver studies, which are labor intensive, and do not capture the full dynamics of the flows.

**Methods:** A pilot study was conducted to investigate the impact of surgery on sinus irrigation through Computational Fluid Dynamics (CFD) simulations. Pre- and post-operative CT scans were obtained on a patient who underwent a primary standard Endoscopic surgery for all sinuses and a revision Draf III frontal sinusotomy. CT based pre- and post-operative CFD models then simulated irrigations of 120 mL saline per nostril at 12 mL/s (typical of Sinugator, NeilMed) and 60 mL/s (SinusRinse Bottle, NeilMed), in a head position with face parallel to the ground.

**Results:** Overall, surgeries most significantly improved frontal sinus irrigation, but surprisingly resulted in less maxillary sinus penetration. This may be due to the removal of superior septum during the Draf III, causing some fluid to exit prematurely across the superior septum. Ethmoid and sphenoid sinuses were poorly irrigated in all cases and may benefit from changing the head positions. Higher flow rate improved some sinuses penetration, but not consistently.

**Conclusion:** CFD modeling of sinonasal irrigations is a novel

technique for evaluating irrigant penetration of individual sinus cavities. It may prove useful in predicting the optimal degree of surgery to allow for maximal sinus irrigant penetration.

Abstract ID# 1076

### **Contralateral transmaxillary corridor as an extension to the endoscopic endonasal approach to the petrous apex**

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**Introduction:** The endoscopic endonasal approach (EEA) has been shown to be an effective means of accessing petrous apex lesions. Lateral lesions require lateralization of the paraclival internal carotid artery (ICA) or a transpterygoid infrapetrous approach. This paper studies the feasibility of adding a contralateral transmaxillary corridor (CTM) to provide a more lateral trajectory for access to lateral lesions of the petrous apex with decreased need for manipulation of the ICA.

**Method:** An EEA and CTM extension were performed bilaterally on five cadavers with image guidance. The anterior wall of the sphenoid sinus and rostrum were removed. The angle from the sagittal and the angle from the axis of the horizontal petrous carotid (HPICA) were measured.

**Results:** The CTM corridor required a partial medial maxillectomy. EEA alone provided a mean angle of 15 +/- 3.13 degrees from the midline (range: 11-22 degrees). The CTM corridor allowed for a mean angle of 39.7 +/- 4.62 degrees (range: 34-47 degrees), an increase by 24.7 +/- 2.58 degrees. When measured from the axis of the HPICA, CTM decreased the angle from 44.8 +/- 2.78 degrees to 20.1 +/- 4.31 degrees. Drilling through the CTM corridor allowed the drill to reach lateral aspects of the petrous apex that would otherwise have required lateralization of the ICA.

**Conclusion:** The CTM corridor is a feasible extension to the standard EEA approach for the petrous apex which safely offers a more lateral trajectory. This may reduce the risk and morbidity in accessing lateral lesions of the petrous apex.

Abstract ID# 961

### **Deafness and the sense of smell**

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**Introduction:** We aim to investigate the sense of smell in congenital profound hearing impaired people and compare the results with healthy individuals.

**Material and Methods:** The sense of smell of congenital profound hearing-impaired and healthy subjects were investigated by a subjective sniffing test. The test examined odor threshold score, odor discrimination score, odor identification

score of all subjects. The results were compared with the smelling ability of normal hearing volunteers. Hearing impaired subjects were all highly-educated individuals.

**Results:** Our study was including 78 participants with a mean age of  $22.1 \pm 2.1$  years, ranging from 19 to 27 years. There were 40 patients in hearing loss group and 38 healthy volunteers in control group. Odor threshold score, odor discrimination score, odor identification score of hearing impaired subjects were not statistically significant from control group results.

**Conclusion:** The results indicate that there is no statistically significant difference between hearing impaired and healthy subjects in the sense of smell.

Abstract ID# 1102

### **Delayed wound healing in primary undifferentiated epithelial crs cell cultures**

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**Introduction:** Epithelial barrier dysfunction has been postulated as a mechanism involved in the pathophysiology of chronic sinusitis (CRS), with recent evidence demonstrating dysregulated basal cell proliferation dynamics. We thus investigated a potential wound healing defect as a potential mechanism of CRS pathophysiology.

**Objective:** To compare the repair capacity in CRS and control patients using an epithelial wounding model in primary undifferentiated epithelial cell cultures raised from surgical samples.

**Methods:** Sinus mucosal specimens were obtained at time of surgery from patients undergoing endoscopic sinus surgery (ESS) for persistent CRSwNP and CRSsNP (n=10) and control patients undergoing endoscopic skull base surgery (n=5). Primary undifferentiated cells were isolated from the specimens and grown to confluence in monolayers. Wounding was performed with a standardized mechanical injury method. Wound healing rates were calculated by measuring the surface area of the wound at 0 and 6 hours after injury.

**Results:** A lower mMedian repair rate was seen in the CRS patients as opposed to the controls (CRS:  $44.719 \mu\text{m}^2/\text{hr}$ ; SD  $\pm 25.470$ ; Controls:  $83.308 \mu\text{m}^2/\text{hr}$ ; SD=8768) ( $p=0.0275$ ).

**Conclusion:** Undifferentiated epithelial cells in CRS have a delayed wound healing capacity compared to those obtained from control subjects. These results suggest that ineffective wound healing following injury may contribute to development or persistence of CRS. Assessment of implicated cell populations using fully differentiated epithelial cell cultures in an air:liquid interface model will help better understand these early findings.

Abstract ID# 998

### **Development of a potential platform for isolation of circulating tumor cells of nasopharyngeal carcinoma**

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**Background:** Nasopharyngeal carcinoma (NPC) is a rare malignancy in most part of the world, but it is a common cancer in southern Asia. The local recurrence and distant metastasis are still the main facing problems. Circulating tumor cells (CTCs), cancer cells originating from the primary tumor which shed into the vasculature and circulate in the bloodstream, have been found to be associated with the prognosis of cancers. However, the technique of isolation of CTCs still remains challenging. The aim of this study was to develop a platform for isolation of CTCs of NPC.

**Methods:** Self-organized titanium oxide (TiO<sub>2</sub>) nanofibers with different densities were made by electrospinning method. Anti-EpCAM antibodies were further conjugated on the TiO<sub>2</sub> nanofibers for capturing NPC CTCs in vitro. The cell capturing performance of different density of TiO<sub>2</sub> nanofibers were evaluated by immunofluorescence. The scanning electronic microscopy (SEM) was used for observing cell morphology.

**Results:** The results demonstrated that high-density TiO<sub>2</sub> nanofibers showed better NPC CTCs capturing performance compared to low-density ones. Besides, SEM revealed good contact of CTCs with TiO<sub>2</sub> nanofibers.

**Conclusion:** The high-density TiO<sub>2</sub> nanofibers conjugated with anti-EpCAM antibodies can capture the CTCs of NPC effectively. It may have the potential to be used as a clinical platform for isolating CTCs of NPC patients in the future.

Abstract ID# 1010

### **Diagnosis and management of cerebrospinal fluid rhinorrhea: an evidence-based review with recommendations**

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**Introduction:** Diagnosis and management strategies employed for cases of cerebrospinal fluid (CSF) rhinorrhea vary widely due to limited evidence-based guidance.

**Methods:** A systematic review of the literature was performed based on recommendations from the Clinical Practice Guideline Manual, Conference on Guideline Standardization (COGS), and Appraisal of Guidelines and Research Evaluation (AGREE). Multiple topics within the categories of diagnostic confirmation, localization, endoscopic repair, and postoperative clinical management of CSF rhinorrhea were examined. Benefit-harm assessments, value judgments, and recommendations were made based on the available evidence. Study exclusion criteria were language other than English, pre-1990 studies, case reports, and non-rhinologic leak.

**Results:** We reviewed over 120 studies examining 22 practices pertinent to the diagnosis and management of CSF

rhinorrhea, reaching a highest aggregate grade of evidence of B. In short, beta-2 transferrin, high resolution computed tomography, and magnetic resonance cisternography were supported by the literature. Computed tomography cisternography, radionuclide cisternography, intrathecal fluorescein, and all types of endoscopic repair are options. The ring sign, glucose testing, routine perioperative antibiotics, and lumbar drainage were not supported by the literature. There were no relevant studies to address postoperative activity restrictions.

**Conclusion:** Despite relatively low levels of evidence, recommendations for the diagnosis and management of CSF rhinorrhea can be made based on the current literature. Higher level studies are needed to better determine optimal diagnostic and clinical management approaches.

Abstract ID# 1101

### **Diagnosis and treatment of sinonasal mucous membrane pemphigoid**

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**Introduction:** Mucous membrane pemphigoid (MMP) is a chronic autoimmune subepithelial blistering disease that affects varying combinations of the upper aerodigestive tract (UADT), esophagus and genitals. Sinonasal MMP can damage the nasal valves, choanae or cause atrophic rhinitis. The diagnosis and management of sinonasal MMP has received scant attention in the literature. The purpose of this retrospective review is to present a diagnostic and treatment algorithm for sinonasal MMP.

**Methods:** Nine were seen between the years 2010-2014 in both the otolaryngology and dermatology clinic affiliated with a tertiary care center. Their charts were reviewed for demographic information, co-morbidities, presenting signs and symptoms, method of diagnosis, pattern of mucosal involvement, treatments, and outcomes.

**Results:** Symptoms of sinonasal MMP are crusting rhinitis, synechiae, nasal valve and/or choanal obstruction, and epistaxis. Patients commonly had other lesions of the UADT in the pharynx and larynx. Diagnosis was most commonly made with sinonasal endoscopy and biopsy with specimens sent for histology, immunofluorescence, and immunoelectron microscopy. Treatment options included topical corticosteroids, oral steroids, rituximab, and surgery for nasal obstruction. A diagnostic and treatment algorithm is presented.

**Conclusion:** A high clinical suspicion of MMP is required for diagnosis, especially for patients with sinonasal symptoms who may of other mucosal lesions. The treatment algorithm outlined prioritizes medical therapy as a first line therapy and utilizes surgery as required for nasal obstruction.

Abstract ID# 971

### **Ectopic pituitary adenomas presenting as isolated parasellar or clival lesions: case series and management recommendations**

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**Introduction:** Ectopic pituitary adenomas presenting as isolated clival or sphenoid masses are rare clinical entities that may mislead the clinician and result in unnecessary interventions or potential medico-legal consequences. We present three such cases and review the literature with an emphasis on radiological findings, and critical preoperative workup

**Methods:** Retrospective chart review.

**Results:** Two patients presented with isolated clival masses and one patient presented with an isolated sphenoid mass. In the patient presenting with a sphenoid mass, CT and MRI revealed an enhancing, expansile mass with dehiscence of the posterior, lateral and superior wall of the sphenoid sinus with a normal pituitary gland and stalk. In both patients with clival masses, CT and MRI revealed an enhancing mass centered in the clivus with erosive changes extending to the inferior margin of the sellar floor, cavernous sinus and carotid canal with a normal appearing pituitary gland. All three lesions were T1 iso/hypodense, T2 hyperintense and enhanced with contrast on MRI. Final pathology revealed pituitary adenoma immunoreactive to prolactin in all cases.

**Conclusion:** Pituitary adenomas can rarely present as an isolated sphenoid or clival mass. Lesions displayed similar MRI findings with an erosive growth pattern toward the sellar floor, cavernous sinus or adjacent carotid artery. All lesions were immunoreactive to prolactin. Patients with clival or parasellar lesions should have a preoperative workup which includes prolactin levels. Patients presenting with similar findings should alert the physician to consider an ectopic pituitary adenoma in the differential to prevent unnecessary surgery and potential complications.

Abstract ID# 1081

### **Educational utility of advanced 3-dimensional virtual imaging in evaluating the anatomical configuration of the frontal recess**

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**Introduction:** Endoscopic sinus surgery represents a key cornerstone in the developmental training of otorhinolaryngology trainees. Mastery of these surgical skills requires a detailed understanding of paranasal sinus and skull base anatomy. The frontal sinus in particular is associated with a wide range of variation and complex anatomical configuration.

**Methods:** Eight otolaryngology trainees at a tertiary academic institution were enrolled for participation. Each subject underwent learning of frontal recess and frontal sinus anatomy with both traditional 2-D learning methods using a standard Dicom viewing software (RadiAnt Dicom Viewer Version

1.9.16) and 3-D learning utilizing a novel preoperative virtual planning software (Scopis Building Blocks, GmbH, Berlin, Germany). Four questionnaires that included a total of twenty items were scored to assess subjects self-assessment on knowledge of frontal recess and frontal sinus drainage pathway anatomy following each learned modality. A two-sample Wilcoxon rank-sum test was used to aid in statistical analysis.

Results: All trainees with the exception of one believed that the virtual 3D planning software helped most in improving their understanding of the spatial orientation of the frontal sinus drainage pathway.

Conclusion: Incorporation of virtual 3D planning surgical software may help augment trainees understanding and spatial orientation of frontal recess and frontal sinus anatomy. The potential increase in trainee proficiency and comprehension theoretically may translate to the operating room leading to improve surgical skill, reduced surgical time, and improvement in patient outcomes.

Abstract ID# 938

#### **Effects of nasal vestibule morphology on airway resistance**

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Introduction: The effects of inter-individual or within-individual morphologic variability around the nasal vestibule on airflow and nasal resistance are poorly understood. In addition, when underlying pathology is present, it is not clear if normal variability in the morphology of the nasal vestibule confounds patient symptoms. The aim of this study is to evaluate the role of nasal morphology on airflow resistance in the nasal vestibule and entire nasal passage using computational fluid dynamics (CFD) modeling.

Methods: Three-dimensional reconstructions of the nasal passage from 16 subjects with normal sinonasal anatomy were created from computed tomography scans; yielding 32 distinct nasal vestibules. The nasal vestibules were classified into three groups based on the shape and form of the airspace: No-notched, Notched, or Elongated. Steady state laminar inspiratory airflow was simulated in each cavity using ANSYS Fluent™. CFD computed nasal resistance values from nostril to anterior inferior turbinate (N-AIT); nostril to choanae (N-C); and anterior inferior turbinate to choanae (AIT-C) were obtained

Results: In the No-notched group, computed nasal resistance (mean ± standard deviation) values were: N-AIT=0.027±0.016Pa.s/ml; N-C=0.073±0.029Pa.s/ml; and AIT-C=0.047±0.032Pa.s/ml. For the Notched group: N-AIT=0.041±0.018Pa.s/ml; N-C=0.061±0.020Pa.s/ml; and AIT-C=0.020±0.016Pa.s/ml. And the Elongated group: N-AIT=0.019±0.010Pa.s/ml; N-C=0.094±0.052Pa.s/ml; and AIT-C=0.075±0.058Pa.s/ml.

Conclusion: Although our pilot report suggests that average nasal resistance was highest in the nasal vestibule with notching. Morphology of the nasal vestibule does not impact overall resistance in the nasal passage. This implies that the main driver of patient's airway patency is the anatomic shape

and architecture from the anterior inferior turbinate to the choanae.

Abstract ID# 1097

#### **Efficacy of laser photocoagulation and cautery as temporizing interventions in hht**

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Introduction: Hereditary hemorrhagic telangiectasia (HHT) is an autosomal dominant vascular dysplasia characterized by spontaneous recurrent epistaxis. Epistaxis ranges from sporadic, low volume bleeds to frequent hemorrhages causing anemia. In moderate-severe cases, laser photocoagulation is often utilized to better control epistaxis. This study evaluated the efficacy of laser photocoagulation of intranasal telangiectases as a treatment for epistaxis in HHT.

Methods: Retrospective chart review was completed for all HHT subjects at our center who had undergone either laser therapy for intranasal lesions from 2011-2014. Data collected included epistaxis severity score (ESS) at time intervention was sought as well as any ESS' recorded in interim. Telephone interviews were conducted at two time points, eighteen months apart to collect ESS on all subjects. Data was analyzed to identify relationships and trends.

Results: Pending. Data stemming from approximately 50 subjects with known HHT will be analyzed.

Conclusion: Pending.

Abstract ID# 1006

#### **Electronic medical record as chronic rhinosinusitis patient database**

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Introduction: The widespread adoption of electronic medical records (EMR) has been an important benchmark for improved cost, quality, safety, and efficiency of medical care. The use of EMRs in medical research is an important and underutilized benefit to their widespread implementation. One such application is the ability to store extensive patient data normally cataloged in traditional database form. We describe a novel method of patient data gathering for disease specific database creation.

Methods: Single institution, single physician patient database was created using the Epic Hyperspace EMR and the Epic Clarify reporting database. Patient data was collated using search terms of SHX187 describing a surgical history of prior endoscopic sinus surgery (ESS). From this initial search query several independent data sets were created which included demographic data, procedure type, date of procedure, and pertinent medical history. Details including relevant past medical history and relevant medication usage are included. The data set contains validated rhinologic measures such as preoperative Lund-Mackay CT scores, Lund-

Kennedy endoscopic scores and Sinonasal Outcomes Test 22 scores.

Results: We detail a straightforward method for creating a rhinology based patient database using EpicCare Outpatient software. This precludes the necessity of secondary database creation and maintenance.

