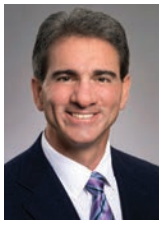

American Rhinologic Society
COSM 2017
April 27-28, 2017
Manchester Grand Hyatt,
San Diego, California
american-rhinologic.org



John DelGaudio, MD

Presidential Welcome
to the ARS at COSM 2017

It is my pleasure to welcome you to the 2017 American Rhinologic Society meeting at COSM in San Diego. This meeting represents the latest installment in this year's world-class educational program schedule that the American Rhinologic Society offers to its membership. This year's Program Chair and President Elect, Richard Orlandi, MD, has assembled another exciting and dynamic program that will feature leaders in our field discussing current topics and the latest developments in clinical Rhinology, along with panels on leadership and an update from the ARS Women in Rhinology section. The latest clinical and basic science research in Rhinology, Allergy, and Skull Base Surgery will be presented via the highest rated abstracts. I would like to thank and congratulate Dr. Orlandi and the Program Committee for their hard work in developing a dynamic program. I would also like to congratulate and thank all the moderators, panelists, and presenters for their contributions, which will make this another hugely successful ARS meeting.

Thank you for being a member of the ARS and contributing to the growth and success of our society. For those of you that are not currently members, I encourage you to join. The benefits of ARS membership continue to expand, and include access to all the educational content of the ARS such as webcasts of previous meetings including Virtual Rhinology I and II and annual meetings, educational surgical videos, and patient and physician educational materials. The newly launched DocMatter ARS member chat room is off to a great start, and provides a forum for discussion of clinical issues among ARS colleagues. Members also receive a subscription to the International Forum of Allergy and Rhinology (IFAR), the journal of the ARS. IFAR's expanded offerings now feature the "Scope it Out" podcasts and the new Case of the Month series. In addition, members of the ARS will receive free registration to the Summer Sinus Symposium. This year will be the 6th Summer Sinus Symposium and for the first time will be held at the Omni Shoreham Hotel in Washington DC, from July 14-16. The Summer Sinus Symposium provides great clinical content that is useful for all practitioners of Rhinology at every level. Membership information can be obtained at the ARS website, American-rhinologic.org or by speaking to one of the ARS staff. We look forward to welcoming you as a new member.

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

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

Welcome to the ARS at COSM—enjoy your time in San Diego!

John M. DelGaudio, MD, FARS
President, American Rhinologic Society

Welcome from the Program Chair

Richard Orlandi, MD, FARS

Welcome to San Diego for the American Rhinologic Society's Spring Meeting, part of the Combined Otolaryngology Spring Meetings (COSM). As your President-Elect, I'm honored to serve as the Program Chair for this 2017 meeting. This one and a half day conference will showcase the latest in Rhinologic and Skull Base discovery and innovation.

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

The Program Committee has reviewed over 180 abstract submissions for the meeting and we are very excited to share with you the very best of these competitive scientific presentations. We owe the Program Committee a huge debt of gratitude for their tireless work in ensuring the finest possible meeting content. Their names are listed below. Please join with me in thanking them for the fine work done on our behalf.

Podium presentations at this year's meeting will reveal cutting edge advances in the following areas:

- Basic science and clinical approaches to the pathophysiology of chronic rhinosinusitis
- Olfaction
- Role of microbes in rhinosinusitis
- New and emerging treatments for rhinologic disease
- Skull base disease

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

A large number of high quality posters will also provide rich and wide-ranging educational content. I encourage you to join with your colleagues on Thursday night to view these posters and meet their authors during an evening reception.

Panels have been an important part of our past successful meetings and this one will be no different. Seven panels will explore new knowledge, provide meaningful dialogue on controversial topics, share experience and wisdom, and put in context the latest advances in our field:

- Optimal Treatment of the Nasal Valve – combined panel with the American Academy of Facial Plastic and Reconstructive Surgery
- Leadership Lessons Learned
- Fresh Out of the Box – Compelling Recent Advances
- Progress Report – Women in Rhinology
- New Insights into the Impact of Chronic Rhinosinusitis
- Advances and Challenges in Managing Cystic Fibrosis
- Culture Shock – Updates on the Microbiome in Rhinosinusitis

I joined the ARS during my rhinologic fellowship in 1997-98. It has been both rewarding and exciting to see how our society has evolved during the nearly 20 years since then. Dedication to providing the best care for our patients remains at our core while we've seen an astounding growth of scholarly innovation. The ARS Spring Meeting at COSM continues the exciting evolution of our society. I hope you will find it exceeds all of your expectations. I look forward to seeing you at our meeting here in San Diego, and later this year at our Summer Sinus Symposium in Washington, D.C. and our Fall Meeting in Chicago!

Richard Orlandi, MD, FARS, ARS President & Program Chair

ARS COSM 2017 Program Committee

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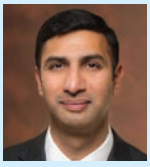

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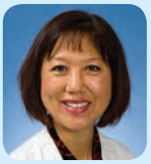

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Jamie Litvack, MD, FARS

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 10.25 *AMA PRA Category 1 Credit(s)™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Learning Objectives from Practice Gaps

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

1. Discuss the medical management of chronic rhinosinusitis (CRS) and appreciate advances in related basic science and translational research.

2. Gain an understanding of the advances in operative and in-office based procedures used in the management of conditions affecting the nose, sinuses and skull base.

3. Discuss the applications of new technologies in the treatment of sinus patients and demonstrate competence in their safe and effective use.

How to obtain your CME certificate:

1. Go to *ARS.CmeCertificateOnline.com*
2. Click on the "ARS at COSM 2017" link
3. On the site, you will be asked to evaluate the overall conference. A certificate will be made available for you to print.

Questions? Email *Certificate@AmedcoEmail.com*

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**January 1 - April 6, 2017*

Women in Rhinology

Women in Rhinology

Women in Rhinology is excited to have **Executive Vice Dean Carol Bradford, M.D., M.S.** as our keynote speaker for our next meeting on Friday, April 28, 2017 from 6:45 to 8:00am.

"Mentorship and Sponsorship: Why it Matters"

Dean Bradford will share her success story which has led to numerous leadership positions. She is an internationally recognized head and neck cancer researcher and faculty leader, and is Executive Vice Dean of Academic Affairs for the University of Michigan School of Medicine. She holds the Charles J. Krause MD Collegiate Professorship in Otolaryngology and was Chair of the University of Michigan Department of Otolaryngology from 2009-2016. Dean Bradford was also elected as the first woman President of the American Head & Neck Society in 2012. Currently, she serves on the Board of Directors for the American Academy of Otolaryngology-Head & Neck Surgery and is the President of the Society of University Otolaryngologists.

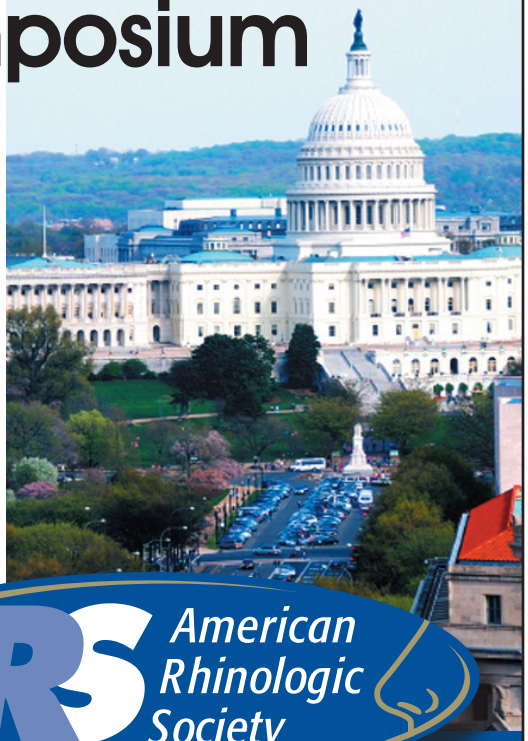
6TH Annual

Summer Sinus Symposium

Family Friendly City! So much to see!

The Best Sinus Course in the World: Improving Rhinology from Office to OR

The ARS has structured this meeting to inform and educate every OTOLARYNGOLOGIST treating nasal and sinus disease.



July 14-16, 2017 *New City! New Venue!*

Omni Shoreham Hotel, Washington, DC

FREE REGISTRATION FOR ARS MEMBERS with your Membership Dues!

Not a member? **Join the ARS NOW** and attend the **Summer Sinus Symposium** for **FREE!**

Meeting details are online at:
http://www.american-rhinologic.org/sss

ARS American Rhinologic Society

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ARS, PO Box 495, Warwick, NY 10990 | **www.american-rhinologic.org/sss**

Podium/Oral Presentations *At-A-Glance*

Thursday, April 27, 2017

7:55am
Welcome
John DelGaudio, MD, FARS

Moderators:
Stella Lee, MD & Amber Luong, MD, PhD, FARS

8:00am
Establishing Urinary Leukotriene E4 as a Diagnostic Biomarker for Chronic Rhinosinusitis with and without Comorbid Asthma and Atopy
Joseph Han, MD, FARS

8:07am
Pre-operative Lund-Mackay Ct Score Predicts Quality of Life Outcome Trajectories After Sinus Surgery in Chronic Rhinosinusitis Patients
Michal Trope, BA

8:14am
Understanding the Relationship Between Olfactory-Specific Quality of Life, Objective Olfactory Loss, and Patient Factors in Chronic Rhinosinusitis
Jose L. Mattos, MD, MPH

8:21am
Role of Tissue Eosinophils in Chronic Rhinosinusitis-associated Olfactory Loss
Leah J. Hauser, MD

8:28am
Discussion

Moderators:
Henry Barham, MD & Eric Wang, MD, FARS

8:33am
LL-37 Causes Cell Death of Human Nasal Epithelial Cells, which is Inhibited with a Synthetic Glycosaminoglycan
Andrew J. Thomas, MD

8:40am
Ciprofloxacin Antimicrobial Activity Against Pseudomonas Aeruginosa is Enhanced by the CFTR Potentiator, Ivacaftor
Do-Yeon Cho, MD

8:47am
Denatonium-induced Bacterial Killing in Sinonasal Epithelium Correlates with Chronic Rhinosinusitis Clinical and Surgical Outcomes
Ryan M. Carey, BSE

8:54am
Oral Glucosamine Treatment Had Anti-Allergic Effect in Mice with Allergic Asthma and Rhinitis
Ah-Yeoun Jung, MS

9:01am
Discussion and Award Presentation

9:08am
Presidential Address
John DelGaudio, MD, FARS

9:18am
Panel: Fresh Out of the Box: Compelling Recent Advances
Moderator: Benjamin Bleier, MD
Panelists: Noam Cohen, MD, PhD, FARS, Stella Lee, MD, Raymond Sacks, MD, FARS

10:00am
Break

Moderators:
Eric Holbrook, MD, FARS & Justin Turner, MD

10:20am
Vitamin D in Airway Epithelium Derived from Chronic Rhinosinusitis Patients
Sophia W. Ma, BMed

10:27am
Assessment of Acquired Mucociliary Clearance Defects Using Microscopic Optical Coherence Tomography
Jessica Grayson, MD

10:34am
The Role of Tight Junctions in the Pathogenesis of Chronic Rhinosinusitis
Raewyn A. Cavubati, MD

10:41am
Calgranulin C (s100a12) is Differentially Expressed in Subtypes of Chronic Rhinosinusitis
Abigail Pulsipher, PhD

10:48am
Discussion

Moderators:
Michael Platt, MD &
David Poetker, MD, FARS

10:54am
Defining a Minimal Clinically Important Difference (MCID) for the Brief Smell Identification Test in Chronic Rhinosinusitis
Joshua M. Levy, MD, MPH

11:01am
Chronic Rhinosinusitis-associated Cytokines in Olfactory Cleft Mucus
Jeffanie Wu

11:08am
Referral Patterns for Patients with Olfactory Dysfunction and their Effect on Outcomes
Aakanksha Rathor, MD

11:15am
Discussion

11:21am
Panel: Leadership Lessons Learned
Moderator: Michael G. Stewart, MD, MPH, FARS
Panelists: Alexander Ciu, MD, FARS, Todd Kingdom, MD, FARS, Scott Stringer, MD, FARS, Carol Bradford, MD

12:00pm
Lunch

Moderators:
Christopher Church, MD, FARS & Devyani Lal, MD

1:00pm
Histopathology in Chronic Rhinosinusitis Varies with Sinus Culture
Ashley L. Heilingoetter, MPH

1:07pm
Microbiota Diversity in a Rabbit Model of Chronic Rhinosinusitis
Do-Yeon Cho, MD (Presented by: Matthew Fort, MD)

1:14pm
Susceptibility of Airway Pathogens to Antimicrobial Effects of Nitric Oxide
Alan D. Workman, BA

1:21pm
Novel Role of Surfactant Protein A in Bacterial Sinusitis
George T. Noutsios, PhD

1:28am
Discussion

Moderators:
Greg Davis, MD, MPH, FARS &
Mark Zacharek, MD, FARS

1:34pm
A Prospective Analysis Evaluating Mucosal Biopsy Location and its Clinical Relevance in Chronic Rhinosinusitis with Nasal Polyps
Ava R. Weibman, BA

1:41pm
The Role of Doxycycline in the Management of Chronic Rhinosinusitis with Nasal Polyps
Sarah M. Kidwai, MD

1:48pm
The Role of Mast Cells and Tim-3 Expression in Determining Severity of Chronic Rhinosinusitis with Nasal Polyposis
Erica Corredera, MS

1:55pm
Discussion

2:01pm
Panel: Culture Shock: Updates on the Microbiome in Rhinosinusitis
Moderator: Andrew Goldberg, MD, FARS
Panelists: Emily Cope, PhD, Richard Douglas, MD, Robert Kern, MD, FARS

Moderators:
Oswaldo Henriquez, MD & Spencer Payne, MD, FARS

2:41pm
Accuracy of Computer-Assisted Navigation: Significant Augmentation by Facial Recognition Software
Jordan T. Glicksman, MD, PhD

2:48pm
A Prospective, Randomized, Single-Blinded Trial for Improving Health Outcomes in Rhinology by the Use of Personalized Video Recordings: Initial Findings
Saurabh Sharma, MD

2:55pm
Immersive Virtual Reality as a Teaching Tool for Neuroanatomy
Katelyn Stepan, MD

3:02pm
Discussion

3:08pm
Business Meeting

3:15pm
Break

Moderators:
Philip Chen, MD & Ashutosh Kacker, MD

3:35pm
Endoscopic Sinus Surgery Improves Pulmonary Function in Cystic Fibrosis Patients with Bilateral Lung Transplants
Christopher R. Roxbury, MD

3:42pm
Chronic Lymphoplasmacytic Rhinosinusitis: Description of a Unique Phenotype
Andrea M. Hebert, MD

3:49pm
Sinus Hypoplasia in the CF Rat Resolves in the Absence of Chronic Infection
Jessica Grayson, MD

3:56pm
CFD Evidence of Posterior Septectomy as Viable Treatment Option for Large Septal Perforation
Bradley A. Otto, MD

4:03pm
Discussion

Moderators:
Subinoy Das, MD, FARS &
Jivianne Lee, MD, FARS

4:09pm
Safety and Efficacy of Fluticasone-Eluting Sinus Implant in Rabbit Model
Vishal Patel, BS

4:16pm
Eustachian Tube Balloon Dilation for Immediate Relief of ET Dysfunction
Vincent Honrubia, MD

4:23pm
Safety and Tolerability of Surfactant Nasal Irrigation
Justin H. Turner, MD, PhD

4:30pm
Cryosurgical Posterior Nasal Nerve Ablation for Improving Rhinitis Symptoms – Extended Follow-up
Jacob Johnson, MD

4:37pm
Discussion

4:45pm
Panel: Advances and Challenges in Managing Cystic Fibrosis
Moderator: Erin O'Brien, MD, FARS
Panelists: Eugene Chang, MD, FARS, Sandra Lin, MD, FARS, Bradford Woodworth, MD, FARS

5:25pm
Closing Remarks and Adjourn

5:30pm
Poster Presentations & Reception

Friday, April 28, 2017

12:00pm
Lunch

12:55pm
Welcome
John DelGaudio, MD, FARS

1:00pm
Panel: New Insights into the Impact of Chronic Rhinosinusitis
Moderator: Zachary Soler, MD
Panelists: Stacey Gray, MD, FARS, Melissa Pynnonen, MD, MSC, Jeffrey Suh, MD

Moderators:
Jeremiah Alt, MD, PhD, FARS, &
Adam DeConde, MD

1:40pm
Distinct Histopathologic Features of Radiation-Induced Chronic Sinusitis
Hannah N. Kuhar, BA

1:47pm
Chronic Sinonasal Tract Inflammation as a Precursor to Nasopharyngeal Carcinoma and Sinonasal Malignancy in the United States
Eric L. Wu, MS

1:54pm
Gender-Specific Differences in Serum IgE Levels and Prevalence of Fungus in Sinonasal Tissue Noted in Chronic Rhinosinusitis Patients Undergoing Endoscopic Sinus Surgery
Antoine Azar, BS

2:01pm
Prevalence of Positive Allergen Reaction in Allergic Rhinitis and Non-Allergic Rhinitis
Aneeza Hamizan, MD

2:08pm
Discussion

Moderators:
Stacey Gray, MD, FARS & Marc Dubin, MD, FARS

2:14pm
Validated Outcome Measures Demonstrate Substantial Facial Pain Improvement Following Endoscopic Sinus Surgery in Patients with Chronic Rhinosinusitis
Daniel R. Cox, MD

2:21pm
Beyond the Lund-Mackay Score: What Radiographic Disease Burden Tells Us about Patient-Reported Outcomes in Chronic Rhinosinusitis
Naweed I. Chowdhury, MD

2:28pm
The Relationship Between Chronic Rhinosinusitis and Socioeconomic Status, Race, and Insurance Status
Madeleine Samuelson, MD

2:35pm
Diagnostic Grouping of Rhinologic Patients by Cluster Analysis
Charles A. Riley, MD

2:42pm
Discussion

2:48pm
Panel: Progress Report: Women in Rhinology
Moderator: Ayesha Khalid, MD, MBA, FARS
Panelists: Robert Kern, MD, FARS, Erin O'Brien, MD, FARS, Winston Vaughan, MD, FARS

3:25pm
Break

Moderators:
Nithin Adappa, MD, FARS &
Marilene Wang, MD, FARS

3:45pm
Molecular Targeted Therapy of Juvenile Nasopharyngeal Angiofibroma: Inhibition of Vascular Endothelial Growth Factor Using Semaxanib
Tran B. Le, MD

3:52pm
Adoption of a Standardized Perioperative Antimicrobial Protocol May Impact the Incidence of Post-Operative Meningitis in Skull Base Surgery: Review of Perioperative Antimicrobial Protocols and Potential Risk Factors in the Development of Meningitis
Chester F. Griffiths, MD

3:59pm
Inhibition of Fibroblast Growth Factor Receptor with Azd-4547 Mitigates Juvenile Nasopharyngeal Angiofibroma
Tran B. Le, MD

4:06pm
The Bilateral Nasoseptal Rescue Flap: An Analysis of 100 Consecutive Patients and Implications for Routine Transphenoidal Surgery
Brian C. Lobo, MD

4:13pm
Discussion

Moderators:
Troy Woodard, MD, FARS & Melissa Pynnonen, MD

4:19pm
Evaluating Real-Time Effects of Topical 1:1000 Epinephrine in Endoscopic Sinus and Skull Base Surgery on Hemodynamic Parameters Through Intra-Operative Arterial Line Monitoring
Michael T. Yim, MD

4:26pm
Effects of Ophthalmologic Solutions on Sinonasal Ciliated Epithelium for Use in Nasal Drug Delivery
Alan D. Workman, BA

4:33pm
Endoscopic Sinus Surgery in Children: Analysis of Pediatric National Surgical Quality Improvement Program Safety Outcomes
Christopher R. Roxbury, MD

4:40pm
An Evidence Based Approach to Reducing Prescriptions for Narcotic Pain Medication after Sinus and Nasal Surgery
Sophia D. Becker

4:47pm
Discussion

4:53pm
Panel: Optimal Treatment of the Nasal Valve (ARS & AAFPRS)
Moderator: Lisa Grunebaum, MD
Panelists: Richard Harvey, MD, FARS, Sam Most, MD, Leigh Sowerby, MD

5:30pm
Closing Remarks and Adjourn
John DelGaudio, MD, FARS

POSTERS

#D001
A Case of Indolent Sinonasal Melanoma in the Setting of Atypical Pigmentation
Benjamin Addicks, MD

#D002
A Critical Evaluation of the Validity of Casts for In Vitro Evaluation of Locally Acting Nasally Administered Drug Products
Per Djupesland, MD, PhD

#D003
A Nationwide Perspective of Pediatric Invasive Fungal Sinusitis: Perioperative Complications and Outcomes
Curtis Hanba, BS

#D004
A Needle in a Haystack: Endoscopic Removal of a Foreign Body from the Infratemporal Fossa
Khrystyna Ioanidis, BScH

#D005
A Novel Presentation of Sinonasal Phosphaturic Mesenchymal Tumor: Case Report and Review of the Literature
Brandon Peine, BS

#D006 Withdrawn

#D007
A Population-based Analysis of Nodal Metastases In Esthesioneuroblastomas of the Sinonasal Tract
Edward Kuan, MD

#D008
A Rare Case of Adenocarcinoma of Unknown Origin of the Clivus
Mahmoud Awad, MD

#D009
A Single-institution Review of Revision Cerebrospinal Fluid Leak Repairs: Clinical Outcomes
Sarah Kidwai, MD

#D010
A Systematic Review of Medical Therapy for Epistaxis in Hereditary Hemorrhagic Telangiectasia
Ashleigh Halderman, MD

#D011
Adjunctive Pain and Anxiety Management for Office-based Rhinology Procedures
Michael Marino, MD

#D012
Adverse Effects of Intranasal Steroids on Intraocular Pressure: A Systematic Review
Evan Somers, MD

#D013
Adverse Events from Balloon Sinus Dilation
Peter Svider, MD

#D014
Adverse Events from Implantable Sinus Stent Devices
Michael Bobian, BS

#D015
Aerd Associated Eosinophilic Otitis Media: Is there Increased Severity of Comorbid Disease?
Ryota Kashiwasaki, MD

#D016
Air Pollution and Chronic Rhinosinusitis: Are there Modifiable Risk Factors for Disease Expression?
Leila Mady, MD, PhD, MPH

#D017
An Endoscopic, Transnasal Resection of A Tubercular Meningioma with Nasoseptal Flap Reconstruction in a Patient with Hht: A Case Report
Christoph Prummer, MD

#D018
An Ergonomical Assessment of Operating Table and Surgical Stool Heights for Seated Otolaryngology Procedures
Philip Chen, MD

#D019
Anatomic Quantification of Nasal Cavity and Olfactory Cleft in Chronic Rhinosinusitis with and without Olfactory Dysfunction
Tracy Cheng, AB

#D020
Are Multiple Cultures Necessary During Sinus Surgery for Chronic Rhinosinusitis?
Craig Miller, MD

#D021
Bacterial Colonization of Nasal Drug Delivery Devices for Chronic Rhinosinusitis and the Utility of Nozzle Sterilization Techniques
Joel Franco, MD

#D022
Balanced Orbital Decompression With En Bloc Lateral Wall Resection and Endoscopic Medial Wall Decompression in Patients with Thyroid Eye Disease
Alexander Limjuco, MD

#D023
B-cell Lymphoblastic Lymphoma of the Skull Base in a Pediatric Patient
Dominic Catalano, BS

#D024
Bilateral Sinonasal Lymphoma in the Absence of a Solitary Lesion: Case Report and Review of Literature
Laura Garcia-Rodriguez, MD

#D025
Case Report: Inferior Meatus Fungal Ball
Guanning Lu, MD

#D026
Case Report: Magnetic Foreign Bodies Embedded in the Septum Discovered During MRI
Sara Gallant, MD

#D027
Causes of Death and Survival Time in Acute Invasive Fungal Sinusitis
Carol Yan, MD

#D028
Central Compartment Atopic Disease
Patricia Loftus, MD

#D029
Chronic Rhinosinusitis with Nasal Polyps have Two Distinct Gene Expression Profiles
Tsuguhisa Nakayama, MD

#D030
Chronic Sinusitis Associated with Zygomatic Implants: A Case Series and Review of the Literature
Amit Arunkumar, B.A.