Conclusion: We describe modern method patient database creation within a standard EMR system. Future studies are needed to validate EMR based databases and compare them to more traditional methods of patient data collection and storage.

Abstract ID# 1060

**Endoscopic modified subtotal lothrop procedure for the management of frontal sinus cholesterol granuloma**

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Objective: Cholesterol granuloma is associated with chronic middle ear and mastoid disease. Rarely, it can occur in the frontal sinus, maxillary sinus, and orbit. We report a case of cholesterol granuloma coexisting with an ossifying fibroma in the frontal sinus of a man who presented with a history of headaches. The lesion was resected via an endoscopic approach.

Methods: Case report.

Results: A 39-year-old man was found to have a lesion in the right frontal sinus during workup for headaches. He underwent resection via a modified subtotal Lothrop procedure (MSLP), a procedure we have described previously which consists of a right-sided Draf IIb procedure with a superior septectomy and an intersinus septectomy. Histology showed cholesterol granuloma, ossifying fibroma and changes characteristic of chronic rhinosinusitis. The patient did well post-operatively.

Conclusion: The MSLP, a variant on the endoscopic modified Lothrop procedure designed to preserve as much of the native sinus anatomy as possible, can be safely and effectively applied to the management of benign sinonasal processes such as cholesterol granuloma.

Abstract ID# 1031

**Endoscopic repair of meningoencephalocele with nasoseptal flap in a patient with crouzon syndrome after frontofacial advancement**

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Introduction: Crouzon syndrome (CS) is a craniofacial dysostosis that may require frontofacial advancement. Meningoencephalocele is a rare complication of craniofacial surgery, with a rate of 0.7-3%. Only one case of a patient with CS with meningoencephalocele after frontofacial advancement was identified, which was repaired transcranially. We report a second case, which we ultimately managed endoscopically. While the advantages of endoscopic approach are well documented, there has been no previous report of use of this technique in a patient with CS after frontofacial advancement. In light of this case, we discuss risk factors for complications of craniofacial remodeling and review the unique skull base anatomy of patients with CS.

Methods: Case report and literature review.

Results: An 8-year-old male with CS was noted to have intracranial hypertension, exophthalmos, class III malocclusion, and nasal airway obstruction. He underwent monobloc frontofacial advancement without complication. Over the next 2.5 years the patient was treated for recurrent bacterial meningitis on 3 occasions. MRI revealed a frontal lobe meningoencephalocele through a left fovea ethmoidalis defect. The patient underwent endoscopic resection of the meningoencephalocele and multi-layer reconstruction with alloderm and pedicled nasoseptal flap. At 3 months follow up, the patient is doing well without evidence of cerebrospinal fluid leak or recurrent meningitis.

Conclusion: Meningoencephalocele is a rare complication of frontofacial advancement that should be considered in patients with meningitis after craniofacial remodeling. This case demonstrates the ability to repair a meningoencephalocele in a patient with CS with a nasoseptal flap as an alternative to craniotomy.

Abstract ID# 1105

**Endoscopic sinus surgery in a low-resource setting**

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Introduction: A significant disparity continues to exist between the rhinologic care provided in first-world countries versus that in the developing world. Fortunately, interest in global outreach appears to be growing, but the resources often required for Endoscopic Sinus Surgery as practiced at 'home' may not be available, requiring substitution or a change in technique.

Purpose: The author's experience with teaching and performing endoscopic sinus surgery in a low resource setting in Guyana will be discussed. Tips and tricks for those interested in global outreach and surgical therapy in a low-resource setting will also be reviewed.

Methods: Retrospective review

Results: Representative cases will be presented including CSF leak repair, post-traumatic fronto-ethmoidal mucocele, inverted papilloma resection, and nasal leishmaniasis. Use of a smartphone endoscope adapter and suction-powered microdebrider, along with the merits of other similar recent innovations in a low-resource setting will also be demonstrated.

Conclusion: Recent advances in technology can be employed to help skirt shortcomings in resources when working in a low-resource setting. These can help facilitate endoscopic sinus surgery and global outreach.

Abstract ID# 1002

### **Epidemiological survey of non-emergent sinus and rhinologic complaints in united states emergency rooms**

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Introduction: Non-emergent rhinologic complaints may place a significant burden on emergency departments (EDs). We aim to characterize utilization of EDs by patients with primary rhinologic diagnoses.

Methods: Retrospective analysis of the Nationwide Emergency Department Sample (NEDS) from 2009-2011. NEDS was queried for visits with a primary rhinologic diagnosis (ICD9 codes 461, 470, 472.0, 473, 477, 478.0, 478.1, 784.7, 784.43/4). Weighted estimates for demographics, diagnosis and disposition were obtained. Predictors of admission were determined by multivariable regression.

Results: A total of 4,182,904 visits were attributed to primary rhinologic diagnoses (1.1% of all ED visits). Mean patient age was 38.1 years (Standard Error [SE]=0.2). The majority were adult (>18 years) (76.1%), male (57.3%) and were seen in winter or spring (63.3%). Most patients were treated and released (97.7%) and were diagnosed with epistaxis (29.5%), acute sinusitis NOS (24.3%) or chronic sinusitis NOS (23.4%). Among admitted patients the most common diagnoses were epistaxis (58.2%) and acute sinusitis (19.5%). Predictors of admission included weekday visit (Odds Ratio [OR] 1.1,  $p<0.0001$ ), older age (OR 1.03,  $p<0.0001$ ), epistaxis (OR 1.3,  $p<0.0001$ ), male gender (OR 1.3,  $p<0.0001$ ). Medicaid and self-pay patients were less likely to be admitted (OR 0.7 and 0.4 respectively,  $p<0.0001$ ). Mean visit charge was \$1,068.70 (SE=16.02).

Conclusion: We provide a comprehensive overview of patients with rhinologic complaints that present to EDs. Most visits are non-emergent and are predominately related to epistaxis or sinusitis. Demographic and socioeconomic factors are associated with admission. This study has implications for ED triage, risk stratification and resource allocation.

Abstract ID# 941

### **Exploring knowledge and expectations regarding sinusitis and surgery in patients presenting to otolaryngology clinic**

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Introduction: The objective was to explore new patients' knowledge and expectations regarding sinusitis and surgical intervention.

Methods: A survey was emailed to patients with sinus-related complaints prior to their first Otolaryngology visit. Questions assessed quality of life, knowledge of sinusitis, expectations regarding treatment options, and associations between these measures.

Results: 50 participants completed the survey (43 (86%) Caucasian, 29 (58%) female, mean baseline SNOT22 score of 43 (SD=17)). Females reported higher SNOT22 scores (M=49+/-18) than males (M=36+/-13),  $p=0.035$ , as well as higher bother from sinusitis (M=86+/-16 vs M=79+/-26),  $p=0.024$ . Sixty-three percent of patients believed that there are risks associated with surgery, and 81% of patients were willing to assume the risks. The most likely expected negative outcome from sinus surgery was lack of improvement of symptoms. When approximating the chance that sinusitis is curable from 0-100%, participants reported a median 74% estimate that sinusitis is curable (range 9%-100%), and surgery, as compared to medical management, was thought to be more likely to cure the disease. Patients who underwent previous surgery believed that sinusitis was 25% less likely to be a curable disease,  $p=0.014$ . Patients who were willing to assume surgical risks were 33% more likely to believe that surgery would cure the disease,  $p=0.012$ .

Conclusion: Sinusitis is a symptom-based illness, making quality of life and treatment expectations important to study. Our analysis suggests that patients believe that sinusitis has a high likelihood of being curable and that the risks of surgery are acceptable to improve symptoms.

Abstract ID#1087

### **Factors predicting the need for endoscopic sinus surgery in patients with odontogenic sinusitis**

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Introduction: Odontogenic sinusitis (OS) presents a therapeutic dilemma. Evidence is lacking whether dental treatment alone is sufficient or whether patients will eventually require sinus surgery (ESS). Our aim was to identify predictors of OS patients needing ESS.

Methods: Retrospective review performed of OS patients analyzing multiple factors including age, gender, symptoms, prior dental procedures, treatment, diabetes, immunosuppression, smoking history, maxillary erosion, maxillary dental hardware (MDH), oral antral fistula (OAF), and Lund-Mackay Score. Descriptive statistics and logistic regression analyses were performed.

Results: All patients (n=43) presented with facial pressure and discolored nasal drainage. Dental symptoms were present in 1 patient. 48% patients (n=21) required ESS. 77% (n=33) were referred for dental evaluation before considering ESS, and 33% (n=11) required ESS. 23% patients (n=10) had ESS concurrent with dental treatment due to OAF or RFB. Univariate analysis showed prior dental procedures, total frontal sinus opacification, total anterior ethmoid opacification, and ostimeatal complex (OMC) involvement as predictors of requiring ESS ( $p < 0.05$ ). In multivariate analysis, only prior dental procedures (OR 12.1,  $p=0.02$ ) and OMC involvement (OR 17.6,  $p=0.03$ ) remained significant. All patients with OAF or MDH required ESS.

Conclusions: Presenting symptoms for OS rarely involve dental complaints, and 48% of patients required ESS. Prior dental procedures and OMC involvement are strong and significant predictors of needing ESS in a multivariate model, and all patients with OAF and MDH required ESS. These patients should be considered for ESS as an upfront treatment modality.

Abstract ID# 1085

**Frontal lobe epidural abscess and cerebritis: a case report and literature review of intracranial complications of pediatric sinusitis**

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Introduction: We present a case of a 7-year old male with sinusitis complicated with a left frontal epidural abscess and cerebritis. Complications can occur in about 5% of pediatric patients with sinusitis. Intracranial complications (IC) are life threatening and the second most common sequelae of pediatric sinusitis. The interdisciplinary management of intracranial pathology associated with pediatric sinusitis will be described. Review of literature on presentation, diagnosis, and treatment of IC of acute sinusitis in children will also be discussed.

Methods: Case report and literature review; Retrospective chart review.

Results: A 7-year old male presented with a one-day history of high fevers, nasal congestion, left facial swelling, and left sided headaches. Examination revealed left periorbital swelling, left frontal swelling and thick, foul-smelling nasal secretions. MRI demonstrated pan-sinusitis with intracranial findings of a 1.2 cm left epidural abscess with a focus of air and local leptomeningeal enhancement. The patient was taken to the operating room for sinonasal endoscopy, bilateral maxillary antrostomies, left anterior ethmoidectomy, as well as a left frontal craniotomy and drainage of abscess. Intraoperative culture of the sinus contents was consistent with Group C Beta-hemolytic Streptococcus and of the epidural fluid revealed *Prevotella intermedia*.

Conclusion: Pediatric sinusitis with IC is a rare and life threatening condition commonly resulting in meningitis, epidural empyema and abscess, venous sinus thrombosis, and brain abscess. Most cases in the literature are treated with surgical intervention and a long-term antibiotic course (4 -8 weeks).

An interdisciplinary cooperation is paramount for successfully treating pediatric sinusitis with IC.

Abstract ID# 1024

**Fronto-orbital mucocele management with steroid eluting stent**

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Endoscopic marsupialization of paranasal sinus mucoceles is highly efficacious, with rare recurrences due to restenosis or recurrent polyposis. Non absorbable stents have been used to prevent re-stenosis in higher risk patients (e.g. previous trauma, difficult anatomy, recurrent mucoceles). More recently, bioabsorbable steroid-eluting stents have been introduced to reduce post-operative adhesions and recurrent polyposis in patients with chronic rhinosinusitis. We present a case in which a bioabsorbable steroid-eluting stent was placed to maintain patency and prevent restenosis of an endoscopically marsupialized fronto-orbital mucocele. This technique may represent a practical and cost effective way to maintain patency of recurrent or difficult to access sinus mucoceles.

Abstract ID# 1015

**Genealogical databases as a tool for extending follow-up in clinical reviews**

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Introduction: Long-term follow-up in clinical reviews often presents significant difficulty with conventional medical records. Publicly accessible genealogical databases such as Ancestry.com provide another avenue for obtaining extended follow-up and added outcome information such as time, place, and cause of death and identified surviving relatives.

Methods: Ancestry.com, the largest genealogical database in the U.S., houses extensive demographic data on an increasing number of Americans. In a recent clinical retrospective review of esthesioneuroblastoma patients treated at our institution, we used this resource to ascertain the outcomes of patients otherwise lost to follow-up. Additional information such as quality of life and supplemental treatments the patient may have received at home was obtained through direct contact with living relatives.

Results: The use of Ancestry.com resulted in a 25 percent increase in follow-up duration as well as incorporation of an additional 30 percent of patients in our study that would otherwise not have had adequate data for inclusion. Many patients within this subset had more advanced disease or were remotely located from our institution. As such, exclusion of these outliers can impact the quality of subsequent outcome analysis.

Conclusions: Online genealogical databases provide a unique resource of public information that is acceptable to institutional review boards for patient follow-up in clinical reviews. Utilization of Ancestry.com has led to significant

improvement in follow-up duration and has increased the number of patients with sufficient data that could be included in a retrospective study of esthesioneuroblastoma patients at our institution.

Abstract ID# 1077

#### **Glubran-2: a new alternative for nasal packing**

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**Introduction:** Nasal packs are commonly used for supporting mucoperichondrial flaps after septoplasty operations. However, they cause pain and patient discomfort. Recent studies have focused on alternatives avoiding these problems. We evaluated histopathological effects of a new tissue adhesive named Glubran-2 (n-butyl cyanoacrylate methacryloxysulpholan) on animal model.

**Methods:** Thirty adult rabbits were randomly divided into three groups. Group-1 consisted of 6 rabbits. Group-2 and group-3 consisted of 12 rabbits. Rabbits in group-1 served as negative controls. They were sacrificed following removal of their nasal septum. In group-2 unilateral mucoperichondrial flap was elevated and unilateral nasal packing was inserted. In group-3 unilateral mucoperichondrial flap was elevated and Glubran-2 applied between the flap and the septal cartilage. Rabbits in group-2 and group-3 were sacrificed at 3rd and 8th weeks in order to evaluate early and late histopathological changes.

**Results:** Mild mucosal inflammation was observed in group-2 and group-3. Mucosal ulceration was not seen in any group. Mild mucosal thickening was detected in group-3 at 8th week. Significant decrease of septal cartilage thickness was observed in group-2 and group-3, without inflammation or degeneration of the septal cartilage.

**Conclusion:** We concluded that Glubran-2 doesn't cause significant histopathological response in nasal septal tissues in animal model and can be tried in septoplasty operations in humans.

Abstract ID# 1074

#### **Identification of potential risk factors associated with development of synechiae following functional endoscopic sinus surgery: a retrospective review**

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**Background:** Synechiae formation in the middle meatus is the most common complications of functional endoscopic sinus surgery (FESS). Our objectives were to determine the incidence of synechiae occurring in a cohort of patients that had undergone FESS, identify characteristics associated with development of synechiae postoperatively and to construct a

predictive model to estimate the probability of developing synechiae.

**Methods:** This retrospective study examined CRS patients with or without nasal polyposis (NP) that had undergone bilateral FESS at a tertiary rhinology centre. All patients received non-absorbable spacers intraoperatively that were left in situ for six days. Demographic and preoperative variables were analyzed to identify synechiae risk factors.

**Results:** Two hundred cases that had received bilateral FESS were retrospectively reviewed. Thirty-eight (19.0% 95%CI: 13.6 – 24.4%) patients developed synechiae. Individuals receiving primary FESS and nasal septal reconstruction (NSR) were strongly associated with the development of synechiae (OR: 3.5, 95%CI: 1.5 – 8.5; OR: 3.0, 95%CI: 1.3 – 6.9). The variables included in the final predictive model were nasal septal reconstruction, primary vs. revision FESS, concha bullosa, requirement of anterior and posterior ethmoidectomy, Lund-Mackay CT score and gender. The predictive model resulted in a sensitivity of 68%, specificity of 73%, positive predictive value of 38% and likelihood ratio of 2.5.

**Conclusion:** Patients undergoing primary FESS and NSR are at greatest odds of developing postoperative synechiae. Potential methods of assessing risk factors and preventing synechiae formation in this population should be evaluated in future studies.

Abstract ID# 966

#### **Image-guided balloon dilatation of sinus ostia in the office setting**

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**Introduction:** Balloon dilatation of sinus ostia has gained increasing popularity as an office-procedure; however, appropriate placement of the balloon catheter may be a challenge, particularly in the outpatient office. Recently, an image-guided balloon catheter system (NuVent, Medtronic ENT, Jacksonville, FL) was introduced.

**Methods:** Charts of 8 patients (7 men and 1 woman, age range 27-68 years), who underwent image-guided balloon dilatation of sinus ostia in the office, were reviewed.

**Results:** Anesthesia consisted of topical 4% lidocaine and 0.01% oxymetazoline, supplemented with infiltration of 1% lidocaine with 1:100,000 epinephrine (3 ml per side) at the sphenopalatine region and the uncinate process on each side. Contour-based registration was performed, and better than 2 mm accuracy was achieved. No slippage of the headset was observed. Balloon dilation of the maxillary sinus (n=11) and frontal sinus (n=14) was performed. Partial ethmoidectomy was performed on 5 sides. The procedure was not completed for 1 maxillary and 1 frontal sinus. Postprocedure reports from patients confirmed a high degree of patient acceptance. Placement of rigid balloon devices was difficult, although the information provided by surgical navigation served to confirm appropriate placement.

**Conclusions:** Image-guided balloon dilatation of sinus ostia may be performed in the office setting in select patients. Surgical navigation enhances surgeon confidence in appro-



prate placement of the balloon catheter. Further investigations should explore the optimal indications for this technology. Additional refinements in instrument and software design are also warranted.

Abstract ID# 1098

### **Improving reliability in stereotactic imaging for endonasal surgery with use granular jamming**

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**Background:** Traditional headband fixation with stereotactic image guidance in endonasal surgery allows for significant movement on the forehead and thus potential for decrease in accuracy, resulting larger target registration error (TRE). In prior studies, it was determined the TRE for traditional headband to be 5.47 mm versus 3.53 of granular jamming. We simulated the use of granular jamming fixation as an alternative to help mitigate these errors, while remaining non-invasive.

**Methods:** Endoscopic drilling of phantom sphenoid sinus masses were simulated by a trained endoscopic skull base surgeon, with the aid of stereotactic imaging registered by both traditional headband and granular jamming fixation (helmet). After 5 min of drilling, unknown to the surgeon, their maximum TRE was introduced. After completion of resection, the sphenoid sinus was reanalyzed using a conoscope. Comparison measurements included time to complete drilling, volume of mass resected, and percentage of mass.

**Results:** Traditional headband and jamming fixation helmet both had acceptable TRE of 0.58 mm and 0.79 mm respectively. After maximal TRE was introduced, traditional headband registration resulted in only 32.98% of tumor resection taking 20 minutes. This compares to that of the jamming fixation helmet with a resection of 73.07% of tumor in 15 minutes.

**Conclusion:** By using a novel granular jamming fixation point in stereotactic registration, we have shown that this can help decrease TRE. In return, under simulation, this resulted in more complete tumor resection in less time. In real world application, this would hopefully result in decrease operative time and decrease in complications.

Abstract ID# 995

### **Incidental finding of lymphoma following septoplasty**

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**Introduction:** Septoplasty, or surgical correction of the deviated septum, is an elective, routinely performed rhinologic procedure to address nasal airway obstruction. In many cases, resected septal cartilage and bone fragments are sent for pathologic review. We report two cases of incidentally

diagnosed lymphoma following elective septoplasty and discuss clinical presentation, diagnosis, and management.

**Methods:** Retrospective review of patients who underwent septoplasty at a tertiary academic medical center between July 1, 2000 and December 31, 2014.

**Results:** Two patients who underwent septoplasty had an incidental diagnosis of lymphoma on pathologic analysis. One patient was noted to have an S-shaped septal deviation producing bilateral nasal obstruction. She underwent a difficult septoplasty, where the mucoperichondrial flap was firmly adherent to the underlying septum and bone. Final pathology demonstrated diffuse large B-cell lymphoma. She was treated with chemoradiation and remains free of disease for 56 months. The other patient had a history of nasal trauma producing left septal deviation. He underwent an uncomplicated septoplasty, with pathology demonstrating low-grade B-cell lymphoma. As there is no further evidence of active disease, he will be monitored closely over the next few months.

**Conclusion:** This is the first reported series of septal lymphoma incidentally diagnosed on septoplasty. Although histopathologic review of specimens from routine nasal and sinus surgery is not always performed, this report highlights the importance of this process in detecting unexpected malignancies which otherwise were clinically silent.

Abstract ID# 943

### **In-office balloon sinus dilation vs medical therapy for recurrent acute rhinosinusitis: Interim results from a randomized, placebo-controlled multi-institutional study**

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**Introduction:** Limited uncontrolled studies evaluating recurrent acute rhinosinusitis (RARS) patients treated with endoscopic sinus surgery have been reported. This study evaluates outcomes of balloon sinus dilation (BSD) performed in-office (IO) versus medical management (MM) for RARS patients.

**Methods:** Adults diagnosed with RARS per AAO-HNS guidelines were enrolled. Subjects were randomized 1:1 to BSD-IO plus MM or MM alone. The MM arm received a sham BSD-IO procedure to blind subjects to group assignment. Strength of blinding was assessed post-procedure and at 8 weeks. The primary outcome was the difference in the Chronic Sinusitis Survey (CSS) score at 24 weeks compared to baseline.

**Results:** Interim data include 24 subjects randomized to BSD and 22 to MM. Baseline characteristics were not significantly different between groups. Twenty-four week CSS results from 19 BSD and 18 MM subjects show mean (SE) CSS changes from baseline of 39.3 (5.4) and 20.1 (5.7) respectively ( $p=0.02$ ). Measures of blinding success post-procedure indicate 84.0% of BSD and 72.7% of MM subjects believed they had BSD ( $p=0.4796$ ). At 8 weeks, 85.7% of BSD and 55.0% of MM subjects believed they had BSD ( $p=0.0430$ ).

Conclusion: Interim results suggest subjects were effectively blinded to group assignment and that BSD-IO plus MM is superior to MM alone in enhancing the quality of life for patients with RARS. To our knowledge, this is the first sinus surgery study to use a sham surgical procedure to blind participants.

Abstract ID# 935

**Intracranial complications of Sinusitis: a 17-year review of 48 cases**

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Introduction: Intracranial complications of sinusitis (ICS) are infrequent, but are associated with potentially fatal outcomes. The aim of this study is to review our experience with ICS.

Methods: A retrospective chart review was conducted using ICD-9 codes to identify patients treated for ICS at a medical center from 1997 to 2014. Data regarding patient demographics, presentation, types of intracranial complication, microbiology, sinuses involved, treatment, and outcome were collected and analyzed.

Results: Forty-eight patients diagnosed with ICS were identified, including 27 pediatric patients and 21 adult patients. The most frequent presenting symptoms were headache and fever. A variety of ICS were identified, including meningitis (19), epidural abscess (10), subdural abscess (9), encephalitis (8), brain abscess (6), multiple intracranial abscesses (5), cavernous sinus thrombosis (5), and superior sagittal sinus thrombosis (1). Meningitis was more common in adult patients ( $P = 0.028$ ), while intracranial abscess was more common in pediatric patients ( $P = 0.005$ ). Frontal sinus was found to be the only significant sinus associated with ICS types ( $P = 0.004$ ). The most common pathogens were *Streptococcus anginosus* (19), highly associated with intracranial abscess ( $P = 0.0002$ ) and frontal sinusitis ( $P = 0.004$ ). There were 12 patients treated with medical therapy alone, and the other 36 patients received intravenous antibiotics and surgical drainage. No mortality occurred, but 6 patients were noted with long-term morbidity.

Conclusion: The study revealed ICS as a complicated and challenging diseases. A high index of suspicion to make early diagnosis and aggressive management can prevent mortality and permanent sequelae.

Abstract ID# 1104

**Intranasal cross-sectional area and quality-of-life changes following endoscopic transsphenoidal skull base surgery**

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Introduction: Endoscopic transsphenoidal surgical approaches to the skull base may produce alteration of intranasal

architecture, yet the effect on nasal airflow and corresponding changes on quality of life (QOL) is not well established. Acoustic rhinometry (AR) can provide quantitative data on the intranasal airway, but has not been previously applied to skull base surgery. We sought to employ AR to quantify the changes in nasal architecture following endoscopic transsphenoidal surgery and the relationship with septal deviation, nasoseptal flap harvest, and sinonasal QOL.

Methods: Consecutive patients undergoing endoscopic transsphenoidal resection of a sellar or suprasellar tumor were prospectively enrolled. All subjects were adults who completed AR and the sinonasal outcome test (SNOT-22) pre- and postoperatively. Cross-sectional area (CSA) was recorded at the internal nasal valve (CSA1), middle turbinate head (CSA2) and middle turbinate body (CSA3). Normative data were also collected from a larger cohort.

Results: Forty patients completed pre- and post-operative assessment. Significant increases occurred postoperatively in mean CSA2 (1.08 cm<sup>2</sup>) and CSA3 (2.47 cm<sup>2</sup>) ( $p < 0.001$ ), whereas CSA1 remained unchanged. Nasoseptal flap harvest did not significantly alter postoperative AR values. Mean SNOT-22 scores improved from 23.0 to 17.8 ( $p = 0.001$ ), though strong correlation was not found with change in AR values. Pre- and postoperative QOL scores were not significantly affected by the presence of nasal septal deviation.

Conclusion: The endoscopic transsphenoidal approach to the skull base results in increased intranasal area and improved sinonasal QOL. These effects are independent of the presence of septal deviation or the use of a nasoseptal flap.

Abstract ID# 970

**iPhone-adapted endoscopy technology provides adequate image quality for diagnostic nasal endoscopy**

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Introduction: Mobile technology has been used in the health-care setting to facilitate fiberoptic intubation, endoscopic urological evaluation, and ventricular catheter placement. We assessed the adequacy of an iPhone-adapted video capture system for endoscopic evaluation in rhinology.

Methods: Bilateral rigid nasal endoscopy was performed on fifteen freshly thawed cadaver heads for a total of thirty sides. Images were captured using a high definition (HD) camera and an iPhone compatible endoscope adapter device. A total of 60 videos were obtained, randomized, and presented to two separate expert reviewers in a blinded fashion. Videos were graded on a 5-point Likert scale for resolution, brightness, color, and overall quality. Reviewers were asked if the images were sufficient for diagnosis. Quality variables were compared using a Wilcoxon matched pairs signed rank test. Diagnostic adequacy was compared using Fisher's exact test.

Results: All videos were adequate for diagnosis regardless of the video capture method. There was no difference in diagnostic adequacy between the two video capture devices ( $p = 1.0$ ). Difference in the ratings of resolution, brightness, color, and overall quality were found between the two devices

( $p < 0.0001$ ). However, the differences were small, with median quality differences rated between 0-2 on the 5-point Likert scale.

Conclusion: Mobile adapted endoscopy equipment allows for remote image capture and video sharing with an ease that has not been previously available. The tested mobile endoscope adapter captured video of sufficient quality for diagnosis.

Abstract ID# 1063

**Isolated chronic nasopharyngitis: Clinical presentation, treatment, and outcomes**

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Introduction: Isolated chronic nasopharyngitis (CNP), ICD-9 code 472.2, is a seldom reported condition that is mistaken as chronic rhinosinusitis (CRS) or recurring acute rhinosinusitis (RARS). The objective of this study is to determine symptoms and clinical exam findings that differentiate CNP from CRS and RARS as well as to identify possible treatment strategies for this type of nasopharyngitis.

Methods: Retrospective case-series report of patients diagnosed with CNP from 2012-2014. Patient demographic information, presenting symptoms, exam findings and treatments are described. Criteria for exclusion included failure to follow up and symptoms primarily related to documented rhinosinusitis.

Results: Twenty-six patients with CNP were identified, whereas half (13) had isolated nasopharyngeal inflammation. The most common presenting symptom was postnasal drip (12/13), often involving small amounts of intermittent purulent debris or crusts. Additional symptoms included nasal congestion (11/13), cough (7/13), auricular fullness (7/13), and throat clearing (5/13). Eight patients had purulence in the nasopharynx (without adenoidal tissue) and 12 had erythema. *S. aureus* was the most common organism cultured. While overt acid reflux symptoms were present in 5/13 patients, all were treated with proton pump inhibitors. Additionally, 11/13 patients were managed with antimicrobial therapy. One patient underwent nasopharyngeal cauterization. Sustained symptom improvement was seen in 8/13 patients.

Conclusion: Isolated CNP is a clinical entity that resembles CRS & RARS, has been overlooked, and demands additional research. It may be multifactorial in its etiology including: inhaled allergy, extra-esophageal reflux and bacterial biofilms. Clinical suspicion and endoscopy of the sinonasal passages, nasopharynx and larynx are paramount in proper identification and subsequent management of this disorder.

Abstract ID# 1062

**Isolated orbital wall fractures - distribution, mechanism, and clinical significance**

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Introduction: The purpose of this study was to characterize the prevalence, distribution, and clinical significance of isolated orbital wall fractures.

Methods: A retrospective analysis was carried out of a consecutive series of computed tomography (CT) head and sinus imaging performed between 1/1/2010 and 7/1/2014 in a university department picture archive to evaluate for orbital fractures. Corresponding electronic medical records were obtained to evaluate for specific adverse clinical outcomes.

Results: Isolated floor, roof, and medial wall fractures demonstrated an even distribution, however, lateral wall fractures were infrequent. Of the total of 50 patients who were evaluated, 9 did not have adequate follow-up to evaluate for clinical consequences while 1 patient had an unsatisfactory clinical examination to properly assess outcomes. Of the 40 remaining patients, 10 (25%) suffered at least one adverse clinical outcome at either discharge or follow-up related to the orbital wall pathology. Isolated orbital roof fractures were associated with no adverse clinical consequences.

Conclusion: The majority of orbital roof fractures were associated with blunt trauma and frontal scalp hematomas - suggesting a buckling mechanism. The most adverse clinical outcomes were seen with fractures involving the medial orbital wall and/or orbital floor whose event patterns suggested a hydraulic mechanism. There were significant differences in fracture displacement when comparing roof fractures (low displacement) to medial and floor fractures ( $p < 0.001$ ). Further research is needed to evaluate the possibility of predictive adverse event modeling for isolated orbital wall fractures and to recommend alternative clinical management based on imaging patterns alone.

Abstract ID# 1035

**Lateral recess sphenoid sinus inverted papilloma with dehiscent carotid artery**

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Introduction: Inverted papilloma (IP) is a benign sinonasal tumor characterized by aggressive local invasion and high recurrence rate. IP arising from the sphenoid sinus is rare. Extension from the lateral recess and proximity or involvement of critical skull base structures can make surgical resection of sphenoid sinus IP challenging. Sphenoid IP arising from the lateral recess has only been reported in a handful of cases. We report the second case of lateral recess sphenoid IP associated with a dehiscent carotid artery, and discuss surgical considerations for complete primary resection.

Methods: We present a case of a 63 year old man with sphenoid sinus IP.

Results: A 63-year-old man presented with 2-year history of left nasal obstruction. Nasal endoscopy demonstrated a papillomatous lesion in the left sphenoidal recess, and subsequent biopsy confirmed inverted papilloma. Computed tomographic (CT) scan showed complete left sphenoid sinus opacification and bony dehiscence over the lateral sphenoid wall. Intraoperative evaluation demonstrated the IP stalk arose from the lateral recess of the sphenoid sinus with a bony dehiscence over the carotid artery. Surgical resection included bilateral sphenoidectomy and extended left sphenoidectomy with removal of the posterior septum, intersinus septum, and vidian canal. Wide surgical exposure along with a bi-naris endoscopic approach with angled instrumentation allowed for complete resection and avoided complications.

Conclusion: IP arising from the lateral recess of the sphenoid sinus is rare and challenging. Associated carotid artery dehiscence has only been described in 1 case. Generous endoscopic exposure and advanced techniques allow for complete resection.

Abstract ID# 947

**Lobular capillary hemangioma formation: an unusual late complication of submucous resection with power instrumentation of the inferior turbinate**

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Submucous resection with powered instrumentation (SRPI) is an effective surgical method to achieve inferior turbinate (IT) reduction with minimal morbidity. We describe a series of 2 cases of capillary hemangioma (pyogenic granuloma) that developed in the posterior third of the inferior turbinate as a late complication after SRPI.

Methods: Case report and literature review.

Results: A 38-year-old male complained of nasal obstruction that failed to respond medical therapy. He underwent septoplasty and SRPI of the IT with resolution of symptoms. The patient presented back six years later with complaints of left sided epistaxis and progressive obstruction. Office nasal endoscopy revealed a round, reddish mass arising from the IT. A computed Tomography (CT) documented an enhancing lesion. The lesion was resected and surgical pathology was consistent with lobular capillary hemangioma.

A 40-year-old male presented with complaints of bilateral nasal blockage and snoring and past medical history of septoplasty. After failing medical therapy with intranasal corticosteroid sprays, he underwent revision septoplasty with SRPI of the IT. Three months following the operation he presented with recurrent nasal obstruction. Office nasal endoscopy revealed bluish pedunculated mass arising from the IT. He underwent transnasal excision biopsy and surgical pathology was consistent with lobular capillary hemangioma.

Conclusion: This is the first report case of hemangioma following SRPI. We report two unique cases of lobular capillary hemangioma as late surgical complications following SRPI of the inferior turbinate. Transnasal endoscopic resection with powered instruments is still an effective treatment with low surgical morbidity and high long-term cure.