#D031
Chronic Sphenoiditis with Deep Neck Space Extension: Case Report with Review of the Literature and Postulated Mechanisms for Extracranial Extension
Isolina Rossi, MS3

#D032
Combined Lid Crease and Endoscopic Approach - A Viable Approach for Lateral Frontal Sinus and Orbital Disease
Alexander Limjuco, MD

#D033
Community-acquired Methicillin-resistant Staphylococcus Aureus Abscesses of the Nose: Comparing Populations at a Community Hospital And Tertiary Hospital in a Major City
Wesley Davison, MD

#D034
Comprehensive Literature Review and Improved Classification System to Better Understand and Treat Barosinusitis
Reza Vaezeafshar, MD

#D035
Correlations Between Cystic Fibrosis Genotype and Sinonasal Disease Phenotype in Patients with Chronic Rhinosinusitis
Waleed Abuzeid, MD

#D036
Cox-2 Overexpression in Primary and Recurrent Inverted and Oncocytic Schneiderian Papillomas
Elisabeth Ference, MD, MPH

#D037
CRS and Immunosuppression Suppressants Agents
Yun Johanna, BA

#D038
Delivering Solutions to the Anterior Ethmoid Region: Evaluation of a Lacrimal Diversion Device in a Cadaver Model
Bobby Tajudeen, MD

#D039
Development of a 3D Printed Skull Base Task Trainer for Teaching Extended Endoscopic Sinonasal Approaches
Brian Cervenka, MD

#D040
Developmental Anomaly – A Duplicate Fronto-ethmoidal Sinus Complex
Jia Hui Jang, MD

#D041 Withdrawn

#D042
Ectopic Olfactory Neuroblastoma: Systematic Review and Report of New Case
Lindsay Yang, BA

#D043
Effects of an Exercise Program on Olfaction in Patients with Alzheimer's Disease
Vidur Bhalla, MD

#D044
Efficacy of Transnasal Endoscopic Dacryocystorhinostomy with Ultrasonic Bone Aspirator in Revision Dacryocystorhinostomy
David Hsu, MD

#D045
Endoscopic "Puncture and Dilate" Hybrid Frontal Sinusotomy Technique for Type 3 Frontal Cell Excision
Thomas Higgins, MD, MSPH, FARS

#D046
Endoscopic "Unzip" Frontal Sinusotomy Technique for Excision of Type 3 Frontal Cells
Thomas Higgins, MD, MSPH, FARS

#D047
Endoscopic Approaches for Intraorbital Dissection
Christopher Brook, MD

#D048
Endoscopic Decompression of Pott's Puffy Tumor in an Adult
Lilun Li, MD

#D049
Evaluating Simulator-based Teaching Methods for Endoscopic Sinus Surgery
Nathan Lindquist, MD

#D050
Evaluation of Patient Nasal Saline Irrigation Practices Following Endoscopic Sinus Surgery and its Effects on Shortterm Outcomes
Frederick Yoo, MD

#D051
Evolution of the Endoscopic Modified Lothrop Procedure in Frontal Sinus Disease: A Systematic Review and Metaanalysis
Liang-Chun Shih, MD

#D052
Extranodal Natural Killer/T-Cell Lymphoma Presenting with Dacryocystitis: A Case Report and Review of Literature
Zhong Zheng, MD

#D053
Feasibility, Cost, and Anatomic Accuracy of 3D Printed Paranasal Sinus and Skull Base Model
Tsung-yen Hsieh, MD

#D054
Fibrous Dysplasia of the Lateral Nasal Wall Presenting as Inferior Turbinate Hypertrophy
Joseph Capo, MD

#D055
Idiopathic Csf Oculorrhea: An Unusual Case Report
Anchal Duggal, Doctor

#D056
Incidence and Survival of Sinonasal Adenocarcinoma: Analysis by Site and Histologic Subtype
Suat Kilic, B.A.

#D057
Incidence of Sphenoid Mucoceles after Endoscopic Transsphenoidal Approach with Sphenoid Obliteration
Katelyn Stepan, MD

#D058
Infective Organisms in Chronic Rhinosinusitis with Nasal Polyps.
Abdullah Albader, MD

#D059
Invasive Fungal Sinusitis after Maxillary Sinus Inverted Papilloma Resection
Sarah Kidwai, MD

#D060
Itraconazole in Refractory Chronic Rhinosinusitis with Nasal Polyposis: A Retrospective Review
Vanessa Stubbs, MD

#D061
Long-term Follow Up of Patients Undergoing 3 Vs. 6 Weeks of Antibiotic Therapy for Chronic Rhinosinusitis
Katherine Adams, BS

#D062
Lower Scores on Preoperative Snot-22 Evaluation Does Not Necessarily Imply Lack of Benefit from Endoscopic Sinus Surgery
Christopher Ito, MD

#D063
Malignancies as a Surprising Result of Fess in an Italian Tertiary Care Center
Stefano Millarelli, MD

#D064
Management of Epistaxis in Patients with Ventricular Assist Device
Clifford Brown, MD

#D065
Management of Odontogenic Cysts by Endonasal Endoscopic Techniques: A Systematic Review and Case Series
Michael Marino, MD

#D066
Management of Pediatric Chronic Rhinosinusitis: Comparisons of Practice Patterns Between the American Rhinologic Society and the American Society of Pediatric Otolaryngology
Daniel Beswick, MD

#D067
Mapping and Comparing Fungal Microbiota in the Sinonasal Cavity of Healthy, Allergic Rhinitis, and CRS Subjects
Devyani Lal, MD

#D068
Morphometric Analysis of Pyriform Aperture Width and its Correlation with Age, Sex, Race, Bmi and Post-operative Nasal Obstruction Score
Yue Ma, MD

#D069
Morphometric Analysis of the Orbital Process of the Palatine Bone and its Relationship to Endoscopic Orbital Apex Surgery
Sarina Mueller, MD

#D070
Mucosal Magnetic Resonance Characteristics in the Posttumour Sinonasal Cavity
Ian Matchett, BMed

#D071
Navigate 1: Eds-flu (Exhalation Delivery System for Fluticasone) for Symptoms of Crswnp (Chronic Rhinosinusitis with Nasal Polyps)
Joseph Han, MD, FARS

#D072
Necrotizing Sinonasal Gangrene in a Patient with Intranasal Opioid Abuse
Matthew Kim, MD

#D073
Neurovascular Sequelae of Invasive Fungal Sinusitis
Daniel Carlton, MD

#D074
New Insights into Predictors of Survival for Sinonasal Melanoma
Edward Kuan, MD

#D075
Non-intestinal Type Sinonasal Adenocarcinoma: A Case Report and Review of the Literature
Stephen Hernandez, MD

#D076
Nose and Tongue: Bitter Taste Receptor Mrna Expression in Nasal and Fungiform Papillae Biopsy
Jennifer Douglas, BA

#D077
Nose Blowing After Sinus Surgery Does Not Adversely Affect Outcomes
Noel Ayoub, BS

#D078
Optimization of Intranasal Drug Deposition in Postoperative Sinuses of Patients with Chronic Rhinosinusitis
Presented by Raewyn Cavubati, MD

#D079
Optimizing Cell Harvest from Nasal Brushings for Determining Local Allergy Responses
Erin Saricilar, Mr

#D080
Orbital Apex Syndrome Following Expanded Endonasal Resection of Infrasellar Craniopharyngioma
Catherine Lumey, MD

#D081
Orbital Subperiosteal Hematoma, a Rare Complication of Pediatric Acute Rhinosinusitis
Joseph White, MD

#D082
Outcomes and Algorithms for Contemporary, Endotype-Directed Therapy for Chronic Rhinosinusitis
Amar Miglani, MD

#D083
Outcomes of Endoscopic Septoplasty without the Use of Postoperative Packing or Splinting
Mary Worthen, MD

#D084
Outcomes of the Endoscopic Modified Lothrop Procedure Following Failure of Primary Functional Endoscopic Sinus Surgery: A Meta-analysis
Christina Fang, MD

#D085
Outfracture: Managing the Recalcitrant Turbinate in the Office Based Setting
Charles Hurbis, M.D.

#D086
Perception of Empty Nose Syndrome and its Impact on Inferior Turbinate Management: Survey of Attendees of the American Rhinologic Society Meeting at AAO
Andrew Thamboo, MD, MHSc

#D087
Polypoid Change of the Middle Turbinate and Paranasal Sinus Polyposis are Distinct Entities
Jacob Brunner, MD

#D088
Posterior Inferior Turbinate Hypertrophy (PITH): A Role in Postnasal Drip
Edward McCoul, MD, MPH, FARS

#D089
Post-transplant Lymphoproliferative Disorder Presenting as Retropharyngeal Abscess
Matthew Kim, MD

#D090
Practice Patterns in Office-based Rhinology: Survey of the American Rhinologic Society
Jivianne Lee, MD, FARS

#D091
Predictors of Unanticipated Admission Within 30 Days of Outpatient Sinonasal Surgery
Isabelle Gengler, MD, MS

#D092
Prevalence and Burden of Rhinitis Medicamentosa in a Tertiary Rhinology Setting
Colin Fuller, MD, MS

#D093
Prevalence of Frontal Cells According to the International Frontal Sinus Anatomy Classification (IFAC)
Garret Choby, MD

#D094
Prevention of Epistaxis and Preservation of Olfactory Function Utilizing Bilateral Mucosal Preserving Nasoseptal Rescue Flap Approach in Skull Base Surgery: Prospective Analysis and Update
Chester Griffiths, MD

#D095
Primary Ciliary Dyskinesia: Management of Chronic Rhinosinusitis in the Adult Population
Jacob Brunner, MD

#D096
Probiotic Sinus Irrigations Side Effects in Patients with Refractory Chronic Rhinosinusitis
Omar Ahmed, MD

#D097
Quality and Readability of Online Rhinology Information by Internet Source
Farshad Chowdhury, MD

#D098
Radiologic Phenotype of Chronic Rhinosinusitis with Atopic Predisposition
Aneeza Hamizan, MD

#D099
Recurrent Nasal Polyposis in Cystic Fibrosis Treated with Propel Implants: A Case Report
Mark Frilling, MS

#D100
A Rare Sphenoid Sinus Meningioma
Mark Frilling, MS

#D101
Relationship Between Specific Atopic Diseases and In-vitro Allergen Tests
Michael Benninger, MD, FARS

#D102
Relationship of Peripheral Blood Eosinophilia to Computed Tomographic Findings of Middle Ear and Sinus Disease in Asthmatic Patients
Terence Zimmermann, MD

#D103
Research Meteorological Environmental Factors And Ifn-il4 Dna Methylation in Cd4+t Cells from Patients with Ar Children
Youjin Li, MD

#D104
Retrieval of Displaced Dental Implants From the Maxillary Sinus: Endoscopic vs Open Approach
Sheran Seneviratne, MBBS

#D105
Sellar Abscess Following Endoscopic Sinus Surgery: A Case Series
Sanjeet Rangarajan, MD

#D106
Short-term Morbidity Following Endoscopic Modified Lothrop (Draf III) Frontal Sinus Surgery Compared to Endoscopic Frontal Sinusotomy (Draf IIA)
Aria Jafari, MD

#D107
Silent Sinus Syndrome After Facial Trauma: A Case Report and Systematic Review
Rakhna Araslanova, MD

#D108
Single Institution Outcomes Following Resection of Skull Base Esthesioneuroblastomas with Extended Follow-up
Andrew Holcomb, MD

#D109
Sinonasal Correlates of Infrasellar Giant Pituitary Adenomas
Karam Badran, MD

#D110
Sinonasal Epithelial-myoepithelial Carcinoma: A Case Report of a Novel Subsite and Review of the Literature
Theodore Schuman, MD

#D111
Sinonasal Osteoblastoma: Pre-operative Radiologic Diagnosis
Philip Locker, BA

#D112
Sinus Pneumatization in Primary Ciliary Dyskinesia
Adam Kimple, MD, PhD

#D113
Skull Base Regeneration After Chemoradiation in Nasopharyngeal Carcinoma
Kelly Moyer, MD

#D114
Strategic Placement of Frontal Sinus Trephination with Endoscopic Treatment for Endonasally Inaccessible Frontal Sinus Mucoceles
Thomas McKnight, MD

#D115
Surgical Management of Inferior Turbinate Hypertrophy: An Evidenced-based Review and Recommendations
Andrew Thamboo, MD, MHSc

#D116
Surgical Management of Silent Sinus Syndrome: When is Orbital Floor Reconstruction Necessary?
Jay Agarwal, MD

#D117
Survey of Endoscopic Skull Base Surgery Practice Patterns Among Otolaryngologists
Todd Wannemuehler, MD

#D118
Synchronous Inverted Papilloma and Recurrent Respiratory Papillomatosis: Case Report and Review of the Literature
Jeremie Oliver, BA, BS

#D119
Synchronously Occurring Exophytic and Inverted Schneiderian Papillomas
Kevin Choi, MD, MS

#D120
The Condemned Sinus: Natural Disease or Surgical Sequella?
Edward McCoul, MD, MPH, FARS

#D121
The Effectiveness of Topical Silver Colloid in Treating Patients with Recalcitrant Chronic Rhinosinusitis
John Scott, MD

#D122
The Efficacy of Topical Intranasal Dexamethasone Versus Fluticasone in Patients with Chronic Rhinosinusitis with Nasal Polyps Following Surgery
Stephanie Cipta, MD

#D123
The Impact of Anti-ige Monoclonal Antibody Therapy in Aspirin Exacerbated Respiratory Disease
Jonathan Yip, MD

#D124
The Presence of Anatomic Variants are Associated with Worse Sinonasal Symptoms in Patients with Chronic Rhinosinusitis
Thomas Holmes, BS

#D125
The Role of Sinus Cultures in Children with Blood or Marrow Transplants
Anatoli Karas, MD

#D126
The Role of Statins in CRS Presentation and Surgical Severity
Jarrett Walsh, MD, PhD

#D127
The Role of the Osteomeatal Complex in Chronic Rhinosinusitis: an Anatomic Study of Maximal Medical Therapy
Satyan Sreenath, MD

#D128
The Snot-nose Assessment in Endoscopic Sinus Surgery
Charles Riley, MD

#D129
Three Year Review of Chronic Rhinosinusitis Microbiome Using DNA Analysis
Brittany Dobson, MD

#D130
Time, Not Supply or Resident Involvement, is the Greatest Driver of Cost Variability in Septoplasty with Inferior Turbinate Surgery
Nicholas Quinn, MD

#D131
Transoral Finger-Retraction for Endonasal Endoscopic Resection of Masseteric and Buccal Space Lesions
Qasim Husain, MD

#D132
Treatment of Oral Telangiectasia with Sodium Tetradecyl Sulfate - A Novel Use
Dennis Tang, MD

#D133
Unilateral Abducens Nerve Palsy Secondary to Sphenoid Sinus Fungal Ball
Caroline Rieger, MD

#D134
Using Fixed Bony Landmarks to Identify the Anterior Aspect of the Olfactory Fossa
Zaahir Turfe, MD

#D135
Validation of Perfusion-based Human Cadaveric Simulation Training for Carotid Artery Injury in Endoscopic Sinus and Skull Base Surgery
Jasper Shen, MD

Poster Presentation & Reception: Thursday, 4/27/2017 5:30pm

Oral Presentations

Thursday, April 27, 2017

7:55am
Welcome
John DelGaudio, MD, FARS

Moderators:
Stella Lee, MD & Amber Luong, MD, PhD, FARS

8:00am
Establishing Urinary Leukotriene E4 As a Diagnostic Biomarker for Chronic Rhinosinusitis with and without Comorbid Asthma and Atopy
Joseph Han, MD, FARS
Griffin Santarelli, MD
Kent Lam, MD
Norfolk, VA

Background:
Urinary leukotriene E4 (LTE4) is a validated marker for the cysteinyl leukotriene pathway, which is central to the pathophysiology of asthma, atopy, and chronic rhinosinusitis (CRS). The contributions of comorbid asthma and atopy to urinary LTE4 (uLTE4) levels in various CRS subtypes is less studied.

Objectives:
We sought to (1) identify reference values for uLTE4 in subjects with and without CRS, and (2) determine how the presence of comorbid atopy and asthma affected uLTE4 levels in CRS.

Methods:
A prospective case control study was conducted in which urinary samples were collected. Control patient did not did not carry the diagnoses of CRS, allergies, or asthma. The CRS patients were stratified according to the presence or absence of asthma and atopy. Urinary LTE4 levels were measured by enzyme immunoassay and adjusted by urinary creatinine concentration.

Results:
There were 85 patients in the study. The average age was 47 years with 45% being female. CRS patients (1,641 pg/mg) had higher concentrations of uLTE4 than control (706 pg/mg)(p=0.02). The CRS with asthma (1,780 pg/mg) (p=0.02) and atopy (1,735 pg/mg) (p=0.02) positively affected urinary LTE4 levels compared to control. CRS without allergy and asthma (838 pg/mg) did not have statistically higher uLTE4 than the control.

Conclusion:
Urinary LTE4 serves as a non-invasive measure of the inflammatory state in CRS. Asthma and atopy contribute to elevated urinary LTE4 levels in CRS.

8:07am
Pre-operative Lund-Mackay Ct Score Predicts Quality of Life Outcome Trajectories after Sinus Surgery in Chronic Rhinosinusitis Patients
Michal Trope, BA
Steven G. Brooks, BS, MPH
Nithin D. Adappa, MD, FARS
Mariel Blasetti, BS
Arjun Parasher, MD
Jordan Glicksman, MD
Philadelphia, PA

Background:
There is a disagreement whether or not pre-operative Lund-MacKay CT scores (LMCTS) are predictive of quality-of-life (QoL) outcomes in chronic rhinosinusitis (CRS) patients before and after functional endoscopic sinus surgery (FESS). The current paper seeks to investigate Lund-MacKay CT scores as a possible predictor for post-surgical SNOT-22 outcomes in CRS patients.

Methods:
Adult patients with medically recalcitrant CRS (n=617) were prospectively enrolled in an observational patient series study. Patient's preoperative CT scans were scored using the Lund-MacKay scoring method, and preoperative and postoperative self-reported quality of life outcomes data (SNOT-22) were collected and evaluated over a 12 month period. In total, 511 patients who met the inclusion criteria and had both a LMCTS and pre and post-operative SNOT-22 scores were included.

Results:
Pre-operative Lund-MacKay CT Scores were significantly associated with SNOT-22 score trajectory over time ($p<0.001$) and SNOT-22 scores at pre-op ($p=0.001$). Using a longitudinal linear mixed effects model, patients in the highest quartile of LMCTS had a 14 point greater improvement between pre-op and 12 month SNOT-22 scores as compared to the patients in the lowest quartile of LMCTS ($p<0.001$; 95%CI=6.5-22.2). Patients with the highest LMCTS also had higher pre-op SNOT-22 scores compared to those with the lowest LMCTS (10.7 pts; $p<0.001$; 95%CI=5.2-16.1).

Conclusion:
Our current study is the largest cohort to address the question of LMCTS and quality-of-life. Our results demonstrate that the Lund-MacKay CT staging method is an indicator of both pre- and post-surgical quality-of-life outcomes for medically recalcitrant CRS patients.

8:14am
Understanding the Relationship Between Olfactory-Specific Quality of Life, Objective Olfactory Loss, and Patient Factors in Chronic Rhinosinusitis
Jose L. Mattos, MD, MPH
Rodney J. Schlosser,, MD, FARS
Kristina A. Storck, MSPH
Zachary M. Soler, MD, MSc
Charleston, SC

Introduction:
Chronic rhinosinusitis (CRS) significantly impacts olfaction. However, the relationship between objective olfaction and patient-reported olfactory-specific quality of life (QOL) is not well understood. Furthermore, objective olfactory testing can be time consuming. Thus we sought to determine if patient-reported olfactory QOL can be used as screening tool for olfactory dysfunction.

Methods:
Olfactory dysfunction was evaluated in 109 patients with CRS using the Questionnaire of Olfactory Disorders-Negative Statements (QOD-NS) and Sniffin' Sticks Test, assessing for olfactory threshold, discrimination, identification, and overall composite scores (TDI). Regression analysis was performed to correlate olfactory metrics and patient and disease-specific factors with QOD-

NS scores. Optimal QOD-NS scores to classify patients based upon objective olfactory function were established.

Results:
Bivariate and multivariate regression analyses of QOD-NS and CRS-associated comorbidities, objective measures of disease, demographics, and CRS-specific QOL were performed. Race, presence of depression, and worse SNOT-22 scores correlated with worse QOD-NS scores ($p < 0.005$). Worse TDI scores correlated with worse QOD-NS scores, and discrimination had the strongest correlation ($p < 0.001$). Mean QOD-NS scores for normosmia, hyposmia, and anosmia were 44 (+/- 7.2), 35.7 (+/- 12.8), and 31.6 (+/- 10.7) respectively. Receiver operating characteristics (ROC) analysis revealed an area under the curve of 0.77 ($p < 0.001$) and a QOD-NS cut off of 38.5 to have maximal Youden's Index to define normal versus abnormal olfaction.

Conclusions:
In CRS, QOD-NS correlates with race, depression status, SNOT-22, and TDI score, with discrimination having the strongest correlation. QOD-NS also appears to be a feasible tool for olfaction screening.