Abstract ID# 1023

**Management of rhinosinusitis during pregnancy: systematic review and expert panel recommendations**

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Objectives: Study management of rhinosinusitis during pregnancy

Methods: 1. Systematic review 2. Expert-panel recommendations

A systematic review was conducted using Medline (1966-2014) and Embase (1980-2014) databases. Title, abstract and full manuscript review were conducted by two authors independently. Search terms included "rhinitis" OR "sinusitis" OR "rhinosinusitis" AND "pregnant" OR "women" OR "gender". Additional terms included "skull base", "CSF", "corticosteroid" and "aspirin". If the abstract noted outcomes specific to women, the full manuscript, references and citations were reviewed. A multispecialty panel with expertise in management of Rhinological disorders, Allergy-Immunology and Obstetrics-Gynecology was invited to review the systematic review. Specific recommendations on managing rhinosinusitis during pregnancy were sought regarding: oral corticosteroids, antibiotics, leukotrienes; topical corticosteroid spray/irrigations/ drops; aspirin for maintaining desensitization; elective surgery for chronic rhinosinusitis (CRS) with polyps prior to planned pregnancy; advice on vaginal birth versus planned Caesarian for skull base erosions/ prior CSF rhinorrhea.

Results: Of 3052 abstracts, 88 full manuscripts were reviewed. No Level 1, 2 or 3 level studies for rhinosinusitis management in pregnancy were found; publications predominantly related to allergic and pregnancy-related rhinitis. Two RCTs studied hypertonic saline nasal lavage and fluticasone nasal spray for allergic rhinitis during pregnancy. Another RCT showed phenylpropranolamine (withdrawn from US) to be effective for pregnancy rhinitis. The expert panel generated recommendations.

Conclusion: This study highlights the need for future trials to guide rhinosinusitis management during pregnancy. Expert-panel recommendations currently compose the best evidence. While conducting trials during pregnancy are challenging, large population-based case-control studies (as with inhaled steroid/asthma) are options.

Abstract ID# 1083

**Metastatic squamous cell carcinoma of the maxillary sinus: a population-based analysis**

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**Background:** Squamous cell carcinoma (SCC) accounts for over 90% of head and neck cancers and 60% to 75% of malignancies of the paranasal sinuses. The most commonly affected paranasal sinus is the maxillary sinus. Epidemiologic, incidence, and survival trends have been studied for SCC of the maxillary sinus, but far less is known about metastasis.

**Methods:** The SEER database was used to extract data for SCC of the maxillary sinus between 2004 and 2011. The resultant cases were stratified according to collaborative stage information, including extent of disease, TNM staging, and regional and distant metastasis.

**Results:** 748 cases of SCC of the maxillary sinus were identified. Neck metastasis was present in 15.4% of cases, whereas distant metastasis was noted in 3.6% of cases. Combined metastasis to the neck and to distant sites was noted in 0.9% of cases, while another 4.4% of cases had unspecified nodal involvement. Neck metastasis was demonstrated in 8.4% of T1 tumors (N=71), 16.4% of T2 tumors (N=54), 14.6% of T3 tumors (N=185), and 17.6% of T4 tumors (N=393). Distant metastasis was not seen in T1 tumors, but was present in 7.3% of T2 tumors, 2.2% of T3 tumors, and 4.6% of T4 tumors.

**Conclusion:** Our study indicates that SCC of the maxillary sinus tends to metastasize to the neck and to distant sites. T1 tumors did not metastasize to distant sites and, therefore, metastatic workup for these cases may be limited to the neck. In all other instances, a comprehensive metastatic workup is warranted.

Abstract ID# 1032

**Midline nasal destructive lesion and skin lesion induced by nasal cocaine**

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**Introduction:** We present the case of a 51 yo male with progressive nasal congestion, voice changes, and enlarging skin lesions. Patient was found to have cocaine abuse with adulterant levamisole contamination. Review of case along with relevant literature is performed.

**Methods:** Case series of one patient with unusual presentation of cocaine induced lesions including osseocartilaginous nasal destruction, palatal fistula, facial and other site skin lesions.

**Findings:** Patient admitted to recent cocaine use after positive toxicology testing which also showed levamisole. Testing of the skin lesions was ANCA positive, while anti-MPO and PR3 were negative. Further workup failed to show any infectious component or evidence of vasculitis. It was felt the skin

lesions were likely related to levamisole. Once cocaine use was terminated, the lesions began to spontaneously regress.

**Conclusion:** Evaluation of nasal destructive lesions should always include cocaine abuse within the differential of other autoimmune or infectious etiologies. The presence of ulcerative skin lesions in conjunction with nasal pathology should raise concern for levamisole adulteration.

Abstract ID# 945

**Nasal epithelial myoepithelial carcinoma: an unusual cause of epiphora, a case report and review of the literature**

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**Background:** Epithelial myoepithelial carcinoma of the nasal cavity is a rare tumor that can result in unilateral epiphora. A case presentation and review of the literature is provided.

**Methods:** A case report is described for a 63 year-old man who presented with unilateral epiphora and was found to have epithelial myoepithelial carcinoma of the nasal cavity. A Pubmed search was performed to gain insights into similar malignancies of the nasal cavity.

**Results:** Seven cases of epithelial myoepithelial carcinoma of the nasal cavity were identified in the literature, none of which presented with epiphora. The case presented here resulted in resolution of symptoms and no evidence of disease following surgical excision.

**Conclusion:** Epithelial myoepithelial is a rare salivary gland malignancy that can arise in the nasal cavity. Unilateral epiphora should prompt nasal cavity examination for the possibility of an obstructive tumor.

Abstract ID# 1109

**Nasal septal abscess in association with pediatric acute rhinosinusitis**

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**Introduction:** Nasal septal abscess (NSA) in the pediatric population is rare and can result in devastating complications. Acutely, the infection can spread contiguously intracranially and, long term, cartilaginous destruction can result in saddle nose deformity. NSA is more commonly associated with nasal trauma but, in rare cases, can occur concomitantly with acute rhinosinusitis (ARS). In these cases, is it not clear if ARS is followed by the development of NSA, or vice versa. We present a case series of pediatric patients presenting with NSA in association with ARS.

**Method:** Retrospective case series.

**Results:** Five patients with NSA were treated by the pediatric otolaryngology department of a tertiary care center from 2003 to 2014. Three of these cases were associated with ARS. Of

these cases, the average age at diagnosis was 9.7 years. Two were male and one was female. In these cases, the bilateral frontal, maxillary and ethmoid sinuses were involved. Sphenoid involvement occurred in two patients. One case was associated with ipsilateral middle turbinate concha bullosa. The cartilaginous septum was compromised in all three cases. All patients were treated with incision and drainage.

**Conclusion:** This is the largest case series of NSA described in the pediatric population. NSA is exceedingly rare but may be associated with ARS. While the etiology of NSA is not always clear, identifying and treating nasal septal abscesses early is imperative to reduce potentially devastating complications.

Abstract ID# 1041

**Nasal septal perforations: physiologic modeling with computational fluid dynamics**

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**Introduction:** Nasal septal perforations (NSPs) often cause bleeding, crusting, obstruction, and/or whistling. The objective of this study was to analyze the impact of NSP size on nasal physiology using computational fluid dynamics (CFD).

**Methods:** A 3-dimensional model of the nasal cavity was constructed from a radiologically normal CT scan using imaging software. Ovoid anterior NSPs that were 0.5, 1, 2, and 3 cm long anterior-to-posteriorly were virtually created in the normal nasal airway. Perforation walls were divided into ventral, dorsal, anterior, and posterior regions. Steady-state inspiratory airflow, heat, and water vapor transport were simulated using CFD software. Air crossover through the perforation, wall shear, resistance, heat flux, water vapor flux, and humidification were analyzed.

**Results:** Air crossover and average wall shear increased with perforation size. Regionally, wall shear and heat and water vapor flux were consistently highest posteriorly and lowest anteriorly, generally increasing with size in those regions. Dorsal and ventral values did not correlate with size. Resistance decreased by 5% or more from normal only in the 3 cm perforation case. No change in humidification with perforation size was evident.

**Conclusion:** High wall shear and heat and water vapor flux in posterior perforation regions may explain the crusting most commonly noted on posterior edges of NSPs. This preliminary study suggests that smaller NSPs may not grossly affect nasal resistance or humidification, and that perforation size effects on individual airflow patterns may be important in dorsal and ventral perforation regions. Further studies should correlate these findings with clinical implications.

Abstract ID# 979

**Nasolabial cyst: a case report**

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Nasolabial cysts are one of those nonodontogenic, rarely experienced maxillofacial region cysts. Embryologic tissue remnants are the culprits for the underlying pathogenesis. A 27-old female patient was admitted to our clinic with complaint of nasal swelling extending from left lower part of the nose to the upper lip. Patient's history revealed that she noticed the swelling two years ago and since that time there has not been significant enlargement in the size of the swelling. There was no history of previous surgery or trauma to oro-nasal region. Physical examination revealed 2x2 cm in size, well circumscribed round, soft consistency mass that is localized in nasolabial fold. The mass was obstructing left nasal vestibule from anterior of the left inferior turbinate. There were no signs of inflammation or infection. Maxillofacial computed tomography showed a well-circumscribed cystic mass that is extending from the left nasal vestibule to upper lip inferiorly without causing any destruction in bony tissue. The mass was excised as unblock via a left gingivobuccal incision under local anesthesia. No compression was applied to operation area. The pathological examination of the lesion was reported as benign cystic mass lined with respiratory epithelium. There were no postoperative complication and the lesion did not recur within six-month follow up period. In conclusion, nasolabial cyst is a rare type of maxillofacial cysts that otolaryngologists may experience during their practice. The diagnosis of nasolabial cysts should be based on clinical and imaging method findings.

Abstract ID# 1103

**Not your typical lymphoma - a rare presentation of primary extranodal Hodgkin disease of the maxillary sinus**

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**Introduction:** Sinonasal lymphomas represent only 1.5% of all lymphomas, with Hodgkin lymphoma occurring significantly less frequently than non-Hodgkin types.

**Case Report:** Here we present an unusual and rare case of primary extranodal Hodgkin disease of the maxillary sinus in a 74 year-old Caucasian female who presented to her primary care physician with right cheek paresthesia.

**Conclusion:** Important considerations are required preoperatively prior to excising biopsying unusual and/or malignant appearing sinonasal masses. The diagnosis in this case was only obtained due to diligence pre- and intraoperatively to assure sufficient tissue was obtained and the pathologist was informed of the radiologic concern for the a lymphoproliferative etiology. Furthermore, the surgical and medical management of extranodal sinonasal Hodgkin's disease is discussed along with a current review of the literature.

Abstract ID# 1028

**Novel approach to choanal atresia with steroid drug alluding stents**

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Choanal atresia frequently is a difficult airway/skull base issue to successfully treat requiring multiple revision surgeries.

We presented a case of a craniofacial patient with narrowed nasopharyngeal opening and congenital choanal atresia previously operated on 20 times for choanal atresia with successful long term success.

Our novel approach using standard surgical techniques with the inclusion of placement of a expandable steroid drug alluding dissolving stent at the time of surgical repair showed successful long term repair (1 year follow up) with an excellent patent nasal airway. Previous repairs on the same area were patent for at most 3 weeks.

This novel use of adjunctive therapy has potential application for tickled stenosis in the airway and provides an alternate method for difficult to treat nasal and choanal stenosis/atresia patients.

Abstract ID# 988

**Novel surgical approach for cavernous hemangioma in nasal bone and systematic review of literature**

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Outcome Objectives: 1) Describe the first-ever use of endoscopic endonasal approach (EEA) for the excision of a rare vascular tumor (cavernous hemangioma) isolated to the nasal bone.

2) Provide a systematic review of intraosseous vascular malformations of the midface and compare the surgical approaches used in treating these rare tumors.

Study Design: Case report and literature review.

Methods: The case history, physical examination, clinical course, radiographic images, and pathology slides are presented. Corresponding literature search of all reports of interosseous hemangiomas in the midface is systematically reviewed.

Results: Fewer than 40 cases within the midface bony skeleton have been previously described. All prior nasal bone lesions were treated with open rhinotomy or open orbitotomy, with EEA reserved for lesions of the nasal cavity or adjacent skull base. In those reports, EEA was shown to be an effective alternative for full resection without recurrence. In our case, a 66 year old woman presented with an incidentally-found lytic mass originating in the left nasal bone. The lesion was removed en bloc using EEA with an adjacent mucosal flap reconstruction. It was confirmed pathologically to be a cavernous hemangioma.

Conclusion: Herein we describe the first-ever nasal bone

cavernous hemangioma removed via EEA. For all previously described midface lesions accessible by endoscopic techniques, the reported surgical outcomes and complications were similar or better than those treated with open surgical techniques. We propose that endoscopic approaches should be considered exclusively over alternative open techniques for these benign tumors.

Abstract ID# 963

**Objective sinonasal functional outcomes in endoscopic anterior skull base surgery: an evidence based review with recommendations**

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Introduction: The use of endoscopic endonasal approaches to the anterior skull base has dramatically expanded in recent years, with clinical end-points and complication rates comparable to traditional approaches. Improved quality of life post surgery has also been well described. The impact of the endoscopic approach on sinonasal function has been less well evaluated. The purpose of this study was to systematically evaluate the literature evaluating objective sinonasal outcomes in endoscopic anterior skull base surgery, and provide evidence-based recommendations.

Methods: A systematic review of the literature was performed based on a published guideline for developing an evidence-based review with recommendations. Objective sinonasal outcomes included were olfaction, mucociliary clearance and nasal airflow.

Results: 10 articles were identified addressing objective olfactory outcomes - 2 randomised control trials, 6 cohort studies and 2 retrospective case series. 1 cohort study investigating mucociliary clearance was identified.

Conclusion: Based on the available evidence, nasal-septal flap (NSF) elevation likely leads to impairment in objective olfactory function. Endoscopic sellar and parasellar surgery without the elevation of a NSF, may lead to a transient reduction in olfactory function. In the absence of a high a priori risk of cerebrospinal fluid (CSF) leak, it is an option to avoid routine NSF elevation in sellar and parasellar procedures, with preservation of at least one vascular pedicle during the approach. Monopolar electrocautery for mucosal incisions may increase the risk of unintended olfactory mucosal damage. Due to limited evidence, no conclusions can be reached of the impact on mucociliary function or nasal airflow.

Abstract ID#: 967

### **Obstructing pediatric nasopharyngeal lobular capillary hemangioma after adenoidectomy**

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**Introduction:** Lobular capillary hemangiomas, historically known as pyogenic granulomas, are benign vascular lesions of the skin or mucous membranes. They most commonly affect children and young adults and often present in the head and neck. While LCH have rarely been reported in the pediatric nasal cavity, there have been no previous reports of occurrence in the nasopharynx.

**Methods:** A retrospective chart review and relevant literature search were performed.

**Results:** A 3 year old girl presented with recurrent symptoms of sleep disordered breathing and awake stertor approximately 4 months after undergoing an adenotonsillectomy. Flexible nasopharyngoscopy demonstrated a posterosuperiorly based pedunculated nasopharyngeal mass causing near total choanal obstruction. Magnetic resonance imaging revealed a 1.0 x 0.9 cm peripherally enhancing mass with no evidence of bony or intracranial extension. The mass was excised en bloc via a transnasal endoscopic approach. Pathologic examination demonstrated a lobular capillary hemangioma. On postoperative follow up, the patient had no evidence of recurrence, and her sleep-disordered breathing had resolved.

**Conclusion:** While the exact etiology of lobular capillary hemangiomas remains unclear, some authors suggest these lesions form via inflammatory reactions at sites of previous trauma. This case may lend credence to this theory since the mass developed at the site of previous adenoidectomy. Lobular capillary hemangioma should be included in the differential diagnosis for pediatric nasopharyngeal masses, especially in the context of recent adenoidectomy or other local trauma.

Abstract ID# 946

### **Ossifying fibroma of the maxilla and sinonasal tract: case series**

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**Background:** Head and neck ossifying fibroma (OF) is a rare, benign, locally aggressive, fibro-osseous tumor. The mandible is the most common site of involvement followed by the maxilla, and less frequently, the sinonasal cavities, orbit, skull base, and calvarium. As OFs are often asymptomatic, lesions may go undiagnosed until significant involvement of adjacent structures or facial distortion ensues. In this study, we aim to expand our understanding of this entity by presenting a case series of OF involving the maxilla and sinonasal tract.

**Methods:** A multicenter retrospective review was performed on all patients with a diagnosis of OF from 2004-2013. Data were collected with respect to age, gender, clinical presentation, treatment, and outcome.

**Results:** A total of 13 patients with OF involving the maxilla and paranasal sinuses were identified. The mean age was 37 years (range, 6-75) with a female predominance (69%). The maxillary sinus was the most frequently involved (46%), with an asymptomatic mass the most common presenting sign (54%). 79% required open surgical resection. After a mean follow-up time of 47.3 months, 3 (23%) developed recurrent disease; all of which were treated with surgical removal utilizing either an endoscopic (1) or external (2) approach.

**Conclusion:** OF of the maxilla and sinonasal tract is an uncommon clinicopathologic entity. Although timely diagnosis may obviate the need for external approaches, open surgical resection is often still necessary for management of extensive lesions. Close follow-up and additional surgery may also be required to treat recurrent disease.

Abstract ID# 1100

### **Otorhinolaryngology residency applicant self-assessment Of workload and performance during simulation tasks**

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**Background:** Otorhinolaryngology residency programs rely upon clinical evaluations, board scores, recommendation letters, and co-curricular activities for applicant evaluation. Such measures have not been shown to correlate with technical skill develop during residency. This study investigates the effort expended by applicants during simulation tasks in a residency interview setting.

**Methods:** Seventy nine medical students over the course of two annual residency application cycles performed two simulation tasks: myringotomy and endoscopic sinus grasping. Each applicant's performance was evaluated by an attending surgeon using the Objective Structured Assessment of Technical Skill Global Rating Scale (GRS), and post-task feedback was provided. Each applicant was asked to report user workload and self-assessment of performance using the National Aeronautics and Space Administration Task Load Index (TLX). Pearson's coefficients and stepwise regression were performed to determine whether traditional applicant characteristics successfully predict user workload during task performance.

**Results:** 232 endoscopic grasping trials and 327 myringotomy trials were performed. All subjects demonstrated a significant improvement in GRS score between first and second trials of both tasks ( $p < 0.001$ ). All subjects demonstrated a significant decrease in perceived user workload (lower TLX score) between first and second trials of both tasks ( $p < 0.0001$ ). Change in GRS score and change in TLX score were significantly correlated, but no traditional applicant assessment metrics successfully predicted user workload.

**Conclusion:** While residency applicants are capable of utilizing attending feedback for improvement, widely-used methods of applicant evaluation do not predict the effort utilized by a trainee to improve in simulation task performance.



Abstract ID# 1080

**Outcomes analysis of the surgical management of frontal sinusitis in cystic fibrosis patients**

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**Introduction:** Surgical management of chronic frontal rhinosinusitis (CFRS) is a challenging problem in cystic fibrosis (CF) patients.

**Methods:** A retrospective chart review was undertaken of consecutive adult patients (age > 18) who had CF and CFRS. Patients presented to a single institution's tertiary rhinology clinic and underwent surgery between May 1994-April 2014. Data was collected prospectively by two independent authors (SN & AM).

**Results:** Seventy CF patients (M=33, F=37) were identified meeting the inclusion criteria. Co-morbid conditions secondary to the CF included diabetes (n=41), hepatic cirrhosis (n=6) and lung transplant (n=14). The initial surgical intervention was always a Draf IIa (average age = 24 (range 18-45)). On average, patients underwent only 1 surgery (range 1-6) with patients being followed for 81 months (range 0.5-240) after surgery. Six patients underwent a modified Lothrop procedure (MELP) due to refractory disease. The average age at first intervention, for this sub-group of patients, was 21 and, with an average of 2 endoscopic sinus surgeries (Draf IIa) (range 1-4) prior to undergoing a MELP. Two patients required an osteoplastic flap for refractory frontal sinusitis with one having undergone a MELP prior to the former procedure.

**Conclusion:** CRS in patients with CF is very difficult to manage. This is the largest review of a single-center's experience regarding the management of frontal sinus disease in CF patients. Risk factors which may predict failure of Draf IIa procedure appears to be known history of diabetes, cirrhosis or a lung transplant.

Abstract ID# 1071

**Outcomes and technical nuances of nasoseptal flap skull base reconstruction in patients with prior septal surgery**

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**Introduction:** The vascularized nasoseptal flap (NSF) has been established as the workhorse in skull base reconstructive surgery. The elevation of these flaps in the virgin nose is facile in experienced hands, but the difficulty increases dramatically in the previously operated patient. No prior studies have demonstrated feasibility or effectiveness of the NSF in patients with prior septal surgery.

**Methods:** A retrospective analysis of the use of the NSF in the previously operated patient was undertaken in a tertiary care skull base center.

**Results:** Twenty-six consecutive cases with NSF elevation and utilization in patients with prior septal surgery were collected and evaluated for flap integrity and cerebrospinal fluid (CSF) leak outcomes. Cohort mean follow-up time was 12 months and composed of 38% pituitary adenoma, 34% encephalocele, and 11% meningioma. Twenty-four NSF were successfully elevated without perforation, of which 5 needed to be altered in length or height due to prior perforations. Twenty-five of the 26 patients were noted to have intraoperative CSF leakage. No patients experienced CSF leak post-operatively or required revision. Flap elevation techniques, pertinent anatomy and limitations are discussed. These include floor and lateral wall extensions and flaps with bilateral pedicle elevation. Postoperative MRI contrast uptake of vascular integrity confirmation is demonstrated in this cohort.

**Conclusions:** This report illustrates that the harvest and reconstruction of skull base defects can be performed with a high success rate and is an extremely viable reconstructive option in the previously operated patient in experienced hands.

Abstract ID# 1013

**Outcomes of chronic frontal sinusitis treated with ethmoidectomy alone: a prospective study**

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**Introduction:** Chronic frontal sinus disease may resolve with treatment of obstruction proximal to the frontal recess without instrumentation of the frontal ostium. Our aim is to determine the efficacy of ethmoidectomy alone for the treatment of chronic frontal sinusitis.

**Methods:** Adults with chronic rhinosinusitis were prospectively enrolled in a multi-center study. Participants with frontal sinusitis on computed tomography were divided into two groups: 1) endoscopic sinus surgery (ESS) incorporating ethmoidectomy, but excluding frontal sinusotomy; and 2) ESS incorporating frontal sinusotomy. The primary outcome was SNOT-22 score. Secondary outcomes included endoscopic scores and use of adjunct steroids and antibiotics.

**Results:** 196 cases undergoing frontal sinusotomy and 30 cases treated with ethmoidectomy without frontal sinusotomy were analyzed. Both groups were comparable across demographic and clinical measures except for greater steroid use and incidence of nasal polyposis in the frontal sinusotomy cohort ( $p < 0.050$ ). However, frontal sinusotomy was not independently associated with any dependent outcome variable in linear regression models. Preoperative endoscopy and computed tomography scores were higher in the frontal sinusotomy group ( $p < 0.001$ ). Post-operatively, both groups showed comparable SNOT-22 scores with worse endoscopy scores in the frontal sinusotomy group ( $p < 0.040$ ). The post-operative improvement in SNOT-22 and endoscopy scores was comparable between groups. Postoperative topical steroid use was more common in the frontal sinusotomy group. Revision surgery was needed in 2.6% of frontal sinusotomy patients and was not required in the non-frontal sinusotomy participants.

Conclusion: The treatment of chronic frontal sinusitis through ethmoidectomy is a potential alternative to frontal sinusotomy and achieves similar outcomes.

Abstract ID# 956

**Outcomes of endoscopic repair of cerebrospinal fluid rhinorrhea without lumbar drains**

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Objective: Lumbar drains (LD) are commonly employed during endoscopic repair of CSF rhinorrhea, either to facilitate graft healing or to monitor CSF fluid dynamics. However, the indications and necessity of LD placement remain controversial. This study seeks to evaluate endoscopic CSF leak repair outcomes in the setting of limited lumbar drain use.  
Study Design: Retrospective case review.

Methods: Patients undergoing endoscopic repair of CSF rhinorrhea between 2004 and 2014 were identified by a review of medical records. Demographic and clinical data were extracted and compared between patients having surgery with and without a perioperative LD. A univariate analysis was performed to identify factors predictive of recurrence.

Results: 107 patients (116 surgical procedures) were identified with a mean follow-up of 15.6 months. 88 of 107 patients (82.2%) had surgery without a LD. Mean hospital stay was 4.48 days in the LD group vs. 1.03 days in the non-LD group ( $p < 0.05$ ). There was no difference in recurrence rate between the LD and non-LD group. Predictors of recurrence included repair technique ( $p = 0.04$ ) and size of defect ( $p = 0.005$ ). BMI, leak site, and etiology were not predictive of leak recurrence.

Conclusion: Use of LDs in endoscopic CSF leak repair was not associated with reduced recurrence rates, regardless of leak etiology, and resulted in a significant increase in hospital length of stay. Though the use of perioperative LDs to monitor CSF dynamics may have some therapeutic and diagnostic advantages, the present series suggests that routine perioperative application of a LD is not mandatory.

Abstract ID# 925

**Pediatric fess & endoscopic skull base surgery**

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Pediatric functional endoscopic sinus surgery (FESS) & endoscopic skull base surgery (ESBS) has changed the current management of pediatric sinonasal and skull base disorders.

The indications for endoscopic skull base surgery continue to expand as experience and technology evolve.

Pediatric ESBS has been established as a safe and feasible technique for a variety of disease states. Special considerations in the pediatric populations include the use of image-

guidance technology, potential anatomic access limitations, and skull base reconstruction with vascularized flaps to prevent cerebrospinal fluid leak.

40 pediatric patients With different pathologies like choanal atresia, complicated sinusitis, invasive fungal sinusitis, isolated sphenoid lesions, mucopyoceles and benign and malignant Tumors abutting the orbit, infratemporal fossa, cavernous sinus and skull base, different sites of csf leaks and meningoencephaloceles and pituitary lesions will be presented and discussed.

Abstract ID# 1025

**Pediatric orbito-ethmoidal osteoid osteoma**

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We present a case and literature review of an osteoid osteoma of the paranasal sinuses.

Osteoid osteoma is a benign bone-forming tumor that is clinically and histologically distinct from classical osteomas. Osteoid osteomas typically occur in the long bones, usually the femur or tibia, causing localized pain in an adolescent male. Radiographic characteristics include a central lucency with patchy mineralization and a surrounding zone of sclerotic bone on CT. Clinically, these lesions have a limited growth potential and a pattern of nocturnal pain relieved by aspirin or other non-steroidal anti-inflammatory medications. Osteoid osteomas rarely occur in the head and neck. When they do occur, they are most common in the cervical vertebrae or mandible.

Our patient is an 11-year old girl who presented with a 10-month history of daily frontal headaches and post-nasal drip. A CT scan demonstrated a well-circumscribed, partially ossified lesion of the right anterior ethmoid sinuses with obstruction of the frontal recess and bowing of the lamina papyracea. The patient underwent an endoscopic resection of the mass from the skull base and lamina papyracea. Intraoperatively, the tumor was noted to be softer than would be expected for a classic osteoma, as it could be removed with a curette and suction. Post-operatively the patient experienced no bleeding or significant discomfort. Osteoid osteomas represent a rare bone-forming lesion in the paranasal sinuses, and although benign, may be the cause of discomfort and associated sinonasal obstruction in a pediatric patient.

Abstract ID# 993

**Pendant drop tensiometry for measuring surface tension effects of sinus rinses on rhinosinusitis mucus: a pilot study**

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Introduction: Although saline irrigations play an important role in the treatment of chronic rhinosinusitis, residual irrigation fluid may alter the cohesive properties of sinonasal mucus, thereby affecting patient perception of disease. The impact of irrigations on mucus properties has not been well studied, despite clinical reliance on irrigations.

**Method:** Sinonasal mucus was collected at the time of endoscopic sinus surgery from five patients with clinical diagnoses of chronic rhinosinusitis (N =2) and allergic fungal rhinosinusitis (N=3). Mucus aliquots were assigned to isotonic saline exposures ex-vivo – including no exposure (control), normal saline, and baby shampoo in normal saline (0.5%, 1%, 5%, and 10%). A CAM200 Optical Tensiometer (Biolin Scientific) was used to determine surface tension of sinonasal mucus samples using pendant drop tensiometry, a technique that measures surface tension by pendant drop shape analysis.

**Results:** Mucus samples from chronic rhinosinusitis patients had variable results when exposed to normal saline. Increasing concentrations of baby shampoo resulted in similar decreases in surface tension. In samples from AFRS patients, normal saline exposures resulted in increases in surface tension in all samples. All AFRS samples exposed to 1% baby shampoo experienced modest decreases in surface tension compared to the control, and marked decreases in surface tension compared to isotonic saline alone.

**Conclusion:** This pilot study demonstrates that pendant drop tensiometry may be used to measure surface tension of sinonasal mucus and the fluid mechanic effects of irrigation fluids. Further investigation is needed to validate these measurements in the context of patient symptoms.

Abstract ID# 949

**Pepsin induces mitochondrial damage and cytokine expression in human nasal epithelial cells in vitro**

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**Introduction:** Evidence supports an association between extraesophageal reflux and medically and surgically refractory CRS. This study analyzed sinus lavage samples for pepsin in patients with and without CRS to elucidate the effect of pepsin on mitochondria activity and cytokine expression in human nasal epithelial cells (HNEpC).

**Methods:** Western blot was used to detect pepsin in sinus lavages from patients with CRS and patients without signs or symptoms of CRS undergoing pituitary tumor resection. Human nasal epithelial cells were treated with pepsin (pH 7; 0.1 mg/mL) for 1 hour or 16 hours and routine electron microscopy (EM) and MTT assay were performed. Cytokine ELISA was performed on media collected from HNEpC cells 16 hours following a 1-hour treatment with pepsin (pH 7; 0.01 mg/mL).

**Results:** Pepsin was detected in sinus lavages from 5/7 patients with CRS and 0/3 patients without CRS. EM showed mitochondrial damage in HNEpC cells treated with pepsin but not in control cells. The MTT assay demonstrated reduced mitochondrial activity in pepsin-treated HNEpC cells compared to untreated cells ( $p < 0.001$ ). Pepsin increased IL-1A ( $p = 0.002$ ) and IL-6 ( $p = 0.04$ ) expression in HNEpC cells.

**Conclusion:** Pepsin in sinus lavages from patients with CRS is consistent with previous studies. This study reveals the

damaging effect of pepsin on mitochondria in nasal epithelial cells in vitro. Cytokines previously associated with CRS were elevated following pepsin treatment of HNEpC cells in vitro. These results demonstrate mechanisms by which pepsin may potentiate CRS.

Abstract ID# 999

**Podoplanin, a novel cell surface marker for human nasal basal cells**

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**Introduction:** Podoplanin (PDPN) is a sialomucin-like transmembrane glycoprotein that has been widely used as a marker for lymphatic endothelium. It has been found in many tissues and tumors, although its expression in the nasal mucosa has not been fully explored. The aim of this study is to examine PDPN expression in human nasal tissues.

**Methods:** The expression of PDPN was investigated by immunofluorescence staining of cultured human nasal epithelial cells (HNECs) and various human nasal specimens, including normal and diseased nasal mucosa tissues. The intensity of PDPN staining in nasal epitheliums between the inferior turbinates of normal, chronic rhinosinusitis (CRS), and cystic fibrosis (CF) cases were compared by digital image analysis.

**Results:** Positive staining for PDPN was found in the majority of HNECs cultured in chamber slides, as well as the bottom-layer of HNECs cultured by an Air-Liquid-Interface (ALI) method. Most HNECs that positively stained for PDPN also expressed two other basal cell markers: Np63 and KRT5. In human nasal tissues, all basal cell layers expressed PDPN.

**Discussion and conclusion:** The expression of PDPN was mainly observed in the basal cell layer of nasal epithelium of both normal and disease nasal mucosa tissues. Its expression was colocalized with Np63 and KRT5 in cultured HNECs. Cell culture stainings revealed that PDPN localizes to the cell surface. These findings may allow future studies to better isolate and characterize basal cells of the nasal mucosa.

Abstract ID# 1110

**Prognosis of upper airway remodelling in chronic rhinosinusitis.**

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**Background:** Remodelling changes of the airway develop during inflammatory conditions such as asthma and chronic rhinosinusitis (CRS). In the lower airway, such remodeling changes are a poor prognostic factor for function and response to therapy. However, the impact of upper airway

remodeling on prognosis is unclear. This study investigates the clinical outcomes of CRS patients with and without remodeling.

**Methods:** A case control study of adult patients with CRS was performed. Mucosal samples were taken during endoscopic sinus surgery (ESS). Histopathological analysis included eosinophilia (greater or less 10/HPF) and remodeling changes (squamous metaplasia, basement membrane thickening, subepithelial fibrosis). Patient reported outcomes (PROMs) were a Nasal Symptom Score (NSS) and Sino-Nasal Outcome Test (SNOT-22) preoperative and at 12 months. The impact of mucosal remodeling changes was assessed relative to severity and response to treatment.

**Results:** 60 patients (48.99±14.18yrs, 45% female) were assessed. 51.7% of patients had eosinophilic CRS (eCRS) and remodelling was associated with eCRS (59.1% v 40.9%, p=0.05). Endoscopic sinus surgery followed by topical treatment improved NSS (2.48±1.05 v 1.11±0.91, p<0.01) and SNOT-22 (2.02±0.99 v 1.01±0.81, p<0.01). The presence of remodelling did not prevent successful outcomes at twelve months postoperatively in either NSS (1.41±1.09 remodelling v 1.35±1.44 none, p=0.86) or SNOT-22 (0.98±1.08 remodelling v 0.91±1.06 none, p=0.82). Treatment requirements differed between groups

**Conclusion:** Remodelling changes occur in CRS as in the lower airway with asthma. In this preliminary study, they did not prevent a successful treatment outcome.

Abstract ID# 981

### **Purely endoscopic endonasal surgery of the craniovertebral junction: a systematic review**

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**Introduction:** Endoscopic endonasal surgery (EES) is a relatively novel approach to the craniovertebral junction (CVJ). The purpose of this analysis is to determine the surgical outcomes of patients who undergo purely EES of the CVJ.