8:21am

Role of Tissue Eosinophils in Chronic Rhinosinusitis-Associated Olfactory Loss

Leah J. Hauser, MD
Rick K. Chandra, MD, FARS
Ping Li, MD
Justin H. Turner, MD, PhD
Nashville, TN

Introduction:
Olfactory dysfunction is one of the hallmark symptoms of chronic rhinosinusitis (CRS). Eosinophilic inflammation has been implicated as a potential causative factor, however, prior studies have been limited by retrospective study designs, concomitant use of systemic corticosteroids, and other confounding factors.

Methods:
CRS and healthy non-CRS control subjects undergoing endoscopic sinus or skull base surgery were prospectively enrolled and completed olfactory testing utilizing the 40-question Smell Identification Test (SIT) immediately prior to surgery. Histopathological evaluation of excised tissue was performed by a pathologist in a blinded fashion. Disease severity and patient reported outcomes were measured via the Lund-Mackay CT grading system and Sinonasal outcome test-22, respectively. The associations between olfactory function, tissue eosinophilia, and disease severity were analyzed using Spearman rank order correlation and multiple linear regression.

Results:
27 subjects with CRS without nasal polyps (CRSsNP), 32 subjects with CRS with nasal polyps (CRSwNP), and 10 healthy non-CRS controls were enrolled. CRSwNP was associated with higher mean tissue eosinophil counts (71.6 vs. 28.1 eosinophils/HPF, $p<0.05$) and lower age/sex-adjusted SIT scores (-17.4 vs. -6.2, $p<0.001$) when compared to CRSsNP. SIT scores were strongly correlated with tissue eosinophil counts in CRSwNP ($r=0.60$, $p=0.0003$), but not CRSsNP ($r=0.16$, $p=0.42$). The correlation between olfactory function and tissue eosinophilia in CRSwNP persisted after adjusting for disease severity ($p = 0.002$).

Conclusions:
Tissue eosinophilia is associated with olfactory loss in CRSwNP, independent of disease severity. These results suggest a possible role for eosinophils or eosinophil-associated cytokines in CRS-associated olfactory loss.

8:28am

Discussion

Moderators:
Henry Barham, MD & Eric Wang, MD, FARS

8:33am

LL-37 Causes Cell Death of Human Nasal Epithelial Cells, which is Inhibited with a Synthetic Glycosaminoglycan

Andrew J. Thomas, MD
Abigail Pulsipher, PhD
Glenn Prestwich, PhD
Siam Oottamasathien, MD
Jeremiah A. Alt, MD, PhD, FARS
Salt Lake City, UT

Introduction:
LL-37 is an immune peptide that regulates the innate and adaptive immune response. Elevated levels of LL-37 have been linked to cell death and inflammatory disease states. Recent findings suggest that a synthetic glycosaminoglycan (GM-0111) can protect against LL-37-induced sinonasal mucosal inflammation. Our objectives were to elucidate 1) the mechanisms by which LL-37 causes sinonasal inflammation and 2) how GM-0111 can prevent these mechanisms.

Methods:
Cultured human nasal epithelial cells (HNEpCs) and mouse macrophages (J774.2) were treated with saline vehicle, LL-37, or GM-0111+LL-37. Adenosine triphosphate (ATP) release was quantified by luminescence, interleukin (IL)-6 and IL-8 release was quantified by enzyme-linked immunosorbent assays (ELISA), and morphological changes were assessed using light microscopy. Annexin V and 7-aminoactinomycin D (7-AAD) detection were used to quantitate early and late cell death states, respectively. Caspase-1, -3/7, and -8 activation (cell death pathways) were assayed using flow cytometry.

Results:
LL-37 causes increased ATP release from HNEpCs and J774.2 cells and IL-6 and IL-8 release from HNEpCs, which are blocked dose-dependently by GM-0111. LL-37 causes increased Annexin V and 7-AAD detection and cell lysis, which are blocked by GM-0111. LL-37 induces robust caspase-1 and -8 activation in both cell lines, which are blocked by GM-0111. Caspase-3/7 is not activated in response to LL-37.

Conclusions:
Our data suggest that LL-37 causes cellular death of HNEpCs and macrophages through the pro-inflammatory necrotic and/or pyroptotic pathways (caspase-1 and -8) rather than apoptosis (caspase-3/7). A synthetic GAG is capable of inhibiting Caspase-1 and -8-dependent cell death of HNEpCs and macrophages.

8:40am

Ciprofloxacin Antimicrobial Activity Against Pseudomonas Aeruginosa is Enhanced by the CFTR Potentiator, Ivacaftor

Do-Yeon Cho, MD
Dong Jin Lim, PhD
Calvin Mackey, BS
Gobind S. Gill, BS
Harrison S. Hill, BS
Bradford A. Woodworth, MD, FARS
Birmingham, AL

Objectives:
Agents that enhance the antimicrobial activity of currently available antibiotics represent a valuable and cost-effective means for improving clinical efficacy against multi-drug resistant bacterial pathogens in chronic rhinosinusitis (CRS). Ivacaftor, a CFTR potentiator, was recently identified as having potentially beneficial off-target effects as a weak inhibitor of bacterial DNA gyrase and topoisomerase IV. The objective of the current study was to evaluate whether ivacaftor enhances the antimicrobial activity of ciprofloxacin against Pseudomonas aeruginosa.

Methods:
Growth of Pseudomonas strain PAO1 in the presence of ciprofloxacin and/or ivacaftor was measured at 600nm using a spectrophotometer and relative optical density units (RODUs) were calculated compared to vehicle control. A static biofilm formation assay was performed in 96-well polystyrene microtiter plates and eradication assessed using live/dead assay (BacTiter-Glo™ assay, Promega) and laser scanning confocal microscopy.

Results:
PAO1 growth was significantly reduced in the presence of ivacaftor (8µg/ml) + ciprofloxacin (0.05µg/ml) (RODUs=0.79+/-0.01) compared to ciprofloxacin alone (RODUs=0.88+/-0.00)(n=5, p<0.001). There was no significant reduction with ivacaftor alone (8µg/ml, RODUs=0.97+/-0.00, p>0.05). Ivacaftor improved ciprofloxacin's antimicrobial efficacy in a dose-dependent fashion (8µg/ml, 0.787+/-0.01; 36µg/ml, 0.74+/-0.00; 72µg/ml, 0.67+/-0.01). Biofilm formation was also significantly decreased in the presence of ivacaftor compared to ciprofloxacin or ivacaftor alone (n=4) when calculating % of dead cells (control = 0.23+/-0.05; Ciprofloxacin = 0.8+/-0.01; Ivacaftor = 0.33+/-0.06; Ciprofloxacin+Ivacaftor = 1.46+/-0.18, p<0.0001).

Conclusions:
Ivacaftor enhanced ciprofloxacin's antimicrobial activity against the PAO1 strain of Pseudomonas aeruginosa. Further studies evaluating the efficacy of ivacaftor/ciprofloxacin combination for Pseudomonas aeruginosa infections in CRS are planned.

8:47am

Denatonium-induced Bacterial Killing in Sinonasal Epithelium Correlates with Chronic Rhinosinusitis Clinical and Surgical Outcomes

Ryan M. Carey, BSE
Alan D. Workman, BA
Noam A. Cohen, MD, PhD, FARS
Philadelphia, PA

Objectives:
Agents that enhance the antimicrobial activity of currently available antibiotics represent a valuable and cost-effective means for improving clinical efficacy against multi-drug resistant bacterial pathogens in chronic rhinosinusitis (CRS). Ivacaftor, a CFTR potentiator, was recently identified as having potentially beneficial off-target effects as a weak inhibitor of bacterial DNA gyrase and topoisomerase IV. The objective of the current study was to evaluate whether ivacaftor enhances the antimicrobial activity of ciprofloxacin against Pseudomonas aeruginosa.

Methods:
Growth of Pseudomonas strain PAO1 in the presence of ciprofloxacin and/or ivacaftor was measured at 600nm using a spectrophotometer and relative optical density units (RODUs) were calculated compared to vehicle control. A static biofilm formation assay was performed in 96-well polystyrene microtiter plates and eradication assessed using live/dead assay (BacTiter-Glo™ assay, Promega) and laser scanning confocal microscopy.

Results:
PAO1 growth was significantly reduced in the presence of ivacaftor (8µg/ml) + ciprofloxacin (0.05µg/ml) (RODUs=0.79+/-0.01) compared to ciprofloxacin alone (RODUs=0.88+/-0.00)(n=5, p<0.001). There was no significant reduction with ivacaftor alone (8µg/ml, RODUs=0.97+/-0.00, p>0.05). Ivacaftor improved ciprofloxacin's antimicrobial efficacy in a dose-dependent fashion (8µg/ml, 0.787+/-0.01; 36µg/ml, 0.74+/-0.00; 72µg/ml, 0.67+/-0.01). Biofilm formation was also significantly decreased in the presence of ivacaftor compared to ciprofloxacin or ivacaftor alone (n=4) when calculating % of dead cells (control = 0.23+/-0.05; Ciprofloxacin = 0.8+/-0.01; Ivacaftor = 0.33+/-0.06; Ciprofloxacin+Ivacaftor = 1.46+/-0.18, p<0.0001).

Conclusions:
Ivacaftor enhanced ciprofloxacin's antimicrobial activity against the PAO1 strain of Pseudomonas aeruginosa. Further studies evaluating the efficacy of ivacaftor/ciprofloxacin combination for Pseudomonas aeruginosa infections in CRS are planned.

8:54am

Oral Glucosamine Treatment Had Anti-Allergic Effect in Mice with Allergic Asthma and Rhinitis

Ah-Yeoun Jung, MS
Min-Jeong Heo, MS
Young Hyo Kim, MD, PhD
Incheon, Korea

Introduction:
Glucosamine is generally used as dietary supplement, because of its anti-inflammatory effect. We aimed to evaluate the anti-allergic effect of glucosamine in mice with allergic asthma and rhinitis.

Methods:
Thirty-two mice were allocated equally into four groups (n=8). In group A (control), we performed intraperitoneal/intra-nasal challenge using PBS. In group B (asthma/rhinitis), we used ovalbumin for intraperitoneal/intra-nasal challenge to induce allergic asthma and rhinitis. In groups C and D (glucosamine treatment), mice were given 1% and 5% of glucosamine orally throughout the period of ovalbumin challenge, respectively. We measured serum total and ovalbumin-specific IgE, titer of cytokines (IL-1, IL-4, IL-5, IL-6, IL-10, IL-17, TNF-a, IFN-?) and the number of inflammatory cells (eosinophils, neutrophils, lymphocytes)

in broncho-alveolar lavage (BAL) fluid. We also performed histo-pathologic examination for lung and nasal cavity. Finally, we performed real-time PCR for genes Bcl-2, EC-SOD, VEGF, caspase-3, Bax, COX-2, Hif-1a and heme oxygenase-1.

Results:
Compared to group B, group D demonstrated significant decrease of serum total and ovalbumin-specific IgE after treatment with glucosamine ($p<0.05$). The titers for IL-4, IL-5, IL-6 and IL-17 in BAL fluid were significantly decreased in Group D ($p<0.05$). The number of eosinophils in BAL fluid was significantly decreased in groups C/D, compared to Group B ($p<0.05$). Groups C and D showed significant improvement of inflammation, compared to group B. Compared to group B, mice in group D showed significant down-regulation of EC-SOD, Bax, Hif-1a and heme-oxygenase-1.

Conclusion:
Glucosamine had significant anti-allergic effect in mice with allergic asthma and rhinitis.

9:01am
Discussion and Award Presentation

9:08am
Presidential Address
John DelGaudio, MD, FARS

9:18am
Panel: Fresh Out of the Box: Compelling Recent Advances
Moderator: Benjamin Bleier, MD
Panelists: Noam Cohen, MD, FARS, Stella Lee, MD, Raymond Sacks, MD, FARS

10:00am
Break

Moderators:
Eric Holbrook, MD, FARS & Justin Turner, MD

10:20am
Vitamin D in Airway Epithelium Derived from Chronic Rhinosinusitis Patients
Sophia W, Ma, BMed
Jesse A Ende, BMed
Raquel Alvarado, PhD
Jenna M. Christensen, PhD
Janet Rimmer, MBBS, MD
Richard J. Harvey, MD, PhD, FARS
Sydney, Australia

Background:
Respiratory epithelium is a key innate defence against inhaled pathogens. Vitamin D3 (VD) immunomodulation may be therapeutic in some diseases. Whether VD affects the innate airway defences including the physical barrier, mucociliary apparatus, and cytokine release is unclear, and its impact on cellular integrity as a topical additive remains unevaluated.

Methods:
Primary human sinonasal epithelial cells from patients with eosinophilic chronic rhinosinusitis (eCRS) and healthy controls were cultured in air-liquid-interface (ALI). These well-differentiated cultures were pre-treated for 24h with VD and toxicity quantified at 24h in unchallenged-ALI by lactate dehydrogenase assay. Innate responses were assessed by measuring transepithelial-resistance (TER) and cilia-beat-frequency (CBF) pre-house dust mite challenge, and at 5mins, 1h and 24h post-challenge, and interleukin(IL)-6 release at 24h by flow cytometry. Data is expressed as pg/mL or fold-change from baseline/control. Data was parametric and compared using t-tests or ANOVA.

Results:
15 patients (53±13.5yrs, 60% female, 53% eCRS) representing 120 ALI-wells were assessed. VD (0, 25, 50, 150IU/mL) was not cytotoxic compared to vehicle (201.59±158.99 vs. 152.12±120.96;150.91±123.05; 210.72±261.26pg/mL, $p=0.464$). VD increased TER for eCRS-wells at 5min (50IU/mL:6.76±3.93 vs. 3.87±2.46, $p=0.04$) and 24h (50IU/mL:0.88±0.49 vs. 0.40±0.42, $p=0.02$;150IU/mL:1.06±0.58 vs. 0.47±0.46, $p=0.01$). CBF increased at 1h for eCRS-wells (50IU/mL:0.62±0.14 vs. 0.41±0.13 $p=0.001$;150IU/ml:0.60±0.13 vs. 0.38±0.11, $p<0.001$). IL-6 release was similar between normal and eCRS.

Conclusion:
Topical VD supplementation in eCRS patients may be beneficial to innate epithelial defences. VD is non-cytotoxic and does not adversely affect the physical barrier, mucociliary apparatus, or IL-6 release. Further studies should clarify its potential as a therapeutic agent.

10:27am
Assessment of Acquired Mucociliary Clearance Defects Using Microscopic Optical Coherence Tomography
Jessica Grayson, MD
Do-Yeon Cho, MD
Shaoyan Zhang, PhD
Dan Skinner, BS
Steven Rowe, MD, MSPH
Bradford Woodworth, MD, FARS
Birmingham, AL

Objectives:
Dehydration of airway surface liquid (ASL) disrupts normal mucociliary clearance (MCC) in sinonasal epithelium leading to chronic rhinosinusitis (CRS). Abnormal chloride (Cl-) transport is one such mechanism that contributes to this disorder and can be acquired secondary to environmental perturbations such as hypoxia. The objectives of this study were to evaluate acquired defects in the MCC apparatus utilizing the novel microscopic optical coherence tomography (µOCT) imaging technique.

Methods:
Primary human sinonasal epithelial cell cultures were subjected to 1% oxygen environment for 12 hours to induce acquired CFTR dysfunction. Ion transport characteristics were assessed with pharmacologic manipulation in Ussing chambers. Airway surface liquid (ASL), periciliary fluid (PCF), and ciliary beat frequency (CBF) were evaluated using µOCT.

Results:
Amiloride-sensitive ISC (expressed as ?µA/cm2) was larger in cultures exposed to hypoxia (Hypoxia: -6.2+/-1.1 vs. Control:-2.9+/-0.7, $p<0.05$), while CFTR-mediated anion transport was significantly diminished (15.1+/-1.7 vs. 20.2+/-2.8, $p<0.05$). Hypoxia diminished all markers of MCC including ASL depth (5.3+/-0.4 unit vs. 7.1+/-0.6 unit, $p<0.05$), PCF (2.4+/-0.1 unit vs. 4.3+/-0.4 unit, $p<0.01$), and CBF (6.1+/-0.5 unit vs. 7.4+/-0.8 unit, $p=0.12$).

Conclusion:
Hypoxia-induced defects in epithelial anion transport in human sinonasal epithelia led to predictable effects on markers of MCC measured with novel µOCT imaging. This imaging method represents a technological leap forward in the assessment of acquired defects in the MCC apparatus.

10:34am

The Role of Tight Junctions in the Pathogenesis of Chronic Rhinosinusitis

Raewyn A. Cavubati
Kristi Biswas, PhD
Ravi Jain, MD
Richard Douglas, MD
Auckland, New Zealand

Background:
Tight junctions are critical in maintaining the epithelial barrier that prevents the penetration of luminal pathogens and antigens into the submucosa. Recent studies have found higher proportions of intra-mucosal micro-colonies in chronic rhinosinusitis (CRS), particularly CRS with cystic fibrosis (CRSwCF). This study hypothesized that tight junction structure is disrupted in CRS, resulting in reduced epithelial barrier integrity.

Method:
Biopsy specimens were taken from patients undergoing endoscopic sinus surgery for CRS (n=8), CRSwCF (n=7) and controls (n=8). Grading of initial mucosal state was performed to quantify parameters of airway remodeling such as goblet-cell hyperplasia and enhanced collagen content. Tight junctions were analyzed using two approaches: (1) quantitative PCR and (2) immunohistochemistry, to measure and validate the expression of three key tight junction proteins: occludin, claudin-1 and zonula occludens-1.

Results:
Tight junction regulation was disrupted at both gene and protein expression levels. CRS and CRSwCF exhibited significantly lower expression relative to controls for tight junction proteins zonula occludens-1 and claudin-1 ($p<0.0001$ and $p<0.0001$ respectively). Reduced zonula occludens-1 expression was shown to have a significant negative correlation with goblet cell count ($r=-0.452$, $p=0.02$) and collagen deposition ($r=-0.450$, $p=0.02$). Reduced expression of claudin-1 was shown to be inversely proportional to clinical disease severity as measured by SNOT-22 symptom score ($r=-0.491$, $p=0.009$) and Lund-Mackay score ($r=-0.374$, $p=0.04$).

Conclusions:
This study implicates changes of tight junction structure in patients with CRS and CRSwCF. Medical therapies that encompass epithelial rehabilitation could promote restoration of tight junction function and subsequent barrier integrity.

10:41am

Calgranulin C (s100a12) is Differentially Expressed in Subtypes of Chronic Rhinosinusitis

Abigail Pulsipher, PhD
Xuan Quin, MS
Brock Davis, BS
Shaelene Ashby, PhD
Jeremiah A. Alt, MD, PhD, FARS
Salt Lake City, UT

Introduction:
Calgranulin C (S100A12) is an innate immune peptide at the air-mucosal interface and when overexpressed has been implicated as a biomarker of inflammatory diseases. Decreased epithelial expression of certain innate immune peptides has been reported in chronic rhinosinusitis (CRS). We hypothesized that S100A12 is differentially expressed in the sinonasal mucosa of patients with CRS compared to controls and that S100A12 is a biomarker of CRS-specific quality of life (QoL) and disease severity.

Methods:
A prospective observational study was conducted that included 27 patients: 14 having CRS with nasal polyposis (CRSwNP), 7 without nasal polyps (CRSsNP), and 6 controls. S100A12 expression was assessed in the anterior ethmoid tissue from all patients using enzyme-linked immunosorbent assay (ELISA), quantitative real-time polymerase chain reaction (qPCR), and immunohistochemical (IHC) analyses. Disease-specific QoL (Rhinosinusitis Disability Index; RSDI) and disease severity (computed tomography and endoscopy) were assessed and correlated to the expression levels of S100A12.

Results:
S100A12 was significantly elevated in patients with CRSsNP compared to patients with CRSwNP and controls ($p = 0.001$), as measured by ELISA, qPCR, and IHC analysis. Patients with CRS had significantly reduced QOL compared to controls as measured by RSDI physical and RSDI total, in addition to exhibiting worse CRS-specific disease severity compared to controls ($p < 0.001$). S100A12 showed no correlation to QoL measures or disease severity.

Conclusions:
S100A12 is differentially expressed in CRS subtypes and elevated in patients with CRSsNP. S100A12 expression did not associate with CRS-specific disease severity or QoL among patients with CRS.

10:48am

Discussion

Moderators:
Michael Platt, MD & David Poetker, MD, FARS

10:54am

Defining a Minimal Clinically Important Difference (MCID) for the Brief Smell Identification Test in Chronic Rhinosinusitis

Joshua M. Levy, MD, MPH
Jess C. Mace, MPH
Todd E. Bodner, PhD
Timothy L. Smith, MD, MPH, FARS
Atlanta, GA

Introduction:
Olfactory dysfunction is a common and defining symptom of chronic rhinosinusitis (CRS). Many measures of olfactory dysfunction in CRS are limited by scoring criteria defined within general populations with interpretations of statistical significance to infer clinically meaningful improvement. This investigation defines a minimal clinically important difference (MCID) for the Brief Smell Identification Test (BSIT) in CRS patients electing endoscopic sinus surgery (ESS).

Methods:
A multi-center cohort of 290 adult patients electing ESS for medically recalcitrant CRS were prospectively enrolled

between March, 2011 and June, 2015 and completed BSIT evaluations before and after ESS. Distribution and anchor-based analytic approaches were utilized to define MCID values of the BSIT across patient cofactors.

Results:
A total of 92 (32%) patients were found to have preoperative olfactory dysfunction (BSIT<9); significantly associated with nasal polyposis (?2=35.0; p<0.001). Without treatment specificity, the effect size distribution-based approach identified 1.0 as a MCID criterion value between "small" and "medium" effect (range: 0.61–1.52) overall. Significant mean postoperative change (?M) was reported for patients with olfactory dysfunction (?M=2.28; p<0.001), both with (n=54; ?M=2.52; p<0.001) and without (n=38; ?M=1.95; p<0.001) nasal polyposis; significantly exceeding the MCID criterion. Anchor-based approaches with regression modeling confirmed associations between MCID values and postoperative changes to olfactory-specific, survey responses (p<0.001).

Conclusions:
Clinically meaningful change in BSIT scores may be defined as an absolute value difference of at least 1.0 point, without limitation to treatment regimen. Significantly exceeding that criterion may be restricted to CRS patients with baseline olfactory dysfunction, regardless of nasal polyposis.

11:01am
Chronic Rhinosinusitis-associated Cytokines in Olfactory Cleft Mucus
Jeffanie Wu
Rick Chandra, MD, FARS
Ping Li, MD
Benjamin P. Hull, MD, MS
Justin H. Turner, MD, PhD
Nashville, TN

Introduction:
The etiology of chronic rhinosinusitis(CRS)-associated olfactory loss is unclear, but may result from inflammatory changes in the olfactory epithelium that results in signaling dysfunction or loss of olfactory neurons. Several pro-inflammatory cytokines have been associated with CRS but their role within the olfactory cleft microenvironment is unknown.

Methods:
Mucus was collected from the olfactory cleft and middle meatus of 22 CRS without nasal polyp(CRSsNP) subjects, 31 CRS with nasal polyps(CRSwNP) subjects, and 10 healthy non-CRS controls. Site-specific levels of 14 cytokines and inflammatory mediators(IL-1beta, IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12, IL-13, IL-17A, TNF-alpha, Eotaxin, RANTES) were assessed using a flow cytometric bead assay in a multiplex format.

Results:
CRSsNP was associated with elevated olfactory cleft mucus levels of IL-2(p=0.0134) and IL-6(p=0.176), while CRSwNP was associated with elevated levels of IL-5(p<0.001), IL-7(p=0.0014), and IL-13(p=0.0002). Olfactory mucus cytokine levels were generally lower than those in the middle meatus, but these differences did not reach statistical significance. Mucus cytokine levels in the olfactory cleft were strongly or moderately correlated with levels in the middle meatus for all measured inflammatory mediators (IL-1beta, r=0.767, p<0.001; IL-4, r=0.402, p=0.029; IL-5, r=0.918, p<0.0001; IL-2, r=0.843, p<0.0001, IL-6, r=0.757, p<0.001; IL-7, r=0.521, p=0.028; IL-8, r=0.736, p<0.0001; IL-10, r=0.685, p<0.0001; IL-13, r=0.801, p<0.0001; IL-17A, r=0.786, p=0.028; TNF-alpha, r=0.542, p=0.0004; RANTES, r=0.630, p<0.0001).

Conclusions:
The inflammatory microenvironment within the olfactory cleft mirrors that within the rest of the sinonasal cavity. High levels of olfactory mucus cytokines could potentially have deleterious effects on olfactory neuron function and turnover.

11:08am
Referral Patterns for Patients with Olfactory Dysfunction and their Effect on Outcomes
Aakanksha Rathor, MD
Zara M. Patel, MD, FARS
Stanford, CA

Introduction:
There is no data currently available on who the best provider may be for evaluating and treating patients with olfactory dysfunction, with otolaryngologists, neurologists and others involved. We sought to review the referral pattern of patients with olfactory dysfunction to see if this affected outcomes.

Methods:
Retrospective database review at a tertiary care center. We evaluated patients with olfactory dysfunction seen between 1990 and 2016 for initial provider, referral pattern, duration of dysfunction, etiology, testing, treatment and outcomes.

Results:
851 cases were reviewed. Age ranged from 7-91, males 46.8% and females 53.2%, with 23.7% smokers. 51.8% saw a non-ENT provider first and 70% of patients were never referred on to see another provider. 74% of patients were not offered any treatment. Objective testing was only performed in 7.5%, and 80.3% of patients had no improvement in their olfactory ability. Patients with no referral were 61% less likely to improve compared to those referred to ENT, and those with referral to another type of provider were 63% less likely to improve. Patients offered treatment were 4.2 times more likely to improve over the course of their referral pattern, and if they received treatment at their first referral, they had a 6.3 fold chance for improvement.

Conclusions:
Patients with olfactory dysfunction should be seen by an otolaryngologist, obtain objective testing to quantify loss, and be offered appropriate treatment options. If a patient is seen by another type of provider first for this symptom, immediate referral to an otolaryngologist can improve outcomes.

11:15am
Discussion

11:21am
Panel: Leadership Lessons Learned
Moderator: Michael G. Stewart, MD, MPH, FARS
Panelists: Alexander Chiu, MD, FARS, Todd Kingdom, MD, FARS, Scott Stringer, MD, FARS, Carol Bradford, MD

12:00pm
Lunch

Moderators:
Christopher Church, MD, FARS & Devyani Lal, MD

1:00pm
Histopathology in Chronic Rhinosinusitis Varies with Sinus Culture
Ashley L. Heilingoetter, MPH
Bobby Tajudeen, MD
Hannah N. Kuhar, BA
Mahboobeh Mahdavinia, MD
Paolo Gattuso, MD
Pete S. Batra, MD, FARS
Chicago, IL

Background:
Structured histopathology reporting facilitates better understanding of the underlying pathophysiology of chronic rhinosinusitis. The microbiology of chronic rhinosinusitis has been studied extensively; however, distinct histopathologic changes associated with bacteria and fungi isolated in chronic rhinosinusitis are largely unknown.

Methods:
A structured histopathology report was utilized to analyze sinus tissue removed during functional endoscopic sinus surgery in a group of patients with chronic rhinosinusitis refractory to medical therapy. Histopathology variables included were degree of inflammation, eosinophil count per hpf, neutrophilic infiltrate, basement membrane thickening, sub-epithelial edema, hyperplastic/papillary changes, mucosal ulceration, squamous metaplasia, fibrosis, fungal elements, Charcot-Leyden crystals, and eosinophil aggregates. Baseline Lund-Mackay scores and Sino-Nasal Outcome Test-22 scores were also collected. The association of culture data with the aforementioned variables was assessed.

Results:
A total of 59 chronic rhinosinusitis patients who underwent functional endoscopic sinus surgery were included. Chronic rhinosinusitis patients with P. aeruginosa had significantly increased neutrophilic infiltrate (71.4% vs. 26.9%, p = 0.018), sub-epithelial edema (28.6% vs. 3.8%, p = 0.015), and presence of fungal elements (28.6% vs. 5.8%, p = 0.042). Chronic rhinosinusitis patients with S. aureus had significantly more hyperplastic/papillary changes (20% vs. 2.3%, p = 0.018), mucosal ulceration (13.3% vs. 0.0%, p = 0.014) and a trend toward increased squamous metaplasia (33.3% vs. 14.2%, p = 0.091).

Conclusion:
Distinct histopathologic changes were noted based on sinus culture data specifically for S. aureus and P. aeruginosa. These findings may have important implications on the extent of surgical management and prognosis after surgery.

1:07pm
Microbiota Diversity in a Rabbit Model of Chronic Rhinosinusitis - *(Presented by Matthew Fort, MD)*
Do-Yeon Cho, MD
Matthew Fort, MD
Calvin Mackey, BS
Daniel Skinner, BS
William E. Swords, PhD
Bradford A. Woodworth, MD, FARS
Birmingham, AL

Background:
Rabbits are useful for preclinical studies of sinusitis because of similar physiologic features to humans. The objective of this study is to evaluate whether induction of rabbit chronic rhinosinusitis (CRS) engenders a shift in microbiota.

Methods:
Generation of CRS was accomplished with insertion of a sterile sponge (merocel) into the left middle meatus of New Zealand white rabbits (n=10) for 2 weeks. After sponge removal, 5 rabbits were observed for another 10 weeks and evaluated for CRS using endoscopy, microCT, and histopathological analysis of the sinus mucosa. Cultures were taken from the left and right maxillary sinuses and submitted for microbiome analysis.

Results:
CT demonstrated opacification of all left sinuses at 2 weeks in all rabbits (n=10), which was again noted at week 12 in rabbits followed for 12 weeks (n=5). Histology at week 2 showed mostly neutrophils. On week 12, significant infiltration of plasma cells and lymphocytes was noted with hyperplastic changes. At the family level, the microbiota of control sinuses had relatively low diversity compared to the sinusitis side; Shannon's diversity index was also significantly elevated in sinusitis ($p<0.0001$). On week 12, bacterial community composition significantly shifted to Gammaproteobacteria with dominance of Pseudomonadales, Pasteurellales, and Burkholderiales. Weighted UniFrac principal coordinate analysis was used to compare community phylogenetic composition, which revealed significantly distinct clusters from three groups ($p=0.001$).

Conclusion:
By blocking the middle meatus for two weeks, rabbit sinuses demonstrated CRS features at week 12 and a significant shift in the microbiome during development of chronic inflammation.

1:14pm
Susceptibility of Airway Pathogens to Antimicrobial Effects of Nitric Oxide
Alan D. Workman, BA
Ryan M. Carey, BS
Michael A. Kohanski, MD, PhD
James N. Palmer, MD, FARS
Nithin D. Adappa, MD, FARS
Noam A. Cohen, MD, PhD, FARS
Philadelphia, PA

Introduction:
Nitric Oxide (NO) is released in the airway as a critical component of innate immune defense against invading pathogenic organisms. It is well documented that bacteriostatic and bactericidal effects of NO are concentration dependent. However, little data exists comparing relative susceptibility of common pathogens to NO at physiologic concentrations. In the present study, we evaluated the effects of NO on four common airway bacteria and one fungus, and examined potential implications of discrepancies in sensitivity.

Methods:
S. epidermis, methicillin-resistant S. aureus, K. pneumoniae, P. aeruginosa, and C. albicans cultures were adjusted to a uniform optical density (OD) of 0.1 and grown in log phase at 37°C with varying concentrations of NO formed by DETA-NONOate. Both OD readings and Colony Forming Units (CFU's) were measured at varying time points to evaluate for inhibitory effects of NO.

Results:
P. Aeruginosa and C. albicans were significantly more sensitive to NO at a concentration (6µM) consistent with induced release in the human airway ($p<0.05$). K. pneumoniae and S. Epidermis were more resistant to NO at all concentrations tested below 60µM ($p<0.05$). 60µM NO completely inhibited growth in all species during an 8-hour testing period.

Conclusions:
Common airway pathogens have varying susceptibility to NO at a concentration typical of induced release in innate immune defense. Relative sensitivity of P. Aeruginosa and relative resistance of S. Epidermis may help explain composition of the healthy microbiome, as well as opportunistic infection in the absence of induced NO release.

1:21pm

Novel Role of Surfactant Protein A in Bacterial Sinusitis

George T. Noutsios, PhD
Amanda L. Willis, MSc
Erin G. Romero, BSc
Julie G. Ledford, PhD
Eugene H. Chang, MD
Tucson, AZ

Introduction:
Chronic rhinosinusitis (CRS) is a common inflammatory disorder of the upper airway and the innate immune system of the sinonasal epithelium is the first line of defense against inhaled pathogens. CRS is characterized by proliferation of recalcitrant bacteria such as Pseudomonas aeruginosa (PA) and an enhanced inflammatory response resulting in epithelial remodeling. Surfactant protein A (SP-A) is a member of the collectin family secreted by the airway epithelia that plays a critical role in airway innate immunity, as it can aggregate bacteria. We hypothesized that SP-A plays a role in bacterial CRS.

Methods:
Air-liquid-interface (ALI) cultures of nasal epithelial cells were derived from human ex vivo healthy and CRS sinus tissues and challenged with PA. SP-A levels were measured with Western Blot and qRT-PCR in ALI and sinus tissues.

Results:
We determined that SP-A i) mRNA and protein levels are significantly increased in CRS tissues compared to healthy sinuses; ii) is indeed expressed in the sinus cavities by utilizing an SP-A knock out and a humanized transgenic mouse; iii) is synthesized and expressed in sinonasal epithelia and is not coming from the lower lungs; iv) mRNA levels are upregulated significantly during PA challenge, but protein levels are downregulated 4h post challenge and upregulated at 12h.

Conclusions:
Although SP-A originates from the lung and the submucosal glands, our findings demonstrate that SP-A is also produced by sinonasal epithelia, and is regulated during PA challenge. These indicate that SP-A plays a role in the sinus innate immune responses during bacterial infections.

1:28am

Discussion

Moderators:
Greg Davis, MD, MPH, FARS & Mark Zacharek, MD, FARS

1:34pm

A Prospective Analysis Evaluating Mucosal Biopsy Location and its Clinical Relevance in Chronic Rhinosinusitis with Nasal Polyps

Ava R. Weibman, BA
Julia H. Huang, MS
Lydia A. Suh, BS
Robert P. Schleimer, PhD
Robert Kern, MD, FARS
Bruce Tan, MD
Chicago, IL

Introduction:
Chronic sinusitis with nasal polyps (CRSwNP) has a high propensity for recurrence. Studies suggest that eosinophilia influences disease severity and surgical outcomes but the selection of mucosal site for measuring eosinophilia has not been examined. The aim of this study was to investigate how region-specific tissue eosinophilia affects radiographic severity, comorbidity prevalence and polyp recurrence risk following sinus surgery.

Methods:
Eosinophil cationic protein (ECP) levels in uncinate and nasal polyp (NP) homogenates from 117 CRSwNP patients were measured using enzyme-linked immunosorbent assay (ELISA). Clinical history, radiographic severity, and time to polyp recurrence were obtained from electronic health records. The correlations between baseline Lund-Mckay scores and comorbidities were compared between uncinate and NP ECP levels. Cox regression and Kaplan-Meier analysis were then performed to assess whether uncinate or NP ECP better predicted recurrence. Censoring occurred at last follow-up if no endoscopic diagnosis of recurrent polyps was observed within 4 years.

Results:
Lund-Mckay scores were significantly correlated with uncinate and NP ECP ($r=0.48$ and 0.25 respectively, $p<0.05$). Uncinate but not NP ECP was significantly higher in patients with asthma ($p<0.01$) and aspirin exacerbated respiratory disease (AERD) ($p<0.05$). Polyp recurrence risk was only significantly higher for patients with eosinophilic uncinate tissue ($HR=2.93$, $p=0.02$). When measured in NP, eosinophilia did not predict recurrence.

Conclusion:
Although ECP in NP was 2-fold higher than in uncinate tissue, eosinophilia in uncinate tissue was a more clinically coherent biomarker of baseline radiographic severity, comorbid asthma and AERD, and prospective polyp recurrence risk than NP eosinophilia.

1:41pm

The Role of Doxycycline in the Management of Chronic Rhinosinusitis with Nasal Polyps

Sarah M. Kidwai, MD
Arjun K. Parasher, MD
Neeraja Konuthaula, MD
Alfred M. Lloreta, MD
Satish Govinderaj, MD
Benjamin D. Malkin, MD
New York, NY

Introduction:
Currently, the optimal management of chronic rhinosinusitis with nasal polyps (CRSwNP) has not been elucidated. While doxycycline alone has some durable effects, its

efficacy in combination with standard therapy has not been examined. We hypothesized that its addition to the standard anti-inflammatory regimen would improve patient outcomes.

Methods:
We performed a double-blind, placebo-controlled trial. Patients with moderate or severe CRSwNP were randomized into two groups, each receiving a 21-day course of oral corticosteroids plus doxycycline or placebo, followed by maintenance therapy. The 22-item sinonasal outcome test (SNOT-22), nasal polyp and visual analog scores (VAS) were recorded at the initial, 3-, 8- and 12-week visits.

Results:
A total of 49 patients were enrolled, 24 in the experimental and 25 in the placebo group. Using a mixed-effects model, no significant improvement in SNOT-22, VAS or nasal polyp score was observed with the addition of doxycycline. In the short term, there was no significant difference in scores from initial to 3-week visit. After 3 weeks, all scores steadily increased towards baseline, with a slower rate of increase of SNOT-22 and nasal polyp scores in the experimental group; however, this was not statistically significant.

Conclusion:
Non-surgical management of patients with CRSwNP remains challenging. We found no significant improvement in disease-specific quality of life or nasal polyp scores with the addition of doxycycline to standard therapy; however, we did see a trend towards a longer treatment effect. Further studies are needed to evaluate the optimal role of doxycycline in the treatment of CRSwNP.

1:48pm
The Role of Mast Cells and Tim-3 Expression in Determining Severity of Chronic Rhinosinusitis with Nasal Polyposis
Erica Corredera, MS
Binh L. Phong, PhD
Lawrence P. Kane, PhD
Stella Lee, MD
Pittsburgh, PA

Introduction:
Mast cell activation in chronic rhinosinusitis with nasal polyposis (CRSwNP) is an area that remains poorly understood. TIM-3 (T cell/transmembrane immunoglobulin and mucin domain-3) enhances mast cell activation at sites of chronic inflammation. The goal of this study was to identify whether TIM-3 expression was present in nasal polyps and if so determine correlation with disease severity in patients with CRSwNP.

Methods:
Human nasal polyp specimens (n=24) obtained during functional endoscopic sinus surgery were enzymatically digested into epithelial and stromal fractions. Viable mast cells expressing TIM-3 were identified using flow cytometry for the following markers: CD45, Live/Dead, c-kit, FceR1, TIM-3. Disease severity was assessed using the following: Sino-Nasal Outcome Test (SNOT-22), Lund Mackay staging system, Lund Kennedy score, and hematologic counts.

Results:
Nonparametric t-test showed greater %TIM3+ in the epithelial fraction than in the stromal fraction. There was a positive correlation between %ckit+FceR1+ mast cells and eosinophil counts and between %ckit+FceR1+ mast cells and Lund Mackay scores. There was no correlation between %TIM-3+ and any clinical severity scale. Split correlation studies were performed by dividing the CRSwNP sample into the following groups: +/-corticosteroid treatment prior to surgery; +/-concomitant disease (asthma, allergic rhinosinusitis, aspirin-exacerbated respiratory disease); +/-isolated asthma. There were no significant differences in the split correlation studies.

Conclusion:
TIM-3 was found to have higher expression in mast cells in the epithelium of nasal polyps. This suggests that TIM-3 may play a role in chronic inflammation in CRSwNP via mast cell activation.

1:55pm
Discussion

2:01pm
Panel: Culture Shock: Updates on the Microbiome in Rhinosinusitis
Moderator: Andrew Goldberg, MD, FARS
Panelists: Emily Cope, PhD, Richard Douglas, MD, Robert Kern, MD, FARS

Moderators:
Oswaldo Henriquez, MD & Spencer Payne, MD, FARS

2:41pm
Accuracy of Computer-Assisted Navigation: Significant Augmentation by Facial Recognition Software
Jordan T. Glicksman, MD, PhD
Christine Reger, RN
Arjun Parasher, MD
David W. Kennedy, MD, FARS
Philadelphia, PA

Introduction:
Over the past 20 years, image guidance navigation has being used with increasing frequency as an adjunct during sinus and skull base surgery. These devices commonly utilize surface registration, where varying pressure of the registration probe and loss of contact with the face during the skin tracing process can lead to registration inaccuracies and the number of registration points incorporated is necessarily limited. The aim of this study was to evaluate the use of novel facial recognition software for image guidance registration.

Methods:
Consecutive adults undergoing endoscopic sinus surgery (ESS) were prospectively studied. Patients underwent image guidance registration via both conventional surface registration and facial recognition software. The accuracy of both registration processes were measured at the head of the middle turbinate (MTH), middle turbinate axilla (MTA), anterior wall of sphenoid sinus (SS) and nasal tip (NT).

Results:
Thirty-eight patients were included in this investigation. Photo recognition was accurate to within a mean of 0.46 mm at the MTH, 0.32 mm at the MTA, 0.43 mm at the SS and 0.38 mm at the NT. Photo registration was more accurate than surface registration at the MTH by an average of 0.39 mm (p=0.009), at the MTA by an average of 0.33 mm (p=0.007) and at the SS by an average of 0.35 mm (p=0.003). The integration of facial recognition software did not adversely affect registration time.

Conclusions:
In this prospective study, automated facial recognition software significantly improved the accuracy of image guidance registration when compared to conventional surface registration.

2:48pm

A Prospective, Randomized, Single-Blinded Trial for Improving Health Outcomes in Rhinology by the Use of Personalized Video Recordings: Initial Findings

Saurabh Sharma, MD
Christopher H. Le, MD
Eugene H. Chang, MD
Hilary C. McCrary, MPH, FARS
Cynthia R. Thompson, AS
Tucson, AZ

Introduction:
Patient-physician communication is critical for compliance, improved outcomes, higher patient satisfaction and subsequently decreased litigation. However, factors such as decreased clinic visit times along with patient anxiety can result in poor recall of critical medical information. We hypothesized that the ability to view short videos of personalized patient encounters would improve health outcomes.

Methods:
We prospectively enrolled patients in a tertiary rhinology clinic after obtaining IRB approval and informed consent. At the end of each clinic visit, counselling videos were recorded onto a portable password-protected tablet and uploaded to a HIPAA-complaint server (Medical Memory). Patients were randomized to receive access to their videos by our research coordinator. We assessed patient satisfaction and medical recall at their first postoperative visit.

Results:
Twenty patients were enrolled with half randomized to not have video access (control) while the remainder had access (test). Ninety percent of those in the control group believed that video access would have improved their recall and understanding. In this group, only thirty percent could correctly identify the surgical procedure and forty percent could identify the surgical risks. In our test group, only forty percent watched their video, however all test patients correctly identified their surgical procedure and associated risks.

Conclusion:
Our initial findings suggest that the use of video recordings improved patient education with better recall of risks and treatment. We hypothesize that personalized videos may be a useful clinical adjunct to improve health outcomes in rhinology and improve patient-physician communication.

2:55pm

Immersive Virtual Reality as a Teaching Tool for Neuroanatomy

Katelyn Stepan, MD
Joshua Zeiger, BA
Stephanie Hanchuk, BA
Anthony Del Signore, MD
Satish Govinderaj, MD
Alfred Iloreta, MD
New York, NY

Introduction:
Three-dimensional (3D) computer modeling and interactive virtual reality (VR) simulation are validated teaching techniques used throughout medical disciplines. However, little objective data exists supporting its use in teaching clinical anatomy. In addition, learner motivation is thought to limit the utilization rate of such novel technologies. The objective of this study is to evaluate the effectiveness, satisfaction and motivation associated with immersive VR simulation in teaching medical students neuroanatomy.

Methods:
Images of normal cerebral anatomy were reconstructed from human DICOM CT and MRI imaging into 3D VR formats compatible with the Oculus Rift, a head-mounted display with tracking capabilities allowing for an immersive VR experience. The ventricular system and cerebral vasculature were highlighted and labeled to create a focused interactive model. We conducted a randomized controlled study with 66 medical students (33 in both the control and experimental groups). Pertinent neuroanatomical structures were studied using either online textbooks or the VR interactive model respectively. We then evaluated the students' anatomy knowledge, educational experience, and motivation (using Instructional Materials Motivation Survey, a previously validated assessment).

Results:
There was no significant difference in anatomy knowledge between the two groups ($p=0.87$). The VR group found the learning experience to be significantly more engaging, enjoyable, and useful (all $p< 0.01$), and scored significantly higher on the motivation assessment ($p< 0.01$).

Conclusion:
Immersive VR educational tools awarded a more positive learner experience and enhanced student motivation. However, the technology was equally as effective as the traditional text books in teaching neuroanatomy to medical students.