**Methods:** A search for articles related to EES of the CVJ was performed using the MEDLINE/PubMed database. A bibliographic search was done for additional articles. Demographics, presenting symptoms, imaging findings, complications, follow-up, and patient outcomes were analyzed.

**Results:** Eighty-eight patients from 30 articles were included. The mean patient age was 48.4 +/- 24.6 years (range 3-96 years), with 44.3% being male. The most common presenting symptom was myelopathy (n=64, 72.7%). The most common indications for surgery were brainstem compression secondary to basilar invagination (n=41, 46.6) and odontoid pannus (n=20, 22.7%). Odontoidectomy was performed in 94.3% of cases. Intraoperative complications occurred in 16 patients (18.2%) and postoperative complications occurred in 18 patients (20.5%). Six patients developed postoperative respiratory failure necessitating a tracheostomy. Neurologic improvement was seen in 88.6% of patients at a mean follow-up of 22.2 months.

**Conclusion:** Our analysis found that EES of the CVJ results in a high rate of neurologic improvement with acceptable complication rates. Given its minimally invasive nature and high success rate, this approach appears to be a reasonable alternative to the traditional transoral approach in select cases. This study represents the largest pooled sample size of EES of the CVJ to date. Increasing use of the endoscopic endonasal approach will allow for further studies with greater statistical power.

Abstract ID# 960

### **Quantification of maxillary sinus accessibility via a middle meatal antrostomy**

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**Objective:** To quantify maxillary sinus (MS) volume and mucosal surface area (SA) that is accessible endoscopically via a middle meatal antrostomy (MMA) and explore the financial implications of utilizing multiple disposable instruments for this procedure.

**Methods:** Eight cadaver maxillary sinuses configured with Stryker (Kalamazoo, MI) image guidance software were evaluated. In each sinus, a standard MMA was created, through which curved microdebriders of 15, 40, 70, and 120 degrees were placed. SA and volume of the region accessible by each microdebrider tip was calculated.

**Results:** Mean MS volume was 16.5+/-2.5 cm<sup>3</sup> and mean SA was 31.0+/-2.3 cm<sup>2</sup>. The 15, 40, 70 and 120 degree microdebriders accessed an average of 10%, 25%, 41%, and 66%, respectively, of the SA, and 2%, 9%, 17%, and 36%, respectively, of the volume. There was a trend toward improved accessibility of the superior half vs. the inferior half (58% vs. 34%; 95% CI superior 44-72%; 95% CI inferior 16-51%). When different degree instruments were combined to maximize accessibility, 81% of the SA of the sinus could be accessed.

**Conclusion:** Microdebriders with increasing curvatures allowed for greater access of the MS mucosa through a middle meatal antrostomy. No single microdebrider curvature or combination of curvatures reached the entirety of the maxillary sinus wall. Knowledge about the area of reach for these blades can lead to lower per cost costs.

Abstract ID# 1005

**Rare spindle cell carcinoma of the nasal cavity initially presenting as leiomyosarcoma**

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**Introduction:** A spindle cell lesion of the head and neck has a broad differential diagnosis with potential to be malignant. Spindle cell carcinoma (SpCC) is usually found on mucosal surfaces; most commonly the larynx, with few cases confined to the nasal cavity. Sarcomas are rare, accounting for less than 1% of all malignancies. To our knowledge, no case has been reported of a nasal cavity mass diagnosed as leiomyosarcoma on initial biopsy, that turned out to be SpCC on final pathology.

**Methods:** Case report and review of the literature.

**Results:** We present a 67-year-old man with nasal obstruction for 3 months. A mass was visualized in the right nasal cavity and biopsied. The tumor cells were positive for smooth muscle actin and muscle-specific actin. Initial diagnoses was moderately differentiated leiomyosarcoma. Due to infiltration of neurovascular structures and the skull base, complete resection was impossible. After palliative surgical resection, he was subsequently treated with adjunct radiation and chemotherapy. Final pathology revealed a biphasic tumor with invasive squamous cells staining positive for cytokeratin and spindle cells staining positive for smooth muscle actin and vimentin.

**Conclusion:** SpCC is an uncommon variant of squamous cell carcinoma rarely presenting in the nasal cavity. Still, SpCC is the most common spindle cell lesion in the head and neck. Other diagnoses such as leiomyosarcoma are even less common and warrant careful consideration of alternative diagnoses. Although surgery is the mainstay of treatment for either lesion, leiomyosarcoma is less susceptible to radiation than SpCC.

Abstract ID# 1068

**Results of primary septorhinoplasty from beginners**

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From the many patients applied to our clinic for nasal obstruction and nasal view disapproval, 37 patients were gone to septorhinoplasty in our clinic in last year. 35 male and 2 female patients were operated. Age range was 19-36 years old. Reason for sex distribution was due to being a military hospital. All patient were nasal septally deviated. Most prominent pathology was c-shaped nose in 10, saddle nose deformity in 1, alar asymmetry in 1 of the patients. Other patients has light to mean degree nasal axis deviation or hump deformity.

1 out of 37 patients were operated with open approach. Nasal dorsum excision, dorsal rasping, anterior approach septoplasty, cephalic resection of lower cartilages, columellar

strut grafting were performed to all patients. Septocolumellar suture was applied on 21 patients, double lateral osteotomies were performed to 9 c-shaped noses. Dorsal collapse in the saddle nose patient was recovered by advancement of nasal bones with medialization osteotomies. Alar asymmetry was overcome by strong columellar strut and lower lateral reinforcement with harvested septal cartilage.

All patient's packings and splints were extracted on postoperative 2. and 7. day respectively.

Repacking was needed for 2 patients for bleeding. Ecchymosis and edema was seen on 13 patients prominently. Inadequate correction of nasal axis was on 4, postoperative persisting nasal base asymmetry was 5, dorsal visible protrusion was seen on 2 patients.

Abstract ID# 1093

**Retrospective review of nasolacrimal fossa anatomical relationships in dacryocystorhinostomy**

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**Introduction:** Dacryocystorhinostomy (DCR) has a reported failure rate between 5-10%. Anatomic variation surrounding the nasolacrimal fossa (NLF) and scarring from adjacent structures postoperatively has been implicated in the failure rate. The purpose of this study is to determine the prevalence of, and a reproducible measurement method for, overlap between the middle turbinate and NLF, as well as the agger nasi air cell-NLF distance.

**Methods:** Retrospective review of 50 normal sinus CTs by two independent reviewers measured the diameter of the NLF and its overlap with the ipsilateral middle turbinate. The distance between the NLF and the ipsilateral agger nasi cell, if present, was also measured.

**Results:** 50 patients were included. 82% of patients had overlap of the lacrimal fossa with the middle turbinate, with chi-squared between readers of  $> 0.99$ . Agger nasi cell was present over 80% of sinuses for both readers, however with disagreement on 5/100 sides. Average agger nasi cell-NLF distance was  $6.7 \pm 2.2$  mm right and  $6.1 \pm 2.1$  mm left reader 1,  $6.4 \pm 2.6$  mm right and  $6.3 \pm 2.6$  mm left for reader 2.

**Conclusion:** The prevalence of the NLF and middle turbinate overlap is common amongst the normal population however with wide variability. We offer a simple and reproducible metric for future prospective studies evaluating causes of DCR failure and the potential of preoperative imaging. In contrast, agger nasi cell-NLF distance may have lower reproducibility as well as wide variability.

Abstract ID# 1059

**Rhinolithiasis: An unusual mass in nasal cavity—a case report**

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**Introduction:** Rhinoliths are uncommon clinical entities reported in clinical practice as unusual cause of unilateral nasal obstruction and foul-smelling nasal discharge. Rhinolith is a mineralized mass in the nasal cavity caused by the deposition of calcareous salts around an endogenous or exogenous nidus.

**Case Report:** A 30 years old male patient presented with 5-year history of right-sided nasal obstruction, foul-smelling nasal discharge and recurrent epistaxis. He received multiple courses of antibiotics and nasal steroids with no benefit. There is no history of trauma or insertion of a foreign body into the nose. Anterior rhinoscopy and nasal endoscopy revealed irregular shaped hard material with crustations and thick secretions around, stuck between nasal septum and inferior turbinate within right nasal cavity. Computed tomography scan of the paranasal sinuses showed large calcified mass extending along the floor of right nasal cavity. It was removed as two pieces by rigid endoscopy under local anesthesia and the nasal cavity irrigated. Surface cleaning of the mass revealed a metal-like stone. Antibiotherapy was applied in postoperative period for one week. On follow-up at one week, the nasal cavity was in good condition and the symptoms were significantly reduced.

**Discussion and Conclusion:** The presence of a rhinolith, which is almost a forgotten entity, should be remembered in patients with unilateral nasal obstruction and foul-smelling nasal discharge, with or without sinusitis. Rigid nasal endoscopy is the method to be used in diagnosis and treatment. Treatment involves removal of rhinolith and use of appropriate antibiotic.

Abstract ID# 1046

**Secondary rhinoplasty of unilateral cleft lip patient: case report**

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Several degrees of nasal deformities are usually associated with the congenital cleft lip and palate patients. Challenging aesthetical and functional problems would be originated from previous surgery scars, growth effect and different anatomy of disease itself. Early lip repair and secondary nasal reconstruction after the age of 14-15 usually preferred to avoid revisions and multiple scars.

21 years old male applied our clinic for his nasal deformity and nasal obstruction. Patient was born with left sided complete non-syndromic cleft lip. He had primary cleft lip repair at childhood and had no nasal intervention till this age. Nasal examination of patient revealed minimally right axis deviation, fallen tip, inadequate tip support, flattened left ala, right sided septal deviation, lower left nasal floor and scar at columellolabial junction and left alar base.

Secondary open approach rhinoplasty procedure was decided to carry out. Due to surgical scar at bottom of columella

incision was made at this line. Lower lateral cartilages stripped out. Left lower lateral cartilage's tip defining point was seen lower localized to other and has thinner structure. Septoplasty was performed and necessary cartilage grafts were harvested. Nasal axis alignment provided by osteotomies. A thick cartilage graft prepared for columellar strut graft. Left lower cartilage was reinforced with additional cartilage grafts and new symmetrical tip defining point was acquired with sutures. Lateralized alar base pulled to midline with transeptal sutures.

Postoperative 1 week results were functionally and aesthetically satisfactory.

Abstract ID# 958

**Significance of residual retromaxillary air cells as a risk factor for revision endoscopic sinus surgery**

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**Objectives:** 1) To determine if retained retromaxillary air cells (RMC) are associated with the need for revision functional endoscopic sinus surgery (FESS). 2) To investigate the incidence and radiographic characteristics of RMCs in patients with recalcitrant chronic rhinosinusitis after prior FESS.

**Study design:** Retrospective chart review of patients undergoing revision FESS at a tertiary medical center between 2012-2014.

**Methods:** Computed tomography scans of patients undergoing revision FESS that met inclusion criteria were independently reviewed by two individuals. Inclusion criteria included prior complete, bilateral FESS including posterior ethmoidectomies. Each side of the scan was assessed for residual RMCs. The radiographic characteristics and Lund-Mackay (LM) scores of the RMCs were recorded.

**Results:** 69 cases of revision FESS met inclusion criteria. The median age of the cohort was 51 years and was composed of 52% males. The mean number of previous ESSs was 2. Retained RMCs were identified in 101/138 analyzed sides (73%). 65% of these RMCs had a LM score of 1 or greater. There was a statistically significant correlation between number of previous FESS and whether RMCs had been opened ( $p = 0.01$ ), and between the height of the RMCs and the number of previous FESS ( $p = 0.015$ ).

**Conclusion:** Our study demonstrates that RMCs are often neglected during FESS, and are commonly found in revision FESS. The majority of RMCs in this cohort demonstrated a LM score of 1 or greater, suggesting that these cells often harbor residual diseased mucosa that may contribute to the need for revision surgery.

Abstract ID# 1029

**Single stage surgery for silent sinus syndrome: a case series**

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**Introduction:** Silent sinus syndrome (SSS) or chronic maxillary sinus atelectasis is a rare phenomenon characterized by enophthalmos or hypoglobus along with maxillary sinus atelectasis and lateralization of the uncinate process without significant classic rhinosinusitis symptoms. Its origins are debated but may occur because of chronic maxillary sinus hypoventilation leading to maxillary sinus collapse and alteration of normal orbital floor architecture. Previous descriptions of surgical management included endoscopic maxillary antrostomy with orbital floor repair via an implant, possibly as a two stage procedure.

**Purpose:** To evaluate a single institution experience of single-stage endoscopic correction of SSS without performing planned up-front orbital correction.

**Methods:** A retrospective review of patients who had undergone endoscopic medial maxillectomy for SSS by the senior author. Clinical records, computed tomography (CT) scans, and operative reports were carefully examined. Also, a systematic review of the literature was performed.

**Results:** Eight patients were identified with SSS, one patient with bilateral SSS, for a total of nine sinuses. Pre-op CT scans confirmed SSS in all 9 sinuses. All patients underwent single-stage endoscopic maxillary mega-antrostomy. All 9 sinuses remained ventilated at a mean follow up of 4.5 months without the need for corrective orbital surgery.

**Conclusion:** This is the largest series of silent sinus syndrome to date. Single-stage surgery without orbital correction appears to be a reasonable initial treatment option. Orbital floor reconstruction should be performed as a second stage procedure only if ventilation of the maxillary sinus does not achieve acceptable resolution of the enophthalmos.

Abstract ID# 992

**Sinonasal extramedullary plasmacytoma: A population-based incidence and survival analysis**

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**Introduction:** Sinonasal extramedullary plasmacytoma (SN-EMP) is a rare plasma cell neoplasm. Published literature on this tumor largely consists of case reports and case-series with small sample sizes. This study analyzed population-based data on SN-EMP patients to understand demographic and clinical features as well as incidence and survival trends.

**Methods:** The Surveillance, Epidemiology, and End Results (SEER) database was queried for SN-EMP and other head and neck EMP (HN-EMP) cases from 1973 to 2011. Cases

were analyzed to determine patient demographics, initial treatment modality, and survival outcomes.

**Results:** Of 778 patients identified with EMP in the head and neck region, 367 patients had SN-EMP and 411 had other HN-EMP. There was a strong male predilection found with a male-to-female ratio of 3.65:1 in SN-EMP group and 1.87:1 in other HN-EMP group. The majority of the patients presented with localized disease in both SN-EMP (84.4%) and other HN-EMP (81.0%) groups. The most common treatment modality was surgery with adjuvant radiotherapy in both SN-EMP (46.3%) and other HN-EMP (38.9%) groups, followed by radiotherapy alone (SN-EMP: 40.7%; other HN-EMP: 34.2%). Five and 10-year disease-specific survival rates were comparable between SN-EMP (88.2% and 83.3%) and other HN-EMP (90.0% and 87.4%) ( $p = 0.6016$  and  $p = 0.4015$ , respectively).

**Conclusion:** This study analyzed the largest cohort of SN-EMP patients to date. There was no statistically significant survival advantage found for any one particular treatment modality over other treatment modalities in both SN-EMP and other HN-EMP. Treatment modality may need to be chosen on a case-by-case basis.

Abstract ID# 991

**Sinonasal neuroendocrine carcinoma: a population-based analysis of incidence and survival**

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**Introduction:** Sinonasal neuroendocrine carcinoma (SNEC) is a rare, aggressive tumor usually associated with a poor prognosis. This study analyzes the clinicopathological characteristics and survival outcomes of SNEC using population-based data.

**Methods:** The Surveillance, Epidemiology, and End Results (SEER) database (1973-2011) was queried for SNEC cases. Data analyzed included patient demographics, incidence, treatment modality, and survival.

**Results:** 201 cases of SNEC were identified. Mean age at diagnosis was 55.8 years ( $\pm 15.7$  years). Overall 5-year disease-specific survival (DSS) rate for SNEC was 50.8%. Five-year survival analysis for SNEC by site revealed DSS of 80.7%, 59.2%, 34.5%, and 33.0% for the sphenoid sinus, nasal cavity, maxillary sinus, and ethmoid sinus respectively ( $p = 0.0014$ ). Cox proportional hazard analysis revealed greater hazard of death for the maxillary (HR 2.14, 95% CI 1.21 – 3.71,  $p = 0.0094$ ) and ethmoid sinuses (HR 1.83, 95% CI 1.05 – 3.16,  $p = 0.0345$ ) when compared to the nasal cavity. Advanced stage disease (stages III-IV, 5-year DSS 40.5%,  $p = 0.0008$ ) was associated with poor survival outcomes. Survival was better among those treated with surgery (with [59.4%] or without [69.0%] radiotherapy) than those treated with primary radiotherapy alone (39.9%) ( $p < 0.0001$ ).

**Conclusion:** SNEC commonly presents at an advanced-stage with poor survival outcomes. Negative prognostic factors include primary tumor site and advanced stage disease.

SNEC is a highly aggressive tumor necessitating surgery and/or surgery with adjuvant radiotherapy as the treatment of choice.