3:02pm
Discussion

3:08pm
Business Meeting

3:15pm
Break

Moderators:
Philip Chen, MD & Ashutosh Kacker, MD

3:35pm

Endoscopic Sinus Surgery Improves Pulmonary Function in Cystic Fibrosis Patients with Bilateral Lung Transplants

Christopher R. Roxbury, MD
Ashleigh A. Halderman, MD
Natalie E. West, MD, MHS
Sandra Y. Lin, MD, FARS
Baltimore, MD

Introduction:
Cystic fibrosis (CF) patients with bilateral lung transplants are an immunocompromised population, and may be at high risk of pulmonary exacerbations secondary to chronic rhinosinusitis. This study aims to explore whether endoscopic sinus surgery (ESS) impacts pulmonary function in this cohort.

Methods:
Between July 1, 2005 to July 1, 2015, 17 adult patients with cystic fibrosis and bilateral lung transplants underwent 17 primary and 7 revision ESS by one surgeon. Pulmonary function tests (PFTs) from 9 months after lung transplant to 12 months after ESS were reviewed. Outcome variables included forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and FEV1 percent predicted (FEV1%). Pre- and post-operative PFTs were compared using one-tailed paired t-tests.

Results:
Mean age was 29.4 years (17-63 years), 11 patients (61.1%) were female, 17 (94.4%) were white and 7/13 with available genotype data were deltaF508 homozygous (53.9%). Mean time from transplant to primary ESS was 46.4 months (10-120 months). Following primary ESS, the best FVC, FEV1, and FEV1% improved by 0.2L (3.5L vs. 3.3L, $p<0.01$), 0.2L (2.7L vs. 2.5L, $p<0.01$), and 7.4% (86.2% vs. 78.8%, $p<0.01$), respectively. Revision ESS did not improve PFTs ($p>0.05$ for all metrics).

Conclusions:
Primary ESS appears to improve pulmonary function in CF patients with bilateral lung transplants. Further studies are needed to characterize how this improvement in pulmonary function might correlate with enhanced quality of life and longer survival in this high-risk patient population.

3:42pm

Chronic Lymphoplasmacytic Rhinosinusitis: Description of a Unique Phenotype

Andrea M. Hebert, MD
Kevin C. Welch, MD, FARS
John A. Moore, MD
Raja R. Seethala, MD
Eric W. Wang, MD, FARS
Stella E. Lee, MD
Pittsburgh, PA

Introduction:
Refractory chronic rhinosinusitis (CRS) with pathologic findings of lymphoplasmacytic infiltrate presents a previously undescribed phenotype with characteristic response to immunomodulators and a high incidence of autoimmunity. The clinical and pathologic characteristics of this refractory CRS phenotype are described.

Methods:
A multi-institutional review was performed on patients with CRS who underwent endoscopic sinus surgery or nasal biopsy from 2011-2016 with the finding of chronic lymphoplasmacytic infiltrate defined as sinonasal mucosa with dense inflammatory infiltrate composed of lymphocytes and plasma cells with a relative lack of eosinophils and a low IgG4:IgG ratio. Clinical and laboratory results were analyzed.

Results:
24 patients were identified with an average age of 44.3 years and a male predominance (2.4:1). The patients presented with refractory sinusitis requiring multiple courses of oral steroid and antibiotics without long term control of symptoms. In addition, a high incidence of autoimmune disease 20.8% (5/24) was noted. For the six patients for whom ANCA levels were obtained, 4/6 were positive and demonstrated favorable response to immunomodulation including methotrexate. Almost half of patients presented with polyps (10/24) but only a fraction had elevated blood eosinophils > 10% (2/19) and asthma (4/24).

Conclusions:
Chronic lymphoplasmacytic rhinosinusitis appears to present with inflammation that is refractory to surgery, corticosteroids, and antibiotics and may require immunomodulatory therapy. This form of CRS appears to be associated with an autoimmune etiology. Further study is required to further define this new disease phenotype.

3:49pm

Sinus Hypoplasia in the CF Rat Resolves in the Absence of Chronic Infection

Jessica Grayson, MD
Matthew Fort, MD
Do-Yeon Cho, MD
Dan Skinner, BS
Shaoyan Zhang, PhD
Bradford Woodworth, MD, FARS
Birmingham, AL

Objectives:
Sinus hypoplasia is considered a hallmark characteristic of patients with cystic fibrosis (CF). Chronic rhinosinusitis (CRS) is nearly universal from a young age, impaired sinus development could be secondary to loss of the cystic fibrosis transmembrane conductance regulator (CFTR) itself or a consequence of chronic infection. The objective of this study is to assess sinus development relative to overall growth in a novel CF animal model.

Methods:
Sinus development was evaluated in CFTR-/- and CFTR+/+ rats at 3 stages of development: newborns, 3 weeks (weaning), and 16 weeks. MicroCT scanning, cultures, and histology were performed. Three-dimensional sinus and skull volumes were quantified.

Results:
At birth, average sinus volumes were significantly decreased in CFTR-/- rats compared to wild type (in mm3+/- s.e.m.; 12.9+/-0.5 vs. 15.3+/-0.3, respectively; $p<0.01$) despite similar weights (in grams+/-s.e.m., 8.3+/-0.7 vs. 7.8+/-0.5, $p=0.58$). While CF rat weights markedly declined by 16 weeks (370.8+/-9.4 vs. 442.8+/-19.6, $p<0.05$), sinus volume actually increased in size similar to wild type rats (201.3+/-4.8 vs. 203.2+/-9.2). The ratio of sinus volume to body weight indicates hypoplasia is present at birth (1.6+/-

0.12 vs. 1.98+/-0.04), normalizes by the time of weaning (1.25+/-0.05 vs. 1.2+/-0.01) and significantly increases compared to CFTR+/+ animals by 16 weeks (0.54+/-0.0 vs. 0.46+/-0.0, p<0.05). Animals did not develop chronic infection.

Conclusion:
CF rat sinuses are smaller at birth, but develop volumes similar to wild type rats with maturation. These findings suggest that loss of CFTR may confer sinus hypoplasia at birth, but normal development ensues in the absence of chronic sinus infection.

3:56pm

CFD Evidence of Posterior Septectomy as Viable Treatment Option for Large Septal Perforation

Bradley A. Otto, MD
Chengyu Li, PhD
Alexander A. Farag, MD
Jillian P. Krebs
Kanghyun Kim, BS
Kai Zhao, PhD
Columbus, OH

Introduction:
Although numerous surgical techniques exist to treat nasal septal perforation (NSP), the surgical closure of large NSP (>2cm) is still challenging. Posterior septectomy has been reported as a simple alternative to treat large NSP, yet its mechanisms for symptom relief are not clear, and if failed, its consequence can't be easily reversed.

Method:
Ten NSP patients were recruited: five underwent posterior septectomy and five conventional flap or button repair. Computational Fluid dynamics (CFD) simulated the nasal aerodynamics based on CT scans. All patients had pre-surgery CT, however, only two had post-surgery CT - both underwent septectomy. We examined surgical outcomes and the nasal airflow features that differ between the two treatment options.

Results:
Both groups of patients had good outcomes as documented by SNOT22 and chart review. Patients undergoing septectomy had significantly larger perforation size (2.32±0.87 vs 1.63±0.60 cm), higher flow rate across the perforation (47.8±28.6 vs. 19.1±11.0 ml/s) and higher wall shear stress (WSS) along the posterior perforation edge (1.04±0.12 vs. 0.93±0.44 Pa) than those not undergoing septectomy. The WSS of posterior edge was reduced by almost 50% in the two post-septectomy patients.

Conclusion:
This is the first CFD analysis on NSP patient cohort. Large NSP could result in increased flow disturbance and WSS that potentially lead to significant symptomatology. The removal of high stress region along the perforation posterior edge may explain why posterior septectomy can be an effective treatment option. Perforation size, location and aerodynamic abnormalities could serve as basis for future treatment decisions.

4:03pm
Discussion

Moderators:
Subinoy Das, MD, FARS & Jivianne Lee, MD, FARS

4:09pm

Safety and Efficacy of Fluticasone-Eluting Sinus Implant in Rabbit Model

Vishal Patel, BS
Francois Lavigne, MD
Steven Pletcher, MD
Alkis Psaltis, MD
Stanford, CA

Background:
A novel drug-eluting sinus implant has been developed to adhere to mucosal surfaces and rapidly integrate to prevent formation of synechiae after sinus surgery. It also releases fluticasone propionate (FP) in a controlled manner to reduce inflammation. The current study investigates the safety and drug delivery efficacy of the implant in a rabbit model.

Methods:
Implants with and without corticosteroid were placed on both intact and denuded maxillary sinuses of White New Zealand rabbits. Sinuses with intact and denuded mucosa without implants acted as controls. A total of 70 sides (35 rabbits) were treated. Histopathologic assessments were carried out at 5, 15 and 28 days. Concentrations of steroid in maxillary sinus mucosa and plasma were measured up to 44 days post-implantation.

Results:
Implants placed on denuded mucosa showed epithelial cells migrating over and under the implant by day 5 post-implantation. The implant was resorbed and re-epithelialized within 15 days, with insignificant foreign body reaction. By day 28, re-epithelialization was complete in all groups, with no significant differences between sinuses with implant (with or without FP) and controls. Drug concentration in the sinus mucosa reached 783ng/g by day 30, decreasing to 148ng/g by day 44. Plasma concentration of FP was generally insignificant and was just above the limit of quantification (10pg/ml) until day 7, then undetectable thereafter.

Conclusions:
A novel drug-eluting implant has been shown to be bioresorbable, biocompatible and safe in rabbits. It delivers therapeutic levels of steroid to the sinus mucosa over time with negligible plasma concentrations.

4:16pm

Eustachian Tube Balloon Dilation for Immediate Relief of ET Dysfunction

Vincent Honrubia, MD
Houston, TX

Introduction:
Studies in children and adults demonstrate presence of Eustachian tube dysfunction (ETD) in nearly 70% of patients undergoing tympanoplasty for chronic otitis media. A novel surgical procedure--Eustachian tube balloon dilation (BDET)--shows tremendous promise. The procedure was adapted from sinus balloon catheter dilation, and there is growing evidence in the literature demonstrating the efficacy of BDET. There is clear short-term (<6 month) benefit across all recorded outcomes, with low complication rates and no major adverse events.

Methods:
The surgical technique involves an in-office procedure under

general anesthesia, with BDET typically done in conjunction with balloon sinuplasty. A balloon catheter is inserted into the ET via the nasal cavity, with dilation for 60 seconds at 12 mmHg. Patient outcomes were measured using the Sinonasal Outcome Test (SNOT-22) as well as the NETS-6/ NETS-7 patient questionnaires, administered pre-surgery as well as post-surgery at 2 and 5 weeks.

Results:
Between 2013-2016, BDET was performed on 341 patients (611 ears). Patients had a 48% reduction in symptoms of ear fullness and a 65% reduction in ear pain. For NETS-7 outcomes, 93% of patients saw a reduction in symptoms.

Conclusion:
The strong evidence from clinically-accepted outcome measures shows that BDET is effective. The hypothesis is that the balloon compresses the mucosal and submucosal cells, inflamed cells slough off, and re-growth of new healthier cells occurs. Histopathology analyses corroborate this finding. These data add to the growing body of evidence that BDET is safe and effective, and provides immediate quantitative relief of ETD symptoms.

4:23pm

Safety and Tolerability of Surfactant Nasal Irrigation

Justin H. Turner, MD, PhD
Jeffanie Wu
Cindy A. Dormini, LPN, MEd
Rick K. Chandra, MD, FARS
Nashville, TN

Rationale:
Abnormal mucous composition and bacterial biofilms are thought to play roles in the etiology of rhinosinusitis. Mucoactive surfactant added to a saline irrigation solution has been hypothesized to address these factors. We evaluated the safety and tolerability of a reformulated surfactant in a sample of normal subjects.

Methods:
33 volunteers were randomly assigned to receive either surfactant solution or buffered saline at baseline in a controlled crossover study design. Each underwent rhinoscopic exam and smell testing via UPSIT-40. Those with non-normosmic UPSIT results or active rhinitis symptoms were excluded. Subjects were instructed to irrigate twice daily with the selected solution for one week while keeping a daily diary. For week 2, treatment was stopped. During week 3, each group switched to the other treatment. Exam, UPSIT, and diary evaluation were completed after each phase.

Results:
Use of the surfactant led to a marginal reduction in UPSIT score of 3.6% (1.33 points) but this was significant statistically (p=0.047). UPSIT scores remained unchanged after treatment with saline. In those receiving surfactant first, UPSIT score after subsequent washout and saline use returned to <1 point of pre-study baseline. After the surfactant phase, moderate or severe congestion was reported in 29% (8/28) of subjects. In contrast, only 6% (2/32) of subjects reported moderate congestion after the saline phase (p=.021).

Conclusions:
In normal volunteers, surfactant nasal irrigation was associated some tolerability issues due to congestion, and induced a small reduction in olfactory acuity that was clinically insignificant and reversible.

4:30pm

Cryosurgical Posterior Nasal Nerve Ablation for Improving Rhinitis Symptoms – Extended Follow-up

Jacob Johnson, MD
Bryant Lin, MD
Ray Weiss, MD
James Atkins, MD
Peter Hwang, MD, FARS
San Francisco, CA

Introduction:
Endoscopic resection of posterior nasal nerves (PNNs) has been described as an efficacious surgical treatment for improving rhinitis symptoms, but the requirement for general anesthesia has limited its acceptance. We have developed a device for office-based cryosurgical ablation of the PNN. We previously reported 3 month results and now are reporting 6 month follow up of the first series of patients treated.

Methods:
27 patients with rhinorrhea and/or nasal congestion for >3 months were recruited (Minimum rhinorrhea and/or congestion subscores of 2 as part of the Total Nasal Symptom Score [TNSS]). Under local anesthesia, the cryo-device was applied endoscopically to the posterior middle meatus and was used to freeze the PNNs bilaterally. Patients were followed up after 7 days, 1 month, 3 months, 6 months and reported symptoms by TNSS and visual analog scale (VAS).

Results:
The procedure was successfully completed in 100% of patients, with no complications. 85% reported no or mild discomfort by the first post-procedure day. TNSS showed significant reduction in symptoms out to 3 months, with an average subject reduction of 46% (-3.3, $p < 0.001$). The improvement in TNSS was maintained at 6 months, with an average subject reduction of 51% from baseline (-4.0, $p < 0.001$). Both subjects' rhinorrhea and congestion individual subscores improved significantly at 6 months ($p<0.001$). Healing was uneventful in all patients.

Conclusion:
Office-based cryoablation of the PNNs is well tolerated and results in improving rhinorrhea and congestion symptoms demonstrate sustainable improvement out to 6 months.

4:37pm

Discussion

4:45pm

Panel: Advances and Challenges in Managing Cystic Fibrosis

Moderator: Erin O'Brien, MD, FARS
Panelists: Eugene Chang, MD, FARS, Sandra Lin, MD, FARS, Bradford Woodworth, MD, FARS

5:25pm

Closing Remarks and Adjourn

Friday, April 28, 2017

12:00pm
Lunch

12:55pm
Welcome
John DelGaudio, MD, FARS

1:00pm
Panel: New Insights into the Impact of Chronic Rhinosinusitis
Moderator: Zachary Soler, MD

Moderators:
Jeremiah Alt, MD, PhD, FARS & Adam DeConde, MD

1:40pm
Distinct Histopathologic Features of Radiation-Induced Chronic Sinusitis
Hannah N. Kuhar, BA
Bobby Tajudeen, MD
Ashley Heilingoetter, BA, MPH
Mahboobeh Mahdavinia, MD, PhD
Paolo Gattuso, MD
Pete S. Batra, MD, FARS
Chicago, IL

Background:
Chronic rhinosinusitis (CRS) after radiation therapy to the paranasal sinuses is a common occurrence. The histopathologic features of radiation-induced CRS have yet to be determined and may have important implications on disease management.

Methods:
A structured histopathology report was utilized to analyze sinus tissue removed during functional endoscopic sinus surgery (FESS). Variables included tissue present, degree of inflammation, eosinophil count per HPF, neutrophil infiltrate, inflammatory predominance, basement membrane thickening, sub-epithelial edema, hyperplastic/papillary changes, mucosal ulceration, squamous metaplasia, fibrosis, fungal elements, Charcot-Leyden crystals, and eosinophil aggregates. Histopathology variables, Lund-Mackay Score (LMS) and SNOT-22 scores were compared among patients with radiation-induced CRS (CRSr) and a cohort of patients with CRS without nasal polyps (CRSsNP).

Results:
15 CRSr and 43 CRSsNP patients who underwent FESS were included. Compared to CRSsNP, CRSr cases had increased squamous metaplasia (40.0% vs. 11.6%, p = 0.016) and sub-epithelial edema (33.3% vs. 9.3%, p = .027). Additionally, CRSr patients had significantly greater mean LMS (13.47 ± 5.13 vs. 4.45 ± 6.73, p < 0.001). CRSr cases exhibited no difference in eosinophil count (p=0.283) or neutrophilic inflammation (p=0.823) when compared to CRSsNP patients.

Conclusion:
Radiation-induced CRS exhibits increased squamous metaplasia and sub-epithelial edema when compared to a cohort of patients with CRSsNP. CRSr cases demonstrate no difference in the inflammatory milieu compared to CRSsNP, lending further credence to the unique nature of radiation to the development of CRS in this patient group. These findings may have important implications on extent of surgical intervention and medical management.

1:47pm
Chronic Sinonasal Tract Inflammation as a Precursor to Nasopharyngeal Carcinoma and Sinonasal Malignancy in the United States
Eric L. Wu, MS
Charles A. Riley, MD
Meichin Hsieh, PhD
Michael J. Marino, MD
Xiao-Cheng Wu, MD, PhD
Edward D. McCoul, MD, MPH, FARS
New Orleans, LA

Introduction:
Chronic inflammatory states have been linked to the development of malignancy. Chronic rhinosinusitis (CRS) and allergic rhinitis (AR) have been associated with nasopharyngeal carcinoma (NPC) in population-based studies in Asia. A similar association with NPC and paranasal sinus malignancy has not been defined in a North American population.

Methods:
The Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database was queried as a case-control study of adults aged 65 years and greater from 2003 to 2011. The study cohort included patients diagnosed with NPC and/or paranasal sinus malignancy. CRS and AR were examined as exposures. Controls were selected from a 5% random sample of Medicare beneficiaries without cancer who lived in the same geographic region.

Results:
2,009 patients with NPC or paranasal sinus malignancy were compared with non-diseased patients matched for gender, age, race, geography, and year of diagnosis. The average age was 76.2 years and 59.4% were male. AR was associated with a greater odds of developing NPC (adjusted odds ratio [aOR] 4.232; 95% CI, 2.958-6.056) and paranasal sinus malignancy (aOR 3.347; 95% CI, 2.493-4.492). CRS was associated with a greater odds of developing NPC (aOR 3.507; 95% CI, 2.124-5.788) and paranasal sinus malignancy (aOR 5.303; 95% CI, 3.552-7.918). The number needed to harm in the exposed population was 311.

Conclusions:
CRS and AR are associated with the development of NPC and paranasal sinus malignancy in the United States elderly population. This epidemiological association will need to be examined for causative pathophysiological mechanisms and utility in clinical diagnosis.

1:54pm
Gender-Specific Differences in Serum IgE Levels and Prevalence of Fungus in Sinonasal Tissue Noted in Chronic Rhinosinusitis Patients Undergoing Endoscopic Sinus Surgery
Antoine Azar, BS
Matthew Zarka, MD
Yu-Hui Chang, PhD
Matthew Rank, MD
Devyani Lal, MD
Phoenix, AZ

Background:
We have previously presented that women with chronic rhinosinusitis (CRS) electing endoscopic sinus surgery (ESS) have higher symptom-burden than men. Causes of these differences warrant further study.

Objectives:
1. Study gender differences in another cohort of CRS patients undergoing ESS. 2. Compare key histopathological and serological features between genders

Methods:
CRS patients undergoing ESS (2011-2014) with structured histopathology reports were identified. Tissue histopathological features that were compared included presence of inflammation, eosinophils per high power field, basement membrane thickness, predominant inflammatory cell-type (eosinophilic/ neutrophilic/lymphoplasmacytic, etc.), and the presence/absence of neutrophilic infiltration, subepithelial edema, hyperplastic/papillary change, mucosal ulceration, squamous metaplasia, fibrosis, fungal elements, Charcot-Leyden crystals and eosinophil aggregates. Serum IgE and eosinophil levels were compared.

Results:
Search criteria yielded 130 subjects (mean age 54.7 years; 49.2% female). Mean preoperative SNOT-22 was 43.3; sinus CT score was 11.3. Women had significantly higher preoperative SNOT-22 scores (48.7 vs. 38.0; p=0.004) but similar CT scores. Women had higher prevalence of primary headache disorders (23.0% vs. 6.2%; p=0.007), but not anxiety or depression. IgE levels were significantly higher amongst females (433.3 vs. 190.8 kU/L; p=0.03). Tissue fungal elements were significantly more common in females (19.0% vs. 5.2%; p=0.02). No significant differences in other criteria chosen for comparison were noted.

Conclusions:
This cohort validates that women undergoing ESS for CRS have higher symptom-burden. While women had higher prevalence of primary headache disorders, they also demonstrated higher serum IgE levels and tissue fungal elements. Mixed etiologies may underlie increased symptom-burden in women, and merit further exploration.

2:01pm

Prevalence of Positive Allergen Reaction in Allergic Rhinitis and Non-Allergic Rhinitis

Aneeza Hamizan, MD
Raquel Alvarado, PhD
Janet Rimmer, MD
William Sewell, MD, PhD
Raymond Sacks, MD, FARS
Richard Harvey, MD, PhD, FARS
Sydney, Australia

Background:
The diagnosis of allergic rhinitis (AR) is based on cutaneous and serological assessment to determine IgE mediated disease. However, discrepancies between these tests and nasal provocation exists. Patients diagnosed as non-allergic rhinitis (NAR) but have a positive nasal allergen provocation test (NAPT) may represent a local allergic condition.

Objectives:
To determine prevalence of nasal reactivity toward allergens among AR and NAR patients. Describe the diagnostic characteristics of NAPT methodologies.

Methods:
Embase (1947-) and Medline (1946-) were searched on the 9th December 2015. A search strategy was used to identify studies on AR or NAR patients subjected to diagnostic local nasal provocation. All studies providing original data on positive NAPT among the AR or NAR population were included.

Results:
The search yielded 4504 studies and 46 were included. The prevalence of nasal allergen reactivity among AR and NAR patients was 80.5% and 27.1%. Reactivity was less specific for AR with pollen (AR v NAR: 93.0 v 40.3%) as compared to dust (AR v NAR: 73.6 v 16.1%). NAPT was less specific when defined by subjective end-points (AR v NAR: 85.4 v 37.3%) when compared to objective measures (AR v NAR: 78.0 v 16.2%) or a combination of both (AR v NAR: 75.5 v 20.4%)

Conclusion:
Tests for nasal reactivity are influenced by allergen and method of assessment with a large local reactive population. Systemic test may not accurately reflect allergic inflammation within the nose. A simple local test for nasal allergy is needed to evaluate patients with rhinitis.

2:08pm

Discussion

Moderators:
Stacey Gray, MD, FARS & Marc Dubin, MD, FARS

2:14pm

Validated Outcome Measures Demonstrate Substantial Facial Pain Improvement Following Endoscopic Sinus Surgery in Patients with Chronic Rhinosinusitis

Daniel R. Cox, MD
Shaelene Ashby, PhD
Joshua Levy, MD
Adam DeConde, MD
Richard R. Orlandi, MD, FARS
Jeremiah A. Alt, MD, FARS
Salt Lake City, UT

Background:
Background: Facial pain is a common symptom of chronic rhinosinusitis (CRS). Although endoscopic sinus surgery (ESS) is known to improve quality of life (QOL) in CRS, little is known about the effect of ESS on facial pain-related outcomes. Our objective was to explore facial pain outcomes after surgery utilizing validated, pain-specific and CRS disease-specific QOL questionnaires.

Methods:
A prospective observational trial of patients electing ESS for medically recalcitrant CRS was completed between August 2013 and May 2016. Facial pain was assessed before and after ESS using the Short-Form Brief Pain Inventory (SF-BPI) and the Short-Form McGill Pain Questionnaire (SF-MPQ). The Sino-Nasal Outcome Test-22 (SNOT-22) was used to measure disease-specific QOL.

Results:
Seventy-four patients were identified for inclusion and were enrolled in the study, of which 42 completed follow up questionnaires. Significant improvement was observed in all pain measures after ESS in patients with CRS. When patients were divided into those with nasal polyps (CRSwNP) and those without nasal polyps (CRSsNP), both groups showed significant improvements in pain scores after ESS. Both groups also experienced significant improvement in disease-specific QOL after ESS based on SNOT-22 scores.

Conclusions:
Facial pain improves following ESS in patients with CRS, both with and without nasal polyposis. Further studies

aimed at better understanding facial pain in CRS and the role of ESS in the management of CRS-related pain are warranted.

2:21pm

Beyond the Lund-Mackay Score: What Radiographic Disease Burden Tells Us about Patient-Reported Outcomes in Chronic Rhinosinusitis

Naweed I. Chowdhury, MD
Jess C. Mace, MPH
Adam S. DeConde, MD
Timothy L. Smith, MD, MPH, FARS
David M. Poetker, MD, FARS
Portland, OR

Introduction:
Numerous studies have shown no association between patient-reported outcomes measures (PROMs) and radiographic disease burden, as measured by Lund-Mackay (LM) computed tomography (CT) scoring, in patients with chronic rhinosinusitis (CRS). This investigation considered alternate metrics of radiographic inflammation as predictors of endoscopic sinus surgery (ESS) outcomes.

Methods:
364/470 (77%) of prospectively enrolled patients with medically refractory CRS were observed an average of 15.2 [±5.0] months after ESS. Preoperative CTs were reviewed to identify the prevalence of healthy sinus region involvement (range: 0-12) and occlusion severity of the ostiomeatal complex (OMC). Evaluation of PROMs, including the 22-item Sinonasal Outcome Test (SNOT-22) and Brief Smell Identification Test (BSIT), was completed for independent groups with prior ESS and nasal polyposis (CRSwNP).

Results:
34% of patients had radiographic opacification in all bilateral sinus regions. Bivariate correlation was found between worse preoperative radiographic involvement and worse scores of the SNOT-22 rhinologic domain (Rs= 0.294; p<0.001). Significantly worse preoperative BSIT scores were also significantly associated with more extensive radiographic involvement (Rs=0.375; p<0.001) in patients with CRSwNP. Patients with bilateral OMC involvement (n=178) reported a significantly greater frequency of postoperative improvement on SNOT-22 total scores compared to either unilateral OMC involvement (85% vs. 73%; p=0.043) or no OMC involvement (85% vs. 75%; p=0.034).

Conclusions:
Radiographic measures of sinonasal disease may have prognostic significance in some subsets of surgically-managed CRS. When measured in the appropriate context, radiographic images are more than just pictures; they are clinically meaningful data which can refine our understanding of CRS outcomes.

2:28pm

The Relationship Between Chronic Rhinosinusitis and Socioeconomic Status, Race, and Insurance Status

Madeleine Samuelson, MD
Rick K. Chandra, MD, FARS
David O. Francis, MD
Nashville, TN

Introduction:
In North America, chronic rhinosinusitis (CRS) affects roughly 5-6% of the population, accounts for approximately $8.3 billion in health care costs annually, and is associated with significant morbidity, with quality of life scores measuring on par with CHF and COPD. But while CRS is a prevalent, costly and debilitating disease, research has been limited with regards to its association with socioeconomic status and healthcare access, despite the importance that these factors play in patient outcomes.

Methods:
Patients diagnosed with CRS and their race, zip code, and insurance category were identified. Economic data was extracted for Davidson county zip codes from the US Census Bureau. We hypothesized that markers of access to health care would have a positive association with the incidence of CRS diagnosis. Indices of health care access include percentage uninsured, below the poverty line, unemployed, of non-Hispanic white origin, non-English speaking, education level, and median household income.

Results:
There was a positive association between the diagnosis of CRS and residence in a zip code with increased healthcare access. Patients residing in a zip code with a median income >$100,000/year were over 2x more likely to be diagnosed with CRS than those from a median income <$35,000/year (p=<0.01). This trend persisted across all nine markers for increased healthcare access.

Conclusions:
Socioeconomic status and healthcare access may influence the prevalence of disease diagnosis and should be considered in future research.

2:35pm

Diagnostic Grouping of Rhinologic Patients by Cluster Analysis

Charles A. Riley, MD
Cameron A. Todd, BS
Sean Parsel, DO
Edward D. McCoul, MD, MPH, FARS
New Orleans, LA

Background:
Symptoms of chronic sinusitis (CS) often overlap with allergic rhinitis (AR) and other conditions. Lack of specificity renders individual clinical parameters insufficient to distinguish between diagnostic groups. Categorization based on multidimensional clinical data may provide a useful adjunct to initial clinical diagnosis.

Methods:
We prospectively enrolled consecutive patients presenting to a tertiary rhinology practice with at least 1 cardinal symptom of CS between November 2015 and October 2016. Unsupervised hierarchical cluster analysis was performed using 21 clinical variables, including 22-item Sinonasal Outcome Test (SNOT-22), Nasal Obstruction Symptom Evaluation (NOSE), serum eosinophil level, presence of polyps and other comorbidities. Discriminant analysis then compared the clusters to idealized diagnostic groups.

Results:
Four clusters were generated from 595 consecutive patients. Cluster 1 had the most women, the highest SNOT-22 and NOSE scores and the most frequent diagnosis of CS. Cluster 2 was the oldest, with the most frequent gastroesophageal reflux disease and the least AR. Cluster 3 had the lowest SNOT-22 and NOSE scores. Cluster 4 was

the youngest, with the most frequent AR and the least CS. Using discriminant analysis, cluster 1 moderately predicted the presence of nonallergic CS, cluster 4 predicted a diagnosis of AR without CS, and cluster 2 predicted the absence of allergic disease. Polyps, eosinophilia and asthma did not contribute significantly to defining the clusters.

Conclusion:
Multifactorial clinical assessments may have a role in generating diagnostic groups among patients presenting with rhinologic symptoms. Traditional phenotypic parameters may have a less significant role than comorbidities and patient-reported measures.

2:42pm
Discussion

2:48pm
Panel: Progress Report: Women in Rhinology
Moderator: Ayesha Khalid, MD, MBA, FARS
Panelists: Robert Kern, MD, FARS, Erin O'Brien, MD, FARS, Winston Vaughan, MD, FARS

3:25pm
Break

Moderators:
Nithin Adappa, MD, FARS & Marilene Wang, MD, FARS

3:45pm
Molecular Targeted Therapy of Juvenile Nasopharyngeal Angiofibroma: Inhibition of Vascular Endothelial Growth Factor Using Semaxanib
Tran B. Le, MD
Shireen Usman, BS
Jake New, BS
Sreeya Yalamanchali, MD
Joel Jones, MD
Sufi Thomas, PhD
Kansas City, KS

Introduction:
Juvenile nasopharyngeal angiofibroma (JNA) recurrences are high in cases where complete resection of the tumor is not feasible. There are currently no molecular targeted therapies for incompletely resected JNA. We have previously shown that AZD-4547, a fibroblast growth factor receptor, inhibits JNA proliferation, migration, and invasion. We hypothesize that Semaxanib (SU-5416), a vascular endothelial growth factor (VEGF) inhibitor, will mitigate JNA-induced human endothelial umbilical vein cell (HUVEC) tubule formation. This has significant implications in mitigating the angiogenic effects of JNA. Our goal is to demonstrate 1) JNA-secreted factors potentiate tubule formation, and 2) the antitumor effects of SU-5416.

Methods:
Tubule formation at 6 hours was assessed in HUVECs treated with vehicle control (DMSO) or SU-5416 as well as in serum free media (SFM) or JNA conditioned media (CM). Tubule length was compared between treatment groups. JNA-HUVEC interaction was assessed via co-culture. Both cells were labeled and plated individually or in combination. Tubule formation at 6 and 16 hours was measured in the presence of DMSO, AZD-4547, SU-5416, or both drugs.

Results:
SU-5416 decreased JNA-induced tubule formation. Combining SU-5416 and AZD-4547 was synergistic in reducing JNA proliferation and tubule formation.

Conclusion:
SU-5416 reduced JNA-induced HUVEC tubule formation. SU-5416 and AZD-4547 treatment had synergistic effects on JNA proliferation and tubule formation. Combining SU-5416 and AZD-4547 has therapeutic potential in treatment of JNA through abrogation of angiogenesis.

3:52pm
Adoption of a Standardized Perioperative Antimicrobial Protocol May Impact the Incidence of Post-Operative Meningitis in Skull Base Surgery: Review of Perioperative Antimicrobial Protocols and Potential Risk Factors in the Development of Meningitis
Chester F. Griffiths, MD
Garni Barkhouarian, MS
Kian Karimi, MD
Daniel Kelly, MD
Los Angeles, CA

Introduction:
National surgical quality improvement program mandates preoperative antibiotic prophylaxis in patients undergoing endonasal skull base. Development of a standardized antibiotic protocol has resulted in a decrease in meningitis when compared to a retrospective review of meningitis incidence.

Methods:
Endonasal endoscopic skull base procedures were studied between 2009 and 2015. Antibiotic regimens, duration of administration and incidence of postoperative meningitis and risk factors were analyzed. Two cohorts were studied. A retrospective review of meningitis and a prospective meningitis incidence after a standardized anitmicrobial protocol was adopted.

Results:
400 endonasal endoscopic skull base procedures (392 pts) were retrospectively reviewed from October 2009 until August 2013. A prospective study was commenced from September 2013 until October 2016 of 265 endonasal skull base procedures (257 patients) after adoption of a standardized antibiotic prophylaxis protocol. The incidence of meningitis in the first group was 1.5% and after protocol adoption was 0%. We identified potential risk factors that may have contributed to the development of meningitis in the first cohort. Inconsistent antimicrobial agent selection, use of antimicrobial agents that do not penetrate the cerebrospinal fluid, prolonged operative time (> 6 hrs-surgical complexity) and long intervals between intra/post operative antibiotic dosing were identified as potential risk factors. Standardized anitmicorbial perioeprative protocol adoption addressing these risk factors will be reviewed.

Conclusions:
Meningitis in endonasal skull base surgery is infrequent with an incidence of 1.8%. Each institution should review and adopt a standardized protocol for antimicrobial agent administration supported by their clinical experience and evidence-based medicine doctrine.

3:59pm

Inhibition of Fibroblast Growth Factor Receptor with Azd-4547 Mitigates Juvenile Nasopharyngeal Angiofibroma

Tran B. Le, MD
Shireen Usman, BS
Jake New, BS
Joel Jones, MD
Sreeya Yalamanchali, MD
Sufi Thomas, PhD
Kansas City, KS

Introduction:
AZD-4547, a small molecule tyrosine kinase inhibitor which blocks activation of fibroblast growth factor receptor (FGFR), can be used to treat Juvenile Nasopharyngeal Angiofibroma (JNA) by inhibiting FGFR-mediated JNA fibroblast cell proliferation, migration, and invasion. Our purpose is to understand the effects of AZD-4547 on JNA fibroblast proliferation, migration, and invasion.

Methods:
Previous studies have characterized the transcriptome of JNA using RNA sequencing and determined that the expression level of FGFR is upregulated in JNA. We isolated fibroblasts from JNA explants of three patients after informed consent. We hypothesized that AZD-4547 would effectively mitigate proliferation, migration, and invasion of primary JNA fibroblast lines. Mitigation of FGFR and downstream signaling was evaluated by immunoblotting. JNA cells were treated with AZD-4547, 0 to 25 µg/mL for 72 hours and the Cyquant assay was performed to quantify proliferation. Migration and invasion of JNA cells were assessed using 24 hour transwell assays with subsequent fixation and quantification.

Results:
AZD-4547 inhibited JNA fibroblast proliferation, migration, and invasion through inhibition of FGFR and downstream signaling, specifically phosphorylation of FGFR and Erk-2. AZD-4547 significantly reduced primary fibroblast proliferation, migration, and invasion compared to the vehicle control (JNA 49, 73, and 96: $P<0.0001$).

Conclusion:
We demonstrated that AZD-4547 effectively mitigates FGFR signaling and decreases JNA fibroblast proliferation, migration, and invasion. Thus, AZD-4547 may have therapeutic potential in the treatment of JNA. Future studies include examining other molecular targets, particularly vascular-endothelial growth factor.

4:06pm

The Bilateral Nasoseptal Rescue Flap: An Analysis of 100 Consecutive Patients and Implications for Routine Transphenoidal Surgery

Brian C. Lobo, MD
Danilo Silva, MD
Troy D. Woodard, MD, FARS
Varun R. Kshettry, MD
Pablo F. Recinos, MD
Raj Sindwani, MD, FARS
Cleveland, OH

Introduction:
The nasoseptal flap (NSF) is well established as the reconstructive workhorse for endoscopic skull base surgery (ESBS). Typically, however, it is not required in routine transphenoidal surgery. The nasoseptal rescue flap (NSRF) technique provides a pedicle-sparing strategy for reconstruction when intraoperative changes require vascularized reconstruction, but obviates the effort and time to harvest the flap upfront. This newer technique offers a quicker surgical approach and permits the design of a tailored NSF after the defect has been created.

Methods:
Retrospective database review. We analyzed 100 consecutive transphenoidal cases where bilateral NRSF strategy was used from January 2014 to the October 2016 . Records were analyzed for NRSF conversion, outcomes and complications.

Results:
Bilateral NRSFs were designed in 100 patients. Patients averaged 51 years old, with 54 females and 46 males. Of the 100 patients reviewed, only seventeen NRSF approaches were converted to full NSFs for use at the end of the procedure. Rationale for conversion included high flow leaks (5 cases), low flow leaks (11 cases), and one exposed carotid without leak (1). Rescue flaps were fashioned and utilized in 3 patients who had previous remote transphenoidal surgery. No post-operative leak or flap ischemia was noted for conversions even in revision surgery.

Conclusion:
The NRSF approach provides the flexibility and reliability of vascularized reconstruction when needed, without the perioperative disadvantages of full flap harvest or elimination of future local reconstructive options. We advocate for the NRSF as part of the standard approach to routine transphenoidal surgery.

4:13pm

Discussion

Moderators:

Troy Woodard, MD, FARS & Melissa Pynnonen, MD

4:19pm

Evaluating Real-Time Effects of Topical 1:1000 Epinephrine in Endoscopic Sinus and Skull Base Surgery on Hemodynamic Parameters through Intra-Operative Arterial Line Monitoring

Michael T. Yim, MD
Omar G. Ahmed, MD
Mas Takashima, MD
Houston, TX

Introduction:
Administration of topical 1:1000 epinephrine is commonly used in practice to achieve vasoconstriction during endoscopic sinus surgery and skull base surgery; however real-time effects on cardiovascular changes from systemic absorption have not been well studied.

Methods:
20 patients undergoing endoscopic trans-sphenoidal resection of a pituitary lesion at a single institution were included into the study. Following arterial line placement by anesthesiology, six cottonoid pledgets soaked in 1:1000 epinephrine were placed into the bilateral nasal passages. Hemodynamic parameters including heart rate, blood pressure, and mean arterial pressure were collected at baseline, 30 seconds, and increments in minutes up to ten minutes. Cottonoid pledgets soaked in saline were used as a control. Additional potentially confounding factors such as use

of anti-hypertensives, stress dose steroids, and positioning with head pins were all performed following termination of data collection.

Results:
The majority of patients showed no significant change following placement of epinephrine soaked cottonoids. Some patients had transient increases in blood pressure following administration of topical epinephrine, however return to baseline cardiovascular values were noted after an average of five minutes. There was no correlative preoperative characteristic that predicted sensitivity to placement of epinephrine. There were no lasting or permanent effects.

Conclusion:
Intranasal topical 1:1000 epinephrine use showed no substantial hemodynamic changes in the majority of patients; however in a subset of patients it can cause transient elevations in blood pressure. Topical epinephrine should be used judiciously in endoscopic sinus surgery.

4:26pm

Effects of Ophthalmologic Solutions on Sinonasal Ciliated Epithelium for Use in Nasal Drug Delivery

Alan D. Workman, BA
Ryan M. Carey, BS
James N. Palmer, MD, FARS
Noam A. Cohen, MD, PhD, FARS
Philadelphia, PA

Introduction:
Off-label use of topical ophthalmologic formulations for treatment of rhinologic disease is cited in recent literature and is anecdotally prevalent among practicing otolarynogologists. Steroids, antibiotics, and other drugs designed for ocular use have subjective clinical efficacy in the nose and sinuses, but their specific effects on the ciliated epithelium are less well defined. This study examines nine commercially available ophthalmologic drug formulations for effects on ciliary motility in sinonasal cultures, in an effort to characterize their utility as topical therapies for sinonasal diseases.

Methods:
Ophthalmologic solutions were tested on human sinonasal cultures grown at an air-liquid interface. Baseline ciliary beat frequency (CBF) was recorded and compared to CBF changes in the 20 minutes following drug addition. Substances were categorized by degree of ciliostimulation or cilioinhibition.

Results:
All ophthalmologic solutions tested had only moderate effects on CBF during the 20-minute experimental period, with no solutions causing overt ciliostasis. Azithromycin, Neomycin, and Olopatadine were slightly ciliostimulatory, while Levofloxacin, Tobramycin, Dexamethasone, Azelastine, and Prednisolone Acetate were cilioinhibitory. Ciprofloxacin elicited moderate cilioinhibition that progressed to ciliostimulation.

Discussion:
All solutions tested appear to be safe for use on ciliated cell surfaces for a period of time typical of mucociliary clearance (10-20 minutes). Both active drugs and excipients can play a role in ciliary modulation, and specific formulations can show unique or unexpected properties. Any other individual ophthalmologic solutions to be used in a nasal drug delivery system should be tested in this manner to evaluate potential ciliary effects prior to clinical use.

4:33pm

Endoscopic Sinus Surgery in Children: Analysis of Pediatric National Surgical Quality Improvement Program Safety Outcomes

Christopher R. Roxbury, MD
Daniel S. Rhee, MD, MPH
Emily F. Boss, MD, MPH
Baltimore, MD

Introduction:
Despite high prevalence of pediatric rhinosinusitis, there is little multi-institutional data regarding safety and adverse events after pediatric endoscopic sinus surgery (ESS). We aim to identify risk factors for adverse events in this cohort using a national patient database.

Methods:
The 2012-2015 National Surgical Quality Improvement Program–Pediatric (NSQIP-P) database was reviewed for ESS cases (CPTs 31231/31237/31240/31254/31255/31256/31267/31276/31287/31288). Predictor variables included patient demographics and comorbidities (cystic fibrosis, asthma, congenital/acquired bleeding diathesis). Outcome variables included 30-day complications, unplanned reoperations, and unplanned readmissions. Independent risk factors for adverse events were identified using multivariate logistic regression adjusting for demographics and comorbidities.

Results:
Of 267,289 cases, 2061 (0.78%) were ESS (mean age 10.3 years, 57.9% male, 77.1% white). The overall 30-day complication rate was 2.7% (N=56); surgical site infection (N=29) and bleeding requiring transfusion (N=14) were most common. There were 92 readmissions (4.5%) and 54 reoperations (2.6%). On multivariate analysis children <3 years were more likely to have bleeding (OR 4.58, CI 1.31-15.97, p=0.02), black children were more likely to undergo reoperation (OR 1.98,CI 1.03-3.82,p=0.04), and children with a bleeding diathesis were more likely to have bleeding (OR 21.01, CI 6.97-63.32, p<0.01), infection (OR 3.02,CI 1.02-8.91,p<0.05), and readmission (OR 2.76,CI 1.42 – 5.39, p<0.01).

Conclusions:
While this population-level study shows pediatric ESS is largely safe, age <3 years, black race, and bleeding diathesis may predict higher risk. Further investigation of appropriateness of NSQIP-P definitions and coding for outcomes such as infection is necessary to prevent overestimation or misinterpretation of safety events following pediatric ESS.

4:40pm

An Evidence Based Approach to Reducing Prescriptions for Narcotic Pain Medication after Sinus and Nasal Surgery

Sophia D. Becker
Marlene Barbato
Jason Brant, MD
Madeleine A. Becker, MD
Daniel G. Becker, MD
Sewell, NJ

Introduction:
Postoperative prescription pain medication has played a significant role in the increase in narcotic addiction in the

last 10 years. Many surgeons prescribe pain medication without an evidence-based approach. This study aimed to determine if the number of narcotic pain pills prescribed to patients after sinus and nasal surgery could be reduced without altering patient care.

Methods:
117 patients undergoing sinus and nasal surgery by the senior author completed a questionnaire, recording both their pain level on a scale of 1-10 and the number of narcotic pain pills taken on the day of surgery and for 3 days postoperatively. All patients were given the senior author's standard prescription for 30 oxycodone/acetominophen 5mg/325mg (Percocet). Each patient's specific surgery, age, gender, and smoking status were also recorded.

Results:
The mean total Percocet usage was 5.1 pills, and the 75th percentile was 7 pills. 92.3% of subjects used fewer than 15 total Percocet pills, 86.3% took fewer than 10, 67.5% took fewer than 5, and 23% took no Percocet at all. Univariate and multivariate analysis found no statistical difference in Percocet usage based on type/extent of surgery, smoking, age or gender. Only older subjects reported lower pain scores (-0.04 score per year, $p = 0.01$).

Conclusions:
Surgeons may prescribe less postoperative pain medication without altering patient care. An evidence-based approach to postoperative pain prescriptions may allow for identical pain control with fewer remaining narcotic pills. Further study may suggest wider application of an evidence-based approach to postoperative pain medication.