Abstract ID# 1000

**Sinusitis in patients concurrently on tumor necrosis factor alpha inhibitors: a case series**

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**Introduction:**

While sinusitis after initiation of tumor necrosis factor alpha (TNF $\alpha$ ) inhibitors has been observed, it is not well described in the literature. In this study, we characterize 12 cases of sinusitis diagnosed in patients who were concurrently on TNF $\alpha$  inhibitors.

**Methods:**

The medical records of 12 patients who were diagnosed with sinusitis by an otolaryngologist while receiving TNF $\alpha$  inhibitor therapy were reviewed. Disease characteristics and treatment course were evaluated.

**Results:**

Of the 12 patients, 10 were diagnosed with one or more episodes of acute bacterial sinusitis and treated with at least one course of antibiotics. 2 were diagnosed with chronic rhinosinusitis. The median (interquartile range) length of time between initiation of TNF $\alpha$  inhibitor therapy and diagnosis of sinusitis by an otolaryngologist was 18 months (5.25, 32.25). 8 of the 12 patients had a history of reactive airway disease prior to diagnosis. Of the 8 patients who underwent sinus CT imaging, 5 demonstrated mild mucosal thickening of the ethmoid and/or maxillary sinuses and 3 demonstrated osteomeatal complex occlusion. TNF $\alpha$  therapy was discontinued in 2 of the 12 patients for recurrent sinus infections. Five of the 12 patients required a procedure, including 3 patients who underwent endoscopic sinus surgery and 2 patients who underwent balloon dilatation.

**Conclusion:**

The results of this case series demonstrate the broad range of sinusitis severity and treatment that occurs with patients who are on TNF $\alpha$  therapy. While surgery was sometimes necessary, discontinuation of TNF $\alpha$  therapy due to recurrent sinusitis was not deemed necessary in most cases.

Abstract ID# 969

**Solitary fibrous tumor of the sinonasal cavity**

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**Introduction:** Solitary fibrous tumors (SFT) are rare mesenchymal neoplasms. Originally described as primary spindle cell tumors of the pleura, they have also been discovered in many extrapleural sites including the lungs, abdomen and liver. SFTs of the sinonasal tract are extremely rare, with fewer than 10 cases reported in the literature.

**Methods:** We report an unusual case of an SFT of the ethmoid cavity in a 78 year old patient who presented with ipsilateral complete nasal obstruction for several years. Endoscopy and CT imaging demonstrated a well-circumscribed mass of the right ethmoid cavity, which was occluding the nasal cavity on the right side. The 1.8cm mass was resected with endoscopic surgery.

**Results:** Permanent histopathology demonstrated a solitary fibrous tumor with negative margins. Immunohistochemical studies showed the neoplasm to be positive for BCL-2 with focal CD-34 expression. Androgen receptor staining was positive. Features of this unusual sinonasal pathology are reviewed from the present case and other published reports.

**Conclusion:** Solitary fibrous tumors are benign tumors which follow an indolent course. They are extremely rare in the sinonasal cavity. The etiology remains unknown and it is hypothesized that endoscopic resection and followup is an adequate therapeutic strategy.

Abstract ID# 1022

**Spontaneous ventilation of the frontal sinus after fractures involving the frontal recess**

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**Introduction:** Frontal sinus fractures (FSF) have potentially catastrophic consequences due to frontal recess (FR) obstruction and proximity to the brain and orbit. Lack of follow-up and ability to predict which type of fracture predisposes to complications has biased surgeons toward definitive interventions such as sinus obliteration and cranialization. These procedures carry inherent risk and may be unnecessary in a subset of patients. This study seeks to better characterize spontaneous ventilation in subjects with FSFs, including those involving the FR.

**Methods:** Review of a prospectively maintained trauma database between 2009-2013 at a level 1 trauma center. Patients with frontal sinus fractures with follow-up imaging (>6 weeks) available were included. The medical records and imaging were reviewed for evidence of spontaneous ventilation of the frontal sinus.

**Results:** Nineteen patients sustained frontal sinus fractures in the study period with mean imaging interval of 67.4 weeks (range, 6-188.4 weeks). Injury mechanisms included assault (47%), fall (26%), motor vehicle accident (11%) and gunshot wound (16%). 8/19 patients (42%) sustained FSFs involving the FR and 7/8 (87.5%) spontaneously ventilated by time of interval imaging. The one patient with persistent radiographic sinus opacification was associated with a nasoorbitalethmoid and medial orbital blowout fracture. 6/19 patients (32%) sustaining FSF sparing the FR spontaneously ventilated by the time of interval imaging. 5/19 patients (26%) underwent surgical intervention.

**Conclusion:** An expectant, sinus-preserving approach to acute FSFs involving the FR is safe and effective. Etiology of re-ventilation failure may be due to tissue obstruction, rather than the frontal recess fracture itself.



Abstract ID# 1108

**Steroid eluting stents effective for complex frontal sinus disease**

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**Introduction:** Treatment of the frontal sinus outflow tract is of paramount importance in regards to the prevention of recurrent frontal sinus disease following endoscopic frontal sinusotomy. Steroid eluting sinus implant are a novel tool for the maintenance of post-surgical frontal sinus drainage. Steroid eluting stents have previously been shown to effectively decrease postoperative polyp burden, reduce the incidence of adhesions and improve patient outcomes. They are ideally suited for the establishment of postoperative frontal sinus drainage. While steroid eluting stents have been deployed in the frontal sinus outflow tract, there are currently no reports in the literature detailing their use or successes.

**Methods:** A retrospective chart review was performed including four patients who underwent revision frontal sinusotomy. A total of seven Propel Mini™ (Intersect ENT) mometasone eluting sinus stents were placed after either Draf IIA or IIB frontal sinusotomy. Indications for surgical intervention included a variety of complex frontal sinus pathologies including frontal sinus mucocele with orbital erosion in the setting of aspirin exacerbated respiratory disease, Pott's puffy tumor, and chronic rhinosinusitis with nasal polyposis.

**Results:** All patients demonstrated significant symptomatic improvement as demonstrated by comparison between pre-operative and postoperative SNOT-22 scores. Postoperative examination also revealed patent frontal sinus outflow tracts with properly deployed sinus implants in all patients. No complications were attributed to the placement of a sinus implant.

**Conclusion:** Our experience has demonstrated that steroid eluting sinus implants are both safe and effective at ensuring post-surgical frontal sinus drainage in a variety of complex frontal sinus pathologies.

Abstract ID# 1079

**Symptomatic nasal obstruction, sleep, and quality of life in patients with chronic rhinosinusitis**

Andrew Thomas, MD  
Shaelene Ashby, PhD  
Richard Orlandi, MD  
Jeremiah Alt, MD, PhD  
Salt Lake City, UT  
USA

**Introduction:** Patients with chronic rhinosinusitis (CRS) have reduced sleep quality and quality of life (QOL), and often complain of nasal obstruction. However, it is unclear what role nasal obstruction plays in these symptoms of CRS.

**Methods:** Patients with CRS (n=28) were prospectively enrolled from August 2013 to December 2014 and completed the Pittsburg Sleep Quality Index (PSQI), Nasal Obstruction Symptom Evaluation (NOSE), Rhinosinusitis Disability Index (RSDI), and the 22-item Sinonasal Outcome Test (SNOT-22). CRS-specific disease severity was evaluated with computed

tomography and nasal endoscopy. We evaluated the relationship between sleep quality, symptomatic nasal obstruction, QOL, and disease severity. Spearman correlation coefficients were used to determine significance ( $p < 0.05$ ).

**Results:** Poor sleep was highly prevalent (82%) and all patients enrolled had symptomatic nasal obstruction (NOSE = 30). Symptomatic nasal obstruction significantly correlated with both the PSQI and SNOT-22 ( $p < 0.05$ ). However, the "#4 trouble sleeping" subdomain of NOSE appeared to be the only factor contributing to this significance. Further, specific NOSE subdomains evaluating nasal obstruction (#1, 2, 3, & 5) lacked significance between sleep and QOL. There was no significant correlation between the NOSE and CRS-specific disease severity.

**Conclusion:** Reported NOSE scores significantly correlated with sleep and CRS-specific QOL in patients with CRS. However, this data is tempered by the findings that the "nasal obstruction" subdomains of the NOSE did not contribute to sleep quality and QOL in patients with CRS.

Abstract ID# 1089

**Systematic review of risk factors for revision sinus surgery**

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Peter Hwang, MD  
Stanford, CA  
USA

**Objective:** To identify risk factors that are predictive of a patient's need for revision endoscopic sinus surgery (ESS).

**Methods:** We performed a systematic review of the English language literature using PubMed, Google Scholar, Scopus and Cochrane Review databases up to November 2014. Inclusion criteria for studies included patients >18 years old with chronic rhinosinusitis (CRS) with and without nasal polyposis who underwent at least one revision endoscopic sinus surgery; a minimum of 6 months of follow up; and the use of quantitative outcome measures, including Sinonasal Outcomes Test (SNOT-22) and/or Rhinosinusitis Disability Index (RSDI) scores, Lund-Kennedy endoscopic scores, and Lund-Mackay CT scores. Two investigators independently reviewed all articles.

**Results:** Four hundred and two abstracts were identified during the initial search of which 48 articles satisfied the inclusion criteria. Two randomized clinical trials were included in the review. All other articles were cohort and case-control studies. The follow up period of cohorts ranged from 6 months to 10 years and the overall failure rate for ESS ranged from 7-28%. In patients who underwent revision surgery, residual air cells and stenotic ostium were the most common findings. Higher preoperative CT scores appear to be predictive of surgical revision. The number of previous sinus surgeries was the most consistent predictor of ESS failure.

**Conclusion:** Familiarity of surgeons with common causes of surgical failure can aid in surgical decision making and patient selection. Future controlled trials are needed to better define risk factors of endoscopic sinus surgery failure and therefore decrease the revision rate.

Abstract ID# 1112

**The clinical relevance of isolated sphenoid sinus opacification**

Anna Knisely, MD  
Henry Barham, MD  
Richard Harvey, MD  
Sydney, NSW  
Australia

**Introduction:** Isolated radiological opacity of the sphenoid or maxillary sinus are common findings in computed tomography (CT) whether discovered incidentally or during investigation of sinonasal symptoms. Chronic inflammatory changes are commonly cited as the cause but neoplasia is an important differential. The incidence of neoplasia in the isolated sphenoid and maxilla sinus is assessed from prior reports

**Methods:** A systematic review of the literature was performed. Medline (1948- present) and Embase (1980 - present) were searched on January 12th, 2015 using a comprehensive strategy limited to English and Human subjects. Case series that reported the pathologic findings from consecutively managed patients with isolated sphenoid or maxillary sinus disease and retrospective reviews were included. A subgroup of maxillary sinus without anterior ethmoid disease was obtained. Case reports were excluded.

**Results:** 1948 studies were found when duplicates were removed. After title review for relevance, 368 studies were identified. Abstract review produced 34 studies. These papers were then screened for 25 included studies of isolated sphenoid or maxillary-only sinus disease. 1187 patients were assessed (1102 sphenoid and 85 maxilla). Neoplasia was present in 18.9% (n=208) of sphenoid cases and 37.6% (n=32) of maxilla-only cases. The incidence of neoplasia was higher in maxillary-only opacity (37.6% v 18.9%, p<0.001). The inclusion of anterior ethmoid changes with the maxillary sinus changes this likelihood.

**Conclusion:** Physicians should be wary of single isolated sinus changes of the maxilla or sphenoid. The incidence of neoplasia is high and early biopsy or exploration should be considered.

Abstract ID# 978

**The effect of mygind's position on endoscopy and snot-22 scores in patients with chronic rhinosinusitis**

Paul Koors, MD  
Spencer Payne, MD  
Charlottesville, VA  
USA

**Objective:** To investigate whether using the Mygind's position for application of topical steroids results in improved physical exam findings and/or symptom profiles in patients with chronic rhinosinusitis.

**Design & Participants:** Retrospective chart review of patients seen in the Rhinology clinic at UVA from January 1st, 2012 through the present. Exclusion criteria included absent endoscopy scores, failure to complete SNOT-22 questionnaires both before and after starting Mygind's or the implementation of other major treatment changes at the same time as starting Mygind's. 48 patients were identified for final inclusion.

Setting: Academic tertiary care center

**Main Outcome Measures:** Endoscopy scores (graded with a standardized scale for assessing polyp severity) and SNOT-22 scores (a validated patient based rhinosinusitis outcome measure)

**Results:** There was a statistically significant decrease in overall endoscopy scores for both the right (p=0.0003) and left (p=0.0006) sides. There was a significant decrease in total SNOT-22 scores (p=0.010). Finally, there was a significant decrease in scores for the individual items on the SNOT-22 questionnaire pertaining to the need to blow nose (p=.0004), nasal obstruction (p=0.039), anosmia (p=0.027), thick nasal discharge (p=0.032), waking up tired (p=0.0164) and reduced concentration (p=0.0302).

**Conclusion:** The application of topical steroids using Mygind's position improves both objective exam findings and subjective symptomatology in patients with chronic rhinosinusitis.

Abstract ID# 1008

**The effect of nsaid-based post-tonsillectomy pain management on post-tonsillectomy hemorrhage rate: a retrospective institutional review**

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Kevin Hsu, DO, MS  
Sri Kiran Chennupati, MD  
Philadelphia, PA  
USA

Adverse outcomes related to post-tonsillectomy hemorrhage is the most feared complication of tonsillectomy in children. Although NSAIDs have been shown to demonstrate improved analgesia in various pediatric surgical procedures, there continues to be debate in the literature regarding their use in post tonsillectomy patients due to the concern of increased bleeding risk. Here we present our institution's experience during transition from opioid-based to NSAID-based post-tonsillectomy analgesics

A retrospective chart review was conducted at our institution after approval from the IRB. Our transition from opioid-based to NSAID-based post-tonsillectomy pain medication occurred on July 1, 2012. The charts were analyzed for patients from July 1, 2010 to June 30, 2012 were placed in the opioid category and those presenting from July 1, 2012 to June 30, 2014 were placed in the NSAID category.

Our chart review produced a total of 5,782 patients who presented for tonsillectomy with or without adenoidectomy between July 1, 2010 and June 30, 2014. There were 157 patients who presented for post-tonsillectomy hemorrhage during the same time period. The incidence of post tonsillectomy hemorrhage was 2.60% among the opioid group and 2.58% among the NSAID group, indicating that there is no increase in the rate of post-tonsillectomy hemorrhage associated with the NSAID medication prescribed at our institution. Based on our retrospective review at a high-volume institution, there is no statistically significant difference in the incidence of post-tonsillectomy hemorrhage among patients treated with opioid-based analgesia and those treated with NSAIDs.

Abstract ID# 924

**The mixed fungal sinusitis**

Ali Almomen, MD  
Damman, Eastern Province  
Saudi Arabia

**Background:** To determine whether histologic tissue invasion occurs in allergic fungal sinusitis.

**Study Design and Setting:** A retrospective chart review of all 200 allergic fungal sinusitis cases over a 5 years period at a tertiary care hospital.

All histologic specimens were evaluated for features of tissue invasion and were correlated clinically and radiologically.

**Results:** In addition to the universal finding of the characteristic allergic fungal mucin with fungal elements on histological examination, 5 cases(2.5%) had additional evidence of mucosal invasion as indicated by granulomatous inflammation in the submucosal tissues . Such coexistent invasion was associated with advanced disease as indicated by a higher incidence of orbital involvement on clinical evaluation and extrasinus spread(intraorbital and intracranial) on ct scans and mri.

2 pts died of intracranial invasion after multiple craniotomies.

**Conclusion:** Advanced allergic fungal sinusitis may be complicated by histologic evidence of tissue invasion.

**Significance:**

The noninvasive and invasive forms of fungal sinusitis are not necessarily discrete and may coexist in the same patient (MIXED FUNGAL SINUSITIS) .

Abstract ID# 1096

**The presentation and palliative management of metastatic hepatocellular carcinoma to the nasal cavity: a case report**

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Richard Lebowitz, MD  
Seth Lieberman, MD  
New York, NY  
USA

**Introduction:** Hepatocellular carcinoma (HCC) rarely metastasizes to the head and neck. Among those rare cases, it is uncommon for it to involve the sinonasal cavity. We report a case of nasal HCC metastasis that led to intractable epistaxis and how it was managed.

Following this presentation, participants should be able to describe the pathophysiology, management options, and role of surgery in the palliative management of metastatic hepatocellular carcinoma to the nasal cavity.

**Methods:** Case report with review of the literature

**Results:** An 80-year-old male presented with 2 months of recurrent epistaxis. Nasal endoscopy revealed a left nasal cavity mass, biopsy of which was consistent with hepatocellular carcinoma. Further work-up revealed cirrhosis of the liver with portal vein thrombosis and HCC metastasis to the right temporalis muscle. The patient underwent angio-embolization of bilateral distal internal maxillary arteries; however, the epistaxis recurred. He then underwent left anterior ethmoidal artery ligation via Lynch incision and concurrent endo-

scopic tumor resection. The patient was most recently seen 6 months after presentation; he has had no further epistaxis and is undergoing systemic therapy with sorafenib.