4:47pm
Discussion

4:53pm
Panel: Optimal Treatment of the Nasal Valve (ARS & AAFPRS)
Moderator: Lisa Grunebaum, MD
Panelists: Richard Harvey, MD, FARS, Sam Most, MD, Leigh Sowerby, MD

5:30pm
Closing Remarks and Adjourn
John DelGaudio, MD, FARS

POSTERS

#D001

A Case Of Indolent Sinonasal Melanoma in the Setting of Atypical Pigmentation

Benjamin Addicks, MD
Rusha Patel, MD
Morgantown, WV

Introduction:
Sinonasal mucosal melanoma is rare but aggressive and often presents at a late stage. We present a case of a patient with an indolent sinonasal melanoma. Resection performed and final pathology review showed the melanoma to arise in a predominant background of atypical pigmentation without malignancy.

Methods:
Retrospective chart review and a literature review performed in PubMed.

Results:
A 78-year-old male who initially presented to ENT clinic for a thyroid nodule. He underwent thyroid lobectomy revealing follilcular thyroid cancer. On post-operative laryngoscopy, a dark mass was found at the left septum and medial to the middle turbinate. Biopsy showed malignant melanoma. Skin exam and imaging did not reveal another primary site or metastatic disease. Retrospective comparison with previous imaging performed and showed stable size of the mucosal melanoma. The patient subsequently underwent endoscopic anterior skull base resection and reconstruction. Intraoperatively the tumor appeared to involve the septum, middle turbinate, and olfactory nerve. Final pathology showed atypical iron pigmentation at the aforementioned sites, with a small focus of mucosal melanoma that was completely excised.

Conclusion:
We present a case of indolent mucosal melanoma arising primarily in a background of atypical pigmentation. To our knowledge, this is the only reported case of this phenomenon in the literature. Review of previous imaging showed this lesion had been present and unchanged for at least a year prior to presentation. Mucosal melanoma with these pathology findings may represent more indolent disease. Further review of this unique pathology can help risk-stratify patients with similar presentations.

#D002

A Critical Evaluation of the Validity of Casts for In Vitro Evaluation of Locally Acting Nasally Administered Drug Products

Per Djupesland, MD, PhD
John Messina, PharmaD
Ramy Mahmoud, MD, MPH
Oslo

Introduction:
Nasal casts seem to offer an inexpensive way of characterizing intranasal drug deposition and there are efforts to use them in regulatory assessment. We compared the only commercially available cast and an alternative, developed to more accurately represent nasal anatomy, with previously published norms.

Methods:
The Koken silicone cast (Koken Co, Japan), based on female cadaver and developed for education, has been described as anatomically correct in some publications. The OptiNose cast (OptiNose AS, Norway), derived from MRI of a healthy male during velum closure also enabling deposition studies with exhalation delivery systems devices. Both casts were subjected to high resolution CT (GE-Healthcare, USA) and intranasal volumes were assessed by water fill.

Results:
CT-inferred cross-sectional dimensions/volumes of the Koken cast are substantially larger than the OptiNose cast. The smallest vertical cross-sectional areas at the valve region by CT are: Koken right/left: 2.55cm2/2.75cm2; OptiNose right/left: 1.18cm2/1.18cm2 vs. “normative” mean/range 0.85cm2 (0.2-1.6cm2). The intranasal volumes from the nostril to the choana of the 2 casts were also markedly different by both CT and water fill: Koken: 35.8cm3/38.1.6cm3, OptiNose; 24.1cm3/25.0cm3 vs. “normative” mean/range 26.4cm3 (20.9.-31.1cm3).

Conclusions:
Koken cast dimensions are outside the normal range (and substantially larger than the OptiNose cast), calling into question the validity of drug deposition data produced using this cast. However, even with anatomically representative casts, commonly used materials are unable to simulate nasal physiology (eg, expanding with positive pressure, narrowing with negative pressure), limiting validity for definitive simulation of in vivo conditions and utility as a regulatory tool.

#D003

A Nationwide Perspective of Pediatric Invasive Fungal Sinusitis: Perioperative Complications and Outcomes

Curtis Hanba, BS
Peter Svider, MD
S. Naweed Raza, MD
Anthony Sheyn, MD
Jean Anderson Eloy, MD
Adam Folbe, MD, FARS
Detroit, MI

Objectives/Hypothesis:
Although uncommon, invasive fungal sinusitis (IFS) is a potentially deadly entity among children. Early recognition is a crucial factor in order to offer successful treatment modalities with the lowest possible attached morbidity. The goal of our study was to identify patient characteristics associated with high risk disease, and to offer a population based examination into this rare and deadly disease process.

Methods:
A retrospective chart review of the 2009 and 2012 Kids' Inpatient Database (KID) was conducted. Our analysis identified 102 patients with likely invasive fungal sinusitis. Outcomes included, species, invasive extension, patient characteristics, and death among others.

Results:
Children with leukemia/lymphoma constituted 90.2% of the patient population. Nearly a quarter of pediatric patients receiving surgical treatment for likely invasive fungal sinusitis died during their hospital stay – 24.9%. Aspergillus was the most commonly recorded mycotic species. Average hospital stay was 59.3 days, and associated hospital costs averaged $746,299 per stay. Patients 0-5 years old were more likely to have orbital involvement – 56.3%. Brain extension was noted in 33.7% of this cohort as well. The only statistically significant independent predictor of patient death was Mucormycosis diagnosis $p = 0.031$, with an odds ratio of 3.835.

Conclusion:
Patient demographics, cytology, and disease extension offer predictive information regarding patient outcomes for invasive fungal sinusitis. A high clinical suspicion and early treatment for these patients may decrease the lengthy and costly hospitalizations in this population.

#D004

A Needle in a Haystack: Endoscopic Removal of a Foreign Body From the Infratemporal Fossa

Khrystyna Ioanidis, BScH
Brian Rotenberg, MD, MPH, FARS
London, ON

Introduction:
Foreign bodies in the head and neck are often encountered by Otolaryngologists and Oral Maxillofacial surgeons. Since they can distort normal anatomy and be difficult to localize, good pre- and intra-operative imaging is crucial to successful removal. This report presents a particularly difficult to localize needle foreign body in the infratemporal fossa as well as the techniques used to identify and remove it.

Methods – Case Report:
The patient had a dental procedure where a 30 gauge needle was lost in the ginigival buccal sulcus. Several attempts at removal were unsuccessful. He then presented to the otolaryngology clinic with trismus, pain with mastication, intermittent right otalgia, and numbness of the right cheek. The needle was localized in the infratemporal fossa and removed using a delicate surgical technique, image guidance technology, and intra-operative imaging.

Results and Discussion:
With difficult foreign bodies, surgeons may benefit from the use of intra-operative imaging to better characterize anatomy and identify the object. This is especially important in the head and neck as the anatomy can be extremely sensitive. The needle in this case was localized on the third extraction attempt after using intra-operative imaging to improve visualization. A needle foreign body in this location has not been found elsewhere in the literature, so the removal technique is important to share.

Conclusions:
While foreign bodies are not rare, they can be difficult to localize. Pre- and intra-operative imaging techniques can facilitate quick removal of foreign bodies and minimize stress and harm to patients.

POSTERS

#D005

A Novel Presentation of Sinonasal Phosphaturic Mesenchymal Tumor: Case Report and Review of the Literature

Brandon Peine, BS
Ronald Kuppersmith, MD
Round Rock, TX

Introduction:
Sinonasal phosphaturic mesenchymal tumors are rare, generally benign tumors that are frequently associated with oncogenic osteomalacia. We present a case that presented with uncontrolled epistaxis and a review of the literature to help clinicians recognize this rare entity.

Methods:
Case report and review of the literature.

Results:
A 49-year old male presented in the emergency department with uncontrolled epistaxis. Endoscopic evaluation revealed a large bleeding mass in the left posterior nasal cavity that filled the choana arising from below and posterior to the inferior turbinate and extending into the maxillary sinus. Oncogenic osteomalacia is a paraneoplastic syndrome that is characterized by diminished mineralization of bone in response to tumor secretion of fibroblast growth factor 23 (FGF23). Pathologic fractures or bone pain secondary to unexplained osteomalacia account for the majority of presentations which lead to the discovery of phosphaturic mesenchymal tumors. Only five percent of phosphaturic mesenchymal tumors are found in the sinonasal area.

Conclusions:
Sinonasal phosphaturic mesenchymal tumors (PMT) are rare tumors that typically present with unexplained osteomalacia. Our case suggests that sinonasal PMTs may present as severe epistaxis, possibly due to increased vascularity of the tumor. Definitive treatment for PMT is complete surgical resection which generally completely resolves the associated osteomalacia.

#D006 WITHDRAWN

#D007
A Population-based Analysis of Nodal Metastases in Esthesioneuroblastomas of the Sinonasal Tract
Edward Kuan, MD
Jose Alonso, BS
Bobby Tajudeen, MD
Marilene Wang, MD, FARS
Maie St. John, MD, PhD
Los Angeles, CA

Introduction:
Esthesioneuroblastoma is an uncommon malignancy of the sinonasal tract arising from the olfactory epithelium. Surgical management of the primary site, often via an endoscopic approach, with or without adjuvant radiation, is often curative. There is limited data regarding management of the neck and the risk of nodal metastases. In this study, we examine the incidence and patterns of esthesioneuroblastoma-related cervical nodal metastases using the Surveillance, Epidemiology, and End Results (SEER) database.

Methods:
The SEER registry was queried for all patients with esthesioneuroblastomas diagnosed between 1973 and 2012. Patient data was then analyzed with respect to age, sex, race, modified Kadish stage, grade, survival functions, and nodal disease, including specific nodal basins.

Results:
381 cases of esthesioneuroblastoma with information on nodal metastases were identified. The overall cervical nodal metastasis rate was 8.7%. Level II metastases were most common (6.6%). 4.5% of cases presented with multiple positive nodal basins. Male sex (p=0.009) and higher tumor grade (p=0.009) correlated with the presence of level II metastases. There was no association of primary tumor site to the presence of nodal metastases (p>0.05). The presence of nodal disease significantly predicted poorer overall (p=0.001) and disease-specific survival (p=0.017).

Conclusions:
The incidence of nodal metastases in esthesioneuroblastoma at diagnosis is rare, and elective management of the neck remains controversial. Primary tumor site does not appear to predict metastases at specific nodal basins.

#D008
A Rare Case of Adenocarcinoma of Unknown Origin of the Clivus
Mahmoud Awad, MD
Marc Otten, MD
David Gudis, MD
New York, NY

Introduction:
Adenocarcinoma of the skull base is a rare occurrence. Herein we report a case of a patient with adenocarcinoma of unknown origin of the clivus.

Methods:
This case report was performed by chart review.

Results: We report a case of a 72-year-old man who presented with 2 months of left-sided headaches and 1 month of diplopia. His pertinent past medical history includes metachronous prostate cancer status post prostatectomy and external beam radiation approximately 20 years ago. On exam he had a left sixth cranial nerve palsy. Imagining demonstrated a large heterogeneous left clival lesion with extension into the sella, left sphenoid sinus and greater sphenoid wing, and left cavernous sinus with encasement of the left cavernous carotid artery. With a presumptive diagnosis of metastatic prostate carcinoma, he underwent a diagnostic and therapeutic endoscopic decompression of the left cavernous sinus. Post-operatively the headaches and diplopia resolved completely. Immunostaining and in-situ hybridization was performed on the tumor specimen, which demonstrated primary adenocarcinoma of unknown origin. The tumor did not have the morphology or markers to support origin from the nasopharynx, prostate, lung, colon, and salivary gland. The patient then underwent induction chemotherapy followed by stereotactic radiation for definitive treatment.

Conclusion:
This report represents a rare case of clival adenocarcinoma of unknown origin, and it demonstrates the potential efficacy of combined multimodality therapy, including subtotal surgical resection and chemoradiation to control locally advanced disease.

POSTERS

#D009

A Single-institution Review of Revision Cerebrospinal Fluid Leak Repairs: Clinical Outcomes

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Introduction:
Multidisciplinary endoscopic approaches to skull-base lesions have led to decreased peri-operative morbidity, preservation of endocrine function, and decreased length of hospital stays. With the introduction of endoscopic transphenoidal surgery, however, the risk of cerebrospinal fluid (CSF) leaks remains. These are often treated surgically in the operating room at time of primary surgery, but oftentimes, a revision surgery is required. Here, we review our incidence of recurrent or persistent CSF leaks, risk factors, etiology, primary and secondary management, and post-operative outcomes.

Methods:
Single-institution case series of patients that underwent a revision cerebrospinal fluid leak repair from 2010-2015

Results:
There were 304 cases of skull-base surgery requiring repair of a CSF leak. Of these, 21 patients were identified as requiring revision surgery one (16), two (5) or three (3) times, with the most common reason for take back CSF leak alone, residual or recurrent disease, or pneumocephalus. Most revision repairs were managed with new skull-base defect reconstructions with nasoseptal flaps, synthetic material, and abdominal fat or less commonly, a gasket miniplate. There was one death in all 21 cases as a result of recurrent disease.

Conclusions:
At our institution, skull-base reconstructions to repair skull-base defects are routinely performed and have a high success rate. We experience a low incidence of CSF leaks requiring revision repairs. In our series, no specific risk factors can predict need for revision. We implemented revised reconstructive methods in all revision cases with good outcomes.

#D010

A Systematic Review of Medical Therapy for Epistaxis in Hereditary Hemorrhagic Telangiectasia

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Introduction:
Hereditary hemorrhagic telangiectasia (HHT) is an autosomal dominant hereditary disorder resulting in vascular dysplasia and formation of arteriovenous malformations. Life-long, recurrent epistaxis is a hallmark of the disease. A vast array of medical therapies have been trialed in this patient population, however, robust evidence based recommendations regarding the medical treatment of epistaxis in HHT are lacking. This systematic review was performed in an attempt to review the current literature to make meaningful evidence based recommendations.

Methods:
A search of the Ovid MEDLINE, Embase, and Cochrane databases was conducted by a reference librarian. Abstracts in the English language and published in a peer review journal were reviewed for relevance and inclusion. Other inclusion criteria were: at least 5 patients, diagnosis of HHT, and clinical outcomes on epistaxis.

Results:
Thirty-eight studies met inclusion criteria. A few small, randomized placebo controlled trials were identified but the majority of studies consisted of prospective case series or retrospective studies. In a few small studies, thalidomide was shown to consistently improve severity and frequency of epistaxis and improve hemoglobin concentrations while decreasing the need for transfusion. Tranexamic acid appeared to only impact the epistaxis severity score for the most part. Submucosal injection of bevacizumab appeared to improve epistaxis to a greater degree than IV or topical bevacizumab.

Conclusion:
Numerous studies exist investigating the effectiveness of different medical therapies on epistaxis outcomes in HHT. Many of the studies are small and the data reported on heterogeneous, therefore, strong evidence based recommendations are difficult.

#D011

Adjunctive Pain and Anxiety Management for Office-based Rhinology Procedures

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Background:
Office-based rhinology procedures are increasingly performed to control costs and enhance patient convenience. Adequate management of pain and anxiety is essential for the technical performance of these procedures, in addition to ensuring a comfortable patient experience. Pharmacologic agents are often used to manage anxiety and pain. Nonpharmacological adjuncts may be useful for achieving these effects without oral opioids and benzodiazepines.

Methods:
Charts of patients who underwent office-based rhinology procedures with the NuCalm system (Solace Lifesciences, Inc.) in combination with local anesthesia with topical 4% tetracaine followed by injected 1% lidocaine with 1:100,000 epinephrine were reviewed. NuCalm is a proprietary system that combines cranial electrotherapy stimulation, neuroacoustic software, light blocking lenses, and topical gamma-aminobutyric acid. No oral agents were used before or during the procedure. Patients rated their pain and anxiety, before, during, and after the procedure. Patients also rated factors for having an office-based procedure.

Results:
Nineteen patients underwent office procedures using the NuCalm system. Preoperative anxiety (2.18) was significantly more than postoperative anxiety (1.29) according to patient reporting on a 5-point scale ($p=0.007$). Preoperative pain (1.83) was not significantly different from intraoperative (2.44) or postoperative pain (2.06, $p=0.181$). The two most important factors for electing an office-based procedure were trust in the surgeon's recommendation and convenience.

Conclusion:
A variety of office-based rhinology procedures are technically feasible, and can be performed with adequate patient comfort without the use of oral drugs. Adjuncts to pharmacologic agents may enhance pain control and anxiety management, and improve patient tolerance of these procedures.

#D012

Adverse Effects of Intranasal Steroids on Intraocular Pressure: A Systematic Review

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Background:
Intranasal corticosteroids (INCS) are common medications used to treat a variety of different sinonasal inflammatory conditions. While the use of INCS is widespread, the potential for ocular side effects associated with INCS administration, including increased intraocular pressure (IOP) and glaucoma, is controversial. This study aims to systematically review the literature to assess the incidence of elevated IOP after use of INCS.

Methods:
A systematic literature search was conducted of the Pubmed, Cochrane and Medline databases, using keyword queries with the terms intranasal steroids, glaucoma, and intraocular pressure. All articles that detailed original measures of IOP following use of INCS were included for analysis.

Results:
The literature search identified 23 studies that met the criteria for review, including 12 randomized controlled trials (RCT), 9 case series, 1 case control study, and 1 cohort study. Of the 12 RCTs, none reported evidence that INCS elevated IOP. Two of the 9 case series reported cases in which increased IOP was observed with INCS use. The case control study and cohort study did not report evidence of elevated IOP after INCS use.

Conclusions:
Administration of intranasal steroids do not increase intraocular pressure based on studies with low levels of bias.

POSTERS

#D013

Adverse Events from Balloon Sinus Dilation

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Significance/Objectives:
Balloon Sinus Dilation (BSD) has become increasingly popular and is touted as a safe and inexpensive alternative to traditional sinus surgery. Our objective was to evaluate the number of serious complications during or following BSD.

Methods:
We utilized the FDA's Manufacture and User Facility Device Experience (MAUDE) database to assess all injuries and device malfunctions in the past 10 years as a result of BSD. Individual injury or malfunction event narratives were reviewed, and characteristics were quantified.

Results:
A total of 165 events were reported in the MAUDE database. There were four reported deaths and 103 injuries. 51 injuries involved the orbit, 13 of which required surgical intervention (such as a later canthotomy and cantholysis). Twenty-eight CSF leaks were reported, six of which were repaired with surgery at the time of injury. Ten significant bleeding events were reported. There were 20 injures due to other causes, including infection (4). Most events occurred in 2013 (26) followed by 2012 (22) and 2014 (19). Fifty-eight malfunction events without injury were reported (24 due to detached tip.)

Conclusion:
Although one reported advantage of BSD is an overall excellent safety profile, surgeons should be aware of potentially serious sequelae. Here, we characterize the frequency of reported nationwide complications, including orbital injury, CSF leaks, significant bleeding, and even death. Risks during or as a result of the procedure may be similar to those of endoscopic sinus surgery utilizing more traditional rigid operative equipment.

#D014

Adverse Events from Implantable Sinus Stent Devices

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Significance/Objectives:
The use of drug-eluting stents following sinus surgery offers the potential benefits of decreased post-operative sinus outflow stenosis. Although these devices have largely been demonstrated to be safe, they do still harbor the potential for serious complications. Our objective was to evaluate the number of complications and malfunctions due to sinus stent placement.

Methods:
The FDA's Manafacture and User Facility Device Experience (MAUDE) database was evaluated for adverse events reported by medical facilities from 2007-2016. Events stemming from sinus stents specifically designed for placement within sinus ostia were included. Each event description was reviewed for types of injury and other clinical findings.

Results:
There were 38 events meeting inclusion criteria. Of these, 26 (68.4%) were found to cause patient injury. The most common injury causing event was a retained stent (10 events), five of which required surgical removal. There were seven infections thought to be as a result of the stents, five of which were found to be caused by fungal organisms and required debridement in the operating room. Only two cerebrospinal fluid leaks were reported, both of which required surgical management.

Conclusion:
Although sinus stent devices possess an excellent safety profile, their use is not without risks and complications. This analysis details adverse events and malfunctions reported to the FDA over the past decade. As an overall low number of nationwide events were reported, these findings suggest that the potential benefits of these devices strongly outweigh the risks.

#D015

AERD Associated Eosinophilic Otitis Media: Is there Increased Severity of Comorbid Disease?

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Introduction:
The association between chronic rhinosinusitis and ear disease in the setting of aspirin-exacerbated respiratory disease (AERD) is unclear. The aim of this study was to determine if patients with AERD have increased sinus disease severity and co-morbid chronic ear disease in comparison to chronic rhinosinusitis patients without AERD.

Methods:
31 AERD patients, 15 chronic rhinosinusitis with nasal polyposis (CRSwNP) patients, and 15 patients without polyposis (CRSsNP) with maxillofacial CT imaging completed within the past 5 years were identified. A CT based staging-system was developed to objectively measure ear disease severity. Two authors independently graded the CT scans (inter-rater reliability of 99.3%, $p< 0.05$) using both the modified Lund-Mackay staging system (mLMK) and the newly developed temporal bone opacification (TBO) staging system.

Results:
A one-way ANOVA with a Welch test demonstrated a statistically significant difference in TBO between all three groups ($p < .01$) and a Pearson's r correlation analysis identified a significant positive correlation between mLMK and TBO ($p < .01$). Games-Howell Post-Hoc testing showed that patients with AERD had a worse TBO score ($p < .01$) than patients with CRSsNP. There was no statistically significant difference in TBO scores between the AERD and CRSwNP groups.

Conclusions:
Patients with AERD were found to have increased disease severity on evaluation of temporal bone and maxillofacial radiographic scores in comparison to CRSsNP. Further investigation of clinical disease severity and pathophysiologic mechanisms is needed.

#D016

Air Pollution and Chronic Rhinosinusitis: Are there Modifiable Risk Factors for Disease Expression?

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Introduction:
While environmental factors have been studied in asthma/COPD, there have been few investigations examining air pollutants (AP) and chronic rhinosinusitis (CRS). No studies have objectively measured the impact of AP on disease inflammation or symptom severity. This study was conducted to objectively examine the relationship between AP exposure and CRS.

Methods:
103 CRS patients with nasal polyps (CRSwNP) with CT imaging were identified. Air quality testing was performed over the span of four years (2009-2013) in regions selected by resident zip codes. To quantify inflammation, modified Lund-Mackay (mLMK) scores were performed by 3 authors (inter-rater reliability 98.6%, $p<0.05$). Total steroid dosing was quantified as well as number of functional endoscopic sinus surgeries (FESS).