**Conclusion:** There are no clear treatment protocols for patients with extra-hepatic HCC metastases. Prognosis is poor with survival rates ranging from 6 weeks to 21 months. Various treatments for these lesions have been reported including resection, radiotherapy, and embolization for control of epistaxis. As described here, on occasions where epistaxis is refractory to embolization, palliative anterior ethmoidal artery ligation with resection of nasal metastasis is a novel and effective approach.

Abstract ID# 1045

**The prognosis for idiopathic olfactory loss and its possible relationship to cognitive dysfunction**

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USA

Idiopathic anosmia is defined as a loss of smell that has no identifiable cause. Although as many as 25-35% of patients presenting with anosmia fall into this category, the prognosis in such cases remains uncertain. In addition, studies have reported an association between neurodegenerative disorders and olfactory loss, suggesting that olfactory deficits might serve as pre-clinical signs of emerging neurodegeneration. The aim of this research was to better understand idiopathic anosmia with emphasis on the prognosis for recovery and the connection between olfactory loss and cognitive function. 29 subjects with a previous diagnosis of idiopathic anosmia completed the University of Pennsylvania Smell Identification Test (UPSIT) at initial presentation and again at the end of the study period. The Sniff Magnitude Test was also included so as to remove the cognitive component implicit in the UPSIT. General cognitive impairment was assessed using the Montreal Cognitive Assessment. Results suggested an overall moderate decrease in olfaction across the study group between initial onset and the time of this study. Increased age had a modest correlation with a decrease in UPSIT score, while initial UPSIT score and the time interval elapsed did not correlate. Furthermore, decreased olfaction was not associated with a higher prevalence of cognitive impairment in this study. Results indicate that the prognosis for recovery when anosmia is idiopathic is poor; and in the majority of cases anosmia worsened over time. Additionally, this study found no correlation between idiopathic anosmia and decreased cognitive function. Further study is warranted to confirm findings.

Abstract ID# 929

### **The relationship between allergic sensitization and sinonasal inflammation in patients with nasal polyps**

Christopher Brook, MD  
Jacob Kuperstock, MD  
Michael Platt, MD  
Boston, MA  
USA

**Objectives/Hypothesis:** To determine the relationship between allergic sensitization and sinonasal inflammation in patients with nasal polyposis.

**Methods:** Case control analysis of patients with symptoms of chronic rhinosinusitis who underwent CT scan and allergy testing at a tertiary care hospital. Patients with symptoms of chronic rhinosinusitis were included if they had undergone allergy testing and CT imaging of the paranasal sinuses. There were 482 patients who met the inclusion criteria, of which 267 had positive specific allergen tests and 216 had negative testing. Of those tested, 42 of the patients with positive specific allergen tests had nasal polyps visualized on endoscopy, and 30 of those without positive allergen testing had nasal polyps. Total IgE levels, allergen sensitizations and Lund-Mackay scores with sub group analysis for each sinus, were calculated for atopic vs non-atopic patients with and without nasal polyps.

**Results:** Patients with nasal polyps and allergen sensitization and patients with polyps without sensitization had equivalent Lund-Mackay scores (10.3 vs 12.43,  $p=0.24$ ). Sub group analysis of individual sinuses revealed that in patients with polyps, the maxillary sinus (0.85 vs 1.03,  $p=0.03$ ) and the sphenoid sinus (0.5 vs 0.85,  $p<0.01$ ) demonstrated higher scores in the non-sensitized group.

**Conclusion:** In patients with chronic sinusitis who have nasal polyps and allergen sensitization, sinus inflammation is less likely to involve the more distal sinuses, suggesting that patients with allergic sensitization may primarily suffer from ethmoid inflammation as a result of close proximity to the primary site of the allergic response in the nasal cavity.

Abstract ID# 1106

### **Theoretical thermal energy transfer from nasal endoscopes and its potential**

Scott Schwartz, BS  
Tyson Fisher, MD  
Peter Svider, MD  
Christopher Kelly, PhD  
Adam Folbe, MD  
Detroit, MI  
USA

**Introduction:** With advanced endoscopic endonasal skull base surgery, the light source is in much closer proximity to critical neurovascular structures. The purpose of this study was to measure energy output from nasal endoscopes as well as from the two most commonly used light sources to determine the theoretical risk of tissue damage to surrounding structures.

**Methods:** Light output from three different nasal endoscopes (0, 30, and 70 degree) and two light sources (Stryker and Storz) were measured using a light intensity meter. This power data was then converted into energy by including the area of each light dot from the specific endoscopes.

**Results:** For a given light source, the 70° scope transmitted 27% more power than the 0° scope and 95% more power than the 30° scope. The combination of these parameters results in the greatest light intensity on the field coming from the 70° scope and the least from the 0° scope. The 70° scope yielded 3.3x greater light intensity on the tissue than the 30° scope and 17x more intensity than the 0° scope due to both greater light transmission efficiency and less spreading of the light for the 70° scope.

**Conclusion:** Differences in power output from endoscopes varied based on both the type of light source used as well as the viewing angle. The theoretical risk of tissue damage seems to be greatest with the 70° scope and had a linear relationship with the input power settings of the light source.

Abstract ID# 1086

### **Transorbital endoscopic identification of supernumerary ethmoid arteries**

Angelique Berens, MD  
Greg Davis, MD  
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Seattle, WA  
USA

**Background:** Anterior and posterior ethmoid arteries supply the paranasal sinuses, septum and lateral nasal wall. Precise identification of these arteries is important during anterior skull base procedures, endoscopic sinus surgery and ligation of ethmoid arteries for epistaxis refractory to standard treatment. There is controversy in the literature regarding the occurrence of supernumerary ethmoid arteries. This study aims to provide the incidence of supernumerary ethmoid arteries by transorbital endoscopic dissection.

**Methods:** The superior lid crease (blepharoplasty) endoscopic approach was used to identify the ethmoid arteries piercing the lamina papyracea on cadaveric specimens. A total of 34 orbits (17 cadavers) were used and measurements were taken from the anterior lacrimal crest to the ethmoid arteries and optic nerve under endoscopic guidance.

**Results:** Thirty-four cadaveric orbits were measured. Short endoscopic videos and photos of measurements were obtained. The data was analyzed with standard descriptive statistics using Microsoft Excel. Overall, there were 3 or more ethmoid arteries in 64% of orbits and 4 or more ethmoid arteries in 9% of orbits. The average number of ethmoid arteries was 2.5. The location relative to anterior lacrimal crest of anterior ethmoid, posterior ethmoid and optic nerve were 20.4mm, 34.3mm, and 40.7mm, respectively. The average distance to the supernumerary ethmoid artery was 28.9mm.

**Conclusion:** The occurrence of supernumerary ethmoid arteries is 64%, much higher than previously reported. These findings are significant to guide safe endoscopic sinus surgery, skull base surgery and effective ligation for epistaxis refractory to standard treatment.

Abstract ID# 990

**Transsphenoidal surgery for malignant pituitary lesions: an analysis of inpatient complications**

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Morgan Pines, BS  
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Adam Folbe, MD  
James Liu, MD  
Jean Eloy, MD  
Newark, NJ  
USA

**Introduction:** Fewer than 4% of pituitary tumors are malignant lesions. These tumors predominantly represent metastatic disease from elsewhere. This study evaluates inpatient complications, demographics, and hospitalization characteristics of patients who underwent transsphenoidal surgery (TSS) for malignant pituitary lesions.

**Methods:** The Nationwide Inpatient Sample was evaluated for TSS patients from 1998-2010. Demographics, hospitalization characteristics, and complications were evaluated among patients with malignant lesions and compared to those with benign tumors.

**Results:** There were 17,425 inpatient records, 1.0% of which involved malignant pituitary tumors. There was no difference in age between these cohorts ( $p=0.378$ ). Patients with malignant tumors had greater length of stays (6.7d vs. 4.5d,  $p=0.003$ ) and higher trending charges (\$55,371 vs. \$40,550,  $p=0.091$ ). The most common postoperative complications among patients with malignant lesions included diabetes insipidus (DI) (17.9%), fluid/electrolyte abnormalities (14.0%), neurological complications (5.6%), CSF rhinorrhea (2.2%), and iatrogenic pituitary disorders (2.2%). Patients with malignant lesions had a significantly greater incidence of postoperative DI and fluid/electrolyte abnormalities (Odds Ratio = 2.0 and 1.7, respectively), while no statistical difference was noted in the incidence of CSF rhinorrhea ( $p=0.372$ ).

**Conclusion:** In this analysis of inpatient hospitalizations for TSS patients, malignant pituitary disease was associated with a greater rate of postoperative DI and fluid/electrolyte abnormalities, but no differences in the rates of postoperative CSF rhinorrhea and other complications. Patients with malignant pituitary lesions undergoing TSS had significantly longer hospitalizations, and higher trending charges than those with benign lesions. This analysis is, however, subject to the limitations of the database.

Abstract ID# 996: **WITHDRAWN**

**Two cases of nasal amyloidosis secondary to lymphoma**

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USA

**Introduction:** Nasal manifestations of amyloidosis are extremely rare with less than 20 cases reported. Amyloid deposition within the nose can result from a primary or secondary process. We present two cases of secondary nasal amyloidosis in the setting of Lymphoma. The diagnostic and management options are discussed as well as a brief review of the existing literature.

**Methods:** Two separate cases of nasal amyloidosis were

identified. Charts were reviewed for demographic, historical, laboratory, diagnostic, and management details. An English language literature search of PubMed and Medline with the terms "nasal, nose, sinus, or sinonasal" and "amyloid or amyloidosis" was performed on 1/3/15.

**Results:** There were one female and one male patient, presenting in the 5th and 6th decades respectively. Both patients had previously been diagnosed with Lymphoma. Both patients presented with profound nasal obstruction. Workup included imaging and biopsy. Topical steroid irrigation provided marginal relief, however no other medical therapies were of benefit. One patient underwent surgery for nasal obstruction with improvement in symptoms up to 6 months. Sixteen previous case reports were reviewed.

**Conclusion:** Nasal amyloidosis is a rarely described clinical and pathologic entity. Nasal symptoms are non-specific. Management typically consists of a search for autoimmune disease, imaging, and biopsy. Medical treatments are topically delivered and offer marginal relief, if at all. Systemic therapies have no proven benefit. Surgery has a limited role to re-establish nasal patency, however recurrence of obstruction is almost certain. Currently, the literature is devoid of effective treatment options.

Abstract ID# 974

**Vd3 does not correlate with th-2 interleukins in chronic rhinosinusitis with nasal polyposis**

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Jess Mace MD, MPH  
Timothy Smith, MD, MPH  
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USA

**Background:** Chronic rhinosinusitis with nasal polyposis (CRSwNP) is associated with a T helper cell type 2 (Th2) immune response. The mechanism behind T-cell differentiation is unknown, but is likely regulated by the complex interplay between local cytokines, activation signals and the inflammatory cell infiltrate. A known immunomodulator and potential contributing factor is Vitamin-D (VD3). VD3 deficiency is associated with CRSwNP and has been shown to alter the local cytokine profile in other diseases. This study investigated the relationship between systemic levels of VD3 and Th2-associated interleukins (IL) in the sinonasal mucus of patients with CRSwNP.

**Methods:** Study subjects undergoing endoscopic sinus surgery (ESS) for CRSwNP were prospectively enrolled from Oregon Health and Science University and the Medical University of South Carolina. Control subjects included patients undergoing ESS for non-inflammatory pathology. Blood samples and mucus were collected at the time of ESS and plasma VD3 levels were measured by ELISA and mucus levels of IL-4, IL-6 and IL-10 were measured by cytometric bead array.

**Results:** 19 subjects were enrolled including 14 subjects with CRSwNP and 5 controls. Levels of IL-4, IL-6 and IL-10 were significantly elevated in CRSwNP patients compared to controls ( $p<0.050$ ). Using a Spearman's correlation, no significant correlations between VD3 and any of the cytokines in patients with CRSwNP were found.

Conclusion: Systemic levels of VD3 are not associated with levels of IL-4, IL-6 or IL-10 in CRSwNP. Further investigation is warranted to elucidate the association and role of VD3 in CRSwNP.

Abstract ID# 973

**Viral infection and biofilm induction in patients with cystic fibrosis**

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Nivedita Sahu, MD  
Eric Wang, MD  
Caleb Phillips, PhD  
Stella Lee, MD  
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USA

Introduction: It has long been recognized that respiratory viral infections can lead to acute pulmonary exacerbations in cystic fibrosis (CF). Furthermore, bacterial infection of the upper airway in CF patients is associated with increased morbidity and disease progression. Respiratory viruses can increase susceptibility to bacterial infections by propagating biofilm formation. This study analyzes respiratory virus presence in the paranasal sinuses of CF patients and correlates viral infection with clinical severity of sinonasal symptoms and the presence of pathogenic bacteria.

Methods: In this prospective study, paranasal sinus specimens from 25 CF patients with sinonasal disease and 19 healthy controls underwent molecular sequencing for viral DNA. Both conventional cultures and molecular sequencing techniques were used to assess the bacterial microbiome. SNOT-22 scores were obtained to assess symptom severity.

Results: 32% (8/25) of CF patients had positive viral screens compared to 0% of healthy controls ( $p=0.0065$ ). Influenza and Rhinovirus strains were the most commonly identified viruses present. SNOT-22 scores were similar between cystic fibrosis patients who tested positive for a respiratory virus as compared to those who did not ( $p=0.93$ ). The Chao1 richness and the Shannon diversity indices were also similar between these two groups ( $p=0.54$  and  $0.30$  respectively).

Conclusion: Respiratory viral infection is more common in CF patients compared to healthy controls and may serve as a precursor for bacterial biofilm formation. Longitudinal assessment of the relationship between respiratory viral infection with pathogenic bacteria may help understand the induction of biofilm formation and the potential for targeted therapy.

Abstract ID# 1091

**When do we operate for chronic rhinosinusitis?: a systematic review of maximal medical therapy prior to endoscopic sinus surgery**

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CANADA

Introduction: Endoscopic sinus surgery (ESS) is considered after failure of maximal medical therapy (MMT) for chronic rhinosinusitis (CRS). There is currently no consensus on the definition of MMT. The purpose of this review is to describe the various MMT criteria reported in the literature that are employed prior to considering a patient a candidate for ESS.

Methods: A systematic review was performed using the 2009 PRISMA guidelines. Study inclusion criteria were: adult population >18 years old enrolled to undergo ESS; CRS based on published diagnostic criteria; publication between 2009 and 2014. Studies were excluded if a description of MMT criteria was not reported. The primary objective was to describe the MMT criteria utilized by authors prior to considering ESS as a treatment option.

Results: Eighty-one of 377 reviewed studies (21.5%) contained a description of MMT criteria. MMT was found to include topical nasal corticosteroids (in 91.3% of studies) for a mean of  $8.4\pm 8.4$  weeks, oral antibiotics (88.8%) for  $23.0\pm 8.4$  days, oral systemic corticosteroids (61.3%) for  $18.3\pm 11.7$  days. Less common criteria included: saline irrigations (38.8%), oral antihistamines (11.3%), oral mucolytics (10.0%), and topical/oral decongestants (10.0%).

Conclusion: A minority of authors explicitly report MMT criteria used as the indication for ESS. A common regimen identified in the literature included a minimum 8-week course of topical nasal corticosteroids, 2 to 3-week course of systemic corticosteroids and 3-week course of oral antibiotics. The creation of uniform criteria to define an indication for ESS will improve the quality of care for patients with CRS.





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#### THURSDAY, JULY 16, 2015

2:00pm - 4:00pm, **Medtronic- Cadaver Workshop**  
"New Instrumentation for FESS by Medtronic ENT"

3:30pm - 5:00pm

**Accurant/Olympus - Cadaver Workshop (Session #1)**

"Advanced Sinus techniques utilizing innovative technologies; Balloons, Navigation, Multi-debrider and RF energy... a cadaveric hands-on opportunity to explore"

5:30pm - 7:00pm

**Accurant/Olympus - Cadaver Workshop (Session #2)**

"Advanced Sinus techniques utilizing innovative technologies; Balloons, Navigation, Multi-debrider and RF energy... a cadaveric hands-on opportunity to explore"

5:00pm - 7:30pm, **Medtronic - Cadaver Workshop**

"New Instrumentation for Skull Base Surgery by Medtronic ENT"

7:00pm - 9:00pm, **Intersect Evening Symposium, Food and beverages will be served.** "Synchronicity: Big Ideas in Rhinology"

#### FRIDAY, JULY 17, 2015

6:45am - 7:45am

**Breakfast Symposium - (Supported by Medtronic)** "Challenges and Rewards for Rhinology During Medical Missions"

3:00pm - 3:45pm

**Entellus Medical - Symposia** "Considerations for Incorporating Office Based Procedures into Your Practice"

6:00pm

**Cocktail Reception at the Signature Room on the 95th Floor**  
John Hancock Building

#### SATURDAY, JULY 18, 2015

6:45am - 7:45am, **Breakfast Symposium - (Supported by Accurant)** "The Challenges of Complex Sinus Anatomy and Navigating Access Utilizing BSP"

10:15am - 11:00am

**Entellus Medical - Symposia** "Considerations for Incorporating Office Based Procedures into Your Practice"

12:30pm - 1:30pm

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