Results:
There were no significant differences in FESS numbers, systemic steroid trials, total steroid dose, or mLMK staging by sex ($p>0.05$). Thirty-six percent underwent =1 FESS, with revision performed in 17%. On average, 2 steroid trials were administered (median total dose =73.5mg). Median mLMK score was 23. Median black carbon (BC) concentration was 0.76 absorbance units (SD 0.13abs). There were significant positive correlations between mLMK and ESS, steroid trials, and dose loads ($p<0.05$). A small positive association was found between mLMK and BC ($r=0.21$), though this was not statistically significant.

Conclusions:
This pilot study is the first of its kind to objectively measure AP exposure and CRS which suggests a positive correlation may exist between disease severity and BC. Further investigation will include analysis by regional differences, symptom severity, and control comparisons.

POSTERS

#D017

An Endoscopic, Transnasal Resection of a Tubercular Meningioma with Nasoseptal Flap Reconstruction in a Patient with HHT: A Case Report

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Introduction:
Hereditary hemorrhagic telangiectasia (HHT) is an autosomal-dominant disorder characterized by telangiectasias effecting cutaneous and mucosal surfaces as well as arteriovenous malformations throughout the body. The most common symptom in this population is epistaxis, with intractable bleeding being common. Given this characteristic, endonasal approaches to skull base tumors coupled with pedicled nasoseptal flap (NSF) reconstruction has been largely avoided in this population.

Case:
We describe a case in which a 62 year old male HHT patient presented with a tubercular meningioma with right optic canal extension. An endoscopic, transnasal approach to the tuberculum sellae and right optic canal was selected over an open approach to minimize brain retraction, decrease morbidity and increase visualization of the dural attachment and surrounding vital structures. A nasoseptal flap was utilized for reconstruction given its excellent success rate in closing high flow cerebrospinal fluid (CSF) fistulas, and avoidance of a secondary harvest site. Our patient had relatively mild nasal manifestations of HHT. Thus, his telangiectasias were addressed with simple bipolar cautery, and the flap was designed to avoid the largest vascular lesions.
A Simpson Grade 1 resection of the meningioma and pedicled nasoseptal flap closure of the defect was performed, with only minor adjustments in technique and no significant increase in OR time. No epistaxis or CSF leak was seen in the immediate postoperative period.

Conclusion:
This case provides evidence that select individuals with HHT are appropriate candidates for endonasal approaches to skull base tumors, as well as reconstruction using nasoseptal flaps.

#D018

An Ergonomical Assessment of Operating Table and Surgical Stool Heights for Seated Otolaryngology Procedures

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Introduction:
Surgeons benefit from proper support and positioning to prevent musculoskeletal injuries and reduce the risk. However, studies on ergonomics are limited with regard to seated otolaryngological procedures. Key elements of an ergonomic operating environment include height of operating tables and surgical chairs. The purpose of this study is to evaluate operating table and surgical seat heights and determine whether adjustments can be made for various surgeon physiques.

Methods:
Operating tables and surgical seat dimensions were measured at local hospitals and the information complemented by an online search of other models.

Results:
Five unique operating tables and five unique surgical stools were identified, both in the local hospital and searching on the Internet. Of available tables, the greatest range was 63.5-124.5 cm, which reaches above the maximum suggested working height of 76.2 cm. The surgical stool with the widest range was adjustable from heights 50.8-72.4 cm. This combination of operative table and surgical stool provides the greatest range of heights.

Conclusions:
Of the available tables and stools measured, the combination of surgical table with a range of 63.5-125.7 cm and surgical stool with a range of 50.8-72.4 cm provide the greatest versatility for diverse physician heights. Ergonomically, this combination may reduce physical fatigue and create a potentially safer working environment for seated surgeons.

#D019

Anatomic Quantification of Nasal Cavity and Olfactory Cleft in Chronic Rhinosinusitis with and without Olfactory Dysfunction

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Introduction:
Nasal and olfactory cleft airspace volumetric changes in chronic rhinosinusitis (CRS) and associated olfactory dysfunction have not been well characterized. This pilot study investigates the changes in the airspace volume and surface area of the nasal cavity and olfactory cleft of healthy subjects and CRS subjects without nasal polyps (CRSsNP).

Methods:
Sinonasal computed tomography (CT) scans of 18 subjects (9 normal and 9 CRSsNP) from 2009-2015 were obtained for this study. Four of the CRSsNP subjects reported olfactory dysfunction (OD), and the other five CRSsNP subjects reported normal olfaction (NOD). Anatomically realistic three-dimensional reconstructions of each subject's nasal and olfactory airspace, excluding the sinuses, were reconstructed from CT images. Nasal and olfactory airspace surface area (SA) and volume (V) were calculated for all subjects.

Results:
On average, nasal airspace SA and V were larger in the healthy subjects (SA=116.6cm2; V=11.6cm3) compared to CRSsNP subjects (OD - SA=93.6cm2; V=8.5cm3; and NOD - SA=114.1cm2; V=11.3cm3). Average olfactory cleft SA and V were SA=8.3cm2; V=0.41cm3 (healthy), SA=5.8cm2; V=0.32cm3 (CRSsNP-OD) and SA=7.5cm2; V=0.44cm3 (CRSsNP-NOD). Furthermore, the olfactory cleft occupied about 7.1% of the nasal cavity SA and 3.5% of intranasal volume among healthy subjects. For CRSsNP-OD and CRSsNP-NOD subjects, the olfactory cleft occupied about 6.2% and 6.6% of the nasal cavity SA and 3.7% and 3.9% of intranasal volume, respectively.

Conclusions:
Results from this pilot study showed that nasal and olfactory cleft airspace SA and V between healthy and CRSsNP-NOD subjects were similar but are both considerably larger compared to CRSsNP-OD subjects.

#D020

Are Multiple Cultures Necessary During Sinus Surgery for Chronic Rhinosinusitis?

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Introduction:
Multiple cultures are commonly obtained from different sinuses where purulence is encountered during endoscopic sinus surgery (ESS). In our institution, a single sinus culture can cost the patient $215.00. This brings into question the utility and necessity of obtaining multiple cultures. The purpose of this study was to evaluate if multiple sinus cultures obtained during a single case is informative in finding additional pathogens or if it is a redundant and cost increasing practice. We hypothesized that multiple sinus cultures are necessary to completely identify the pathogens responsible for an individual's sinus disease. We seek to add information on the utility of performing multiple sinus cultures from a patient care and a health economic standpoint.

Methods:
This was a retrospective review of a single rhinologists surgical database from 2008-2016. Patients were included if they underwent ESS for chronic rhinosinusitis and had multiple cultures obtained during surgery. Culture difference was recorded as a discrepancy of an infectious pathogen between cultures.

Results:
We identified 222 patients with multiple sinus cultures. Of those, 49.5% had a difference of pathogens noted on culture between different sinuses.

Conclusions:
Our results support sampling multiple infected sinuses during ESS for bacterial culture and sensitivity analysis. Greater than 50% of patients in our cohort may have potentially been incorrectly treated without the full complement of cultures obtained. Despite the cost, multiple cultures appear beneficial to appropriately identifying individuals' sinus pathogen. Further analysis is ongoing to identify specific patients that may be more appropriate for multiple sinus cultures.

POSTERS

#D021

Bacterial Colonization of Nasal Drug Delivery Devices for Chronic Rhinosinusitis and the Utility of Nozzle Sterilization Techniques

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Introduction:
Nasal drug delivery devices (NDDD) may act as reservoir for pathogenic bacteria. Studies have not examined the potential benefits of in vivo nozzle sanitization. Also, studies have not examined differences in the NDDD and the time before nozzle bacterial colonization. The purpose of the study was to examine patients using NDDD to establish the duration of use before colonization occurs, to determine if the type of device affects the rate of colonization, and to determine if isopropyl alcohol used in vivo has an effect on NDDD colonization.

Methods:
Patients with allergic rhinitis (AR) with and without chronic rhinosinusitis (CRS) over 4 months used a NDDD. Mechanical liquid spray pumps (LSP) and pressurized metered-dose inhalers (MDI) were used with and without sanitization with isopropyl alcohol. Culture swabs were obtained at days 10, 20, and 30 of each month.

Results:
MDI grew pathogenic bacteria by 10 days in 60% of samples (AR 33%, CRS 75%). LSP grew pathogenic bacteria by 15 days in 55% of samples (AR 13 days, 43%, CRS 17 days, 75%). In the AR group, daily cleansing with isopropyl alcohol eliminated the growth of pathogenic bacteria. No significant decrease was seen within the CRS group, or between devices.

Conclusions:
No significant difference was observed between MDI and LSP regarding overall time to bacterial colonization. The AR group demonstrated fewer samples colonized and a shorter time to colonization (LSP only). Isopropyl alcohol proved to be effective in preventing bacterial colonization in the AR group.

#D022

Balanced Orbital Decompression with En Bloc Lateral Wall Resection and Endoscopic Medial Wall Decompression in Patients with Thyroid Eye Disease

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Introduction:
Orbital decompression in thyroid eye disease (TED) is an established and effective surgical treatment for rehabilitative proptosis reduction and for restoration of vision in compressive optic neuropathy. Balanced medial and lateral wall decompression has been advocated for the additional effect of minimizing post-operative diplopia and hypoglobus. “En bloc” removal of the anterior lateral orbital rim has been not only uncommonly described but also not reported in balanced decompression. We described the clinical outcomes of balanced decompression with endoscopic medial wall and external complete lateral wall removal in patients with TED.

Methods:
A non-comparative, interventional, retrospective case series of 11 patients who underwent balanced orbital decompression surgeries for TED between August 2015 and August 2016 at West Virginia University was performed. All patients had complete removal of the lateral orbital wall including the anterior orbital rim along with endoscopic medial wall decompression. Patient demographics, indications for surgery, pre-, intra-, and post-operative findings were recorded.

Results:
Of the 17 operated orbits, the mean age was 58.1 (43-75) years. Indications for surgery included proptosis with exposure keratoconjunctivitis, lagophthalmos, and optic neuropathy. The average reduction in proptosis was 6.3mm (4-11). Average follow-up time was 10 weeks. Postoperatively, all patients had maintained or improved visual acuity along with improvement or reduction of lagophthalmos. 9% (1) of patients developed post-operative diplopia.

Conclusions:
Balanced decompression with “en bloc” resection of the lateral rim and wall combined with endoscopic medial wall decompression is an effective technique for proptosis reduction and restoration of vision in patients with TED.

#D023
B-cell Lymphoblastic Lymphoma of the Skull Base in a Pediatric Patient
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Introduction:
Lymphoblastic lymphoma (LBL) is an unusual form of non-Hodgkin's lymphoma (NHL) more commonly identified in children and males. Less than 10% of cases are of B-cell origin (B-LBL), comprising 2.5% of childhood NHLs. B-LBL often involves bone, skin, and lymph nodes, and extranodal involvement of the head and neck is exceedingly rare. We present the first reported case of a skull base B-LBL in a pediatric patient.

Results:
An 8-year-old female with several months of congestion and rhinorrhea presented with sudden bilateral vision loss and cranial nerve VI palsies. Imaging revealed an extensive skull base soft tissue mass involving the nasopharynx, paranasal sinuses, septum, cavernous sinuses, sella turcica, orbital apices, optic canals, trigeminal cisterns, and carotid arteries. Endoscopy revealed a dense submucosal tumor involving the posterior nasal septum and occluding the nasopharynx bilaterally. Biopsies revealed small round blue cells with immunohistochemistry consistent with B-LBL/acute lymphoblastic leukemia (ALL). Systemic steroids and ALL chemotherapy regimen was initiated with significant improvement in vision. Bone marrow biopsy showed <1% lymphoblasts confirming the diagnosis of B-LBL. Repeat endoscopy one week after initiation of therapy showed significant reduction in size of the nasopharyngeal component.

Conclusion:
B-LBL involvement of the sinonasal cavity is poorly described in the literature. Current treatment consists of chemotherapy regimens developed for ALL due to the similarities between the diseases. Steroids and intrathecal chemotherapy may also be advised, while stem cell transplantation is not routinely performed.

#D024
Bilateral Sinonasal Lymphoma in the Absence of a Solitary Lesion: Case Report and Review of Literature
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Objective:
Primary sinus lymphoma is a rare diagnosis accounting for about 0.2 to 5% of extra nodal lymphomas. However, lymphomas account for the second most common malignancy in the head and neck after squamous cell carcinoma. This report aims to present a rare case of primary sinus lymphoma that presented with non-specific bilateral sinus complains in the absence of a solitary mass lesion.

Study Design:
Retroactive case report.

Methods:
We present the case of a 50-year-old African American female with an atypical presentation of sinonasal lymphoma. Literature review is performed.

Results:
We present a case of a 50-year-old patient who presented to the Otolaryngology clinic for evaluation of chronic nasal congestion and sinusitis for one-year duration. CT scan was significant for scattered mucosal thickening bilaterally in all paranasal sinuses; however no discrete mass lesion was identified. She underwent functional endoscopic sinus surgery and pathology was positive for diffuse large B-cell lymphoma. She was discussed at a our institution's multidisciplinary tumor conference and recommendation was made for R-CHOP with intrathecal therapy. Literature review reveals that sinonasal lymphoma is a rare but known entity. The authors believe this to be one of very few cases of bilateral sinonasal lymphoma presenting in the absence of a mass lesion.

Conclusions:
Sinonasal lymphoma is a rare diagnosis. We present a case of lymphoma found to be masquerading as chronic sinusitis. The otolaryngologist should maintain a high index of suspicion for non-typical sinus pathology.

POSTERS

#D025

Case Report: Inferior Meatus Fungal Ball

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Introduction:
Fungus balls are typically found within an isolated paranasal sinus. The exact pathogenesis of fungus balls remains unknown but it is hypothesized that an anaerobic environment within the paranasal sinuses creates favorable conditions for Aspergillus growth. This case illustrates an example of a fungal ball forming in an unusual location, the inferior meatus.

Results/Discussion:
A 77-year-old female presented to our otolaryngology clinic with a two-month history of left-sided epistaxis and hemoptysis as well as a two year history of left-sided nasal airway obstruction and thick rhinorrhea. Initial exam revealed thick purulent drainage within the left inferior meatus as well as friable tissue and debris. Subsequent radiographic work-up and pathology from endoscopic sinus surgery was consistent with a fungus ball with Actinomyces colonization within the inferior meatus. Her symptoms fully resolved with surgical treatment alone in short-term follow-up. Only four prior cases of fungus balls located within the nasal cavity have been described and two of those cases were within the inferior meatus.

Conclusion:
This case describes a unique location for a fungal ball, illustrates that anaerobic conditions may not be required for their formation, and demonstrates that concomitant Actinomyces colonization found on pathology does not require prolonged antibiotic treatment.

#D026

Case Report: Magnetic Foreign Bodies Embedded in the Septum Discovered During MRI

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Introduction:
Foreign bodies in the upper aerodigestive tract are a common otolaryngologic complaint, usually found in younger children after accidental ingestion or aspiration. Magnets are dangerous foreign bodies when inserted or ingested in multiples, as their attraction to each other can damage tissues interposed between them. We present an unusual case of nasal magnet insertion and its consequences in an adolescent male.

Case Report:
An 11-year-old male was undergoing MRI during which he reported severe nasal pain. Ultimately, it was discovered that he had inserted 2 magnets into his nose 3 months prior. On evaluation of the nasal septum, granulation tissue was seen on the right, and foreign body was partially visualized on the left. A radiopaque foreign body in the nasal septum was identified on plain radiograph. The patient was taken for elective surgical removal of the foreign body, which was performed exclusively through the left nasal cavity. After removal, we found the 2 pieces of magnet with a round piece of septal cartilage between them. The mucosa on the right septum remained intact, likely having healed over the right-sided magnet. There was no evidence of perforation at one-month follow-up.

Discussion:
A review of the literature pertaining to nasal foreign bodies and magnet-related otolaryngologic complications in the pediatric population is performed.

Conclusion:
Parents and pediatric patients should be counseled regarding the risks posed by inappropriate ingestion or insertion of small magnets that children may encounter in toys or hobbies.

#D027

Causes of Death and Survival Time in Acute Invasive Fungal Sinusitis

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Introduction:
Acute invasive fungal sinusitis (AIFS) is an aggressive infection with a high mortality rate. Little is known about disease survival time and causes of death, though both frequently asked questions by patients. This study assessed survival outcomes and specific causes of death in AIFS.

Methods:
After retrospective review, 46 cases of AIFS diagnosed from 2000 to 2016 were identified. Patient demographics, risk factors, time to and cause of death, and survival outcomes were analyzed.

Results:
AIFS was generally found in immunosuppressed patients with hematologic malignancies (25), uncontrolled diabetes (11), or other immunocompromised states (8). Overall survival (OS) was 30.4% and disease-specific survival was 52.5%. Median survival time was 3.4 months. Specific causes of death included septic shock with multi-organ failure (9), respiratory failure (7), direct intracranial spread (6), and cirrhosis (1). Ten patients were free of fungal infection at time of death and 9 patients had unknown causes of death. Using multivariate analyses, intracranial involvement (hazard ratio [HR] 20.8, 95% confidence interval [CI] 4.22-103.1, $p<0.001$) and absolute neutrophil count < 500 (HR 4.3, 95% CI 1.50-12.4, $p=0.007$) were poor prognostic factors for survival. Diabetes as the cause of immunosuppression was a favorable prognostic factor for survival (HR 0.030, 95% CI 0.004-0.199, $p<0.001$).

Conclusion:
AIFS is a life-threatening infection with a median survival time of 3.4 months and 30.4% OS. Septic shock and respiratory failure are common causes of death in fatal AIFS cases. This study represents the largest series of AIFS cases to date.

#D028

Central Compartment Atopic Disease

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Objective:
Isolated polypoid changes of the middle turbinate are recently reported as having very high association with inhalant allergy. With more advanced polypoid change of the turbinate comes mucosal disease of the central sinonasal compartment (i.e. the middle and superior turbinates and the posterosuperior nasal septum), while the lateral sinus mucosa remains relatively normal. This chronic rhinosinusitis (CRS) phenotype is introduced and described as Central Compartment Atopic Disease (CCAD) in this series.

Methods:
A phenotypic case-series of patients from two institutions who presented with sinonasal symptoms and demonstrated central compartment polypoid changes on computed tomography (CT) scan were assessed. Allergy status was determined by Immunocap or epicutaneous challenge. The endoscopic appearance of turbinate edema was assessed.

Results:
Fifteen patients are described (age 42.4±14.8yrs, 47% female). All 15 patients had a diagnosis of allergic rhinitis symptomatically and had positive allergy assessments. All (100%) patients had turbinate head edema and CT scans showing central nasal soft tissue thickening with peripheral clearing. Even with more severe disease, a central focus of inflammatory change exists.

Conclusion:
CCAD may represent a local inhalant allergy process affecting the central nasal structures of ethmoid origin. Although inhalant allergy changes are mainly within the nasal cavity, medial to lateral progression to the sinuses is likely to be a simple obstructive phenomenon. This is a pattern of CRS distinct from the more diffuse sinonasal inflammatory disease. Such a CRS phenotype likely requires allergy management as a core component.

POSTERS

#D029

Chronic Rhinosinusitis with Nasal Polyps have Two Distinct Gene Expression Profiles

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Introduction:
Chronic rhinosinusitis (CRS) is defined as inflammation of the nose and the paranasal sinuses. CRS is divided into CRS with nasal polyps (CRSwNP) and without nasal polyps (CRSsNP). CRSwNP is characterized by eosinophil infiltration and type 2 inflammations. However CRSwNP patients in Asia don't show the same inflammation pattern and is characterized by type 1 and 3 inflammations. To clarify these inflammatory differences, we identified the gene expression pattern in Japanese CRS patients.

Methods:
Nasal polyp tissues and uncinate process tissues from CRS and control patients were collected during the surgery. Eosinophilic CRSwNP (ECRSwNP) and non-eosinophilic CRSwNP (NECRSwNP) were diagnosed by JESREC Score. We extracted total RNA from the tissues and real-time PCR was performed.

Results:
Expression of type 2 inflammation and eosinophil related genes (CLC, IL-5, IL-13, CCL26, and TSLP) was elevated in nasal polyp tissues in ECRSwNP. In NECRSwNP, type 1 inflammation and neutrophil related genes (CSF3 and IL-8) was elevated. PCA analysis showed nasal polyps in ECRSwNP and NECRS had different endotypes.

Conclusions:
The characteristic gene expression profiles of nasal polyps in Japanese patients indicated the existence of at least two different endotypes. This gene expression profile would help to understand the pathogenesis of nasal polyps and ethnic differences.

#D030

Chronic Sinusitis Associated with Zygomatic Implants: A Case Series and Review of the Literature

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Introduction:
Zygomatic implants may be used for dental restoration in patients with inadequate maxillary bone for placement of traditional implants. Prior studies have debated whether zygomatic implants are associated with clinically significant maxillary sinusitis, including several that describe radiologic evidence of sinusitis in patients without clinically significant symptoms. This case series reviews three patients with clinical, endoscopic and radiologic evidence of chronic maxillary sinusitis as a complication and describes the use of endoscopic sinus surgery to decompress the maxillary sinus.

Methods:
We performed a retrospective review of three patients with a history of zygomatic implants for dental restoration and subsequent maxillary sinusitis treated with endoscopic sinus surgery.

Results:
At the time of presentation, the mean SNOT-22 and Lund-Mackay scores were 48 and 10.7, respectively. Symptoms and endoscopic evidence of disease persisted despite medical management including culture-directed antibiotics. All patients underwent endoscopic sinus surgery with improvement of symptoms. At the time of endoscopic sinus surgery all patients demonstrated endoscopic evidence of maxillary sinusitis with mucopurulence from the middle meatus. One patient with a history of recurrent facial abscesses adjacent to the implant developed a facial abscess following surgery, likely secondary to intraoperative seeding of the implant. None of the patients required hardware removal.

Conclusions:
Chronic maxillary sinusitis may result from placement of zygomatic implants. Endoscopic surgery to decompress the maxillary sinus may allow retention of implants while improving symptoms and limiting the risk of complications.

#D031

Chronic Sphenoiditis with Deep Neck Space Extension: Case Report with Review of the Literature and Postulated Mechanisms for Extracranial Extension

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Background:
Isolated primary sphenoid sinusitis is a rare occurrence, estimated to make up less than 3% of sinus infections. The posterior anatomic location of the sphenoid makes treatment challenging when it becomes infected. Complications involving intracranial extension to surrounding structures often result in cranial nerve deficits due to their proximity. A single case of chronic sphenoiditis with direct extracranial extension into the prevertebral space is reported with a discussion on clinical presentation, diagnosis, and management.

Methods:
Report of a single case and review of the literature.

Results:
A 46-year-old female patient with diffuse headaches radiating into the neck and throat was evaluated in the office. Computed tomography (CT) demonstrated sphenoiditis with direct extension into the prevertebral space. Imaging revealed a route of direct extension through the clinoid and directly into the clivus to form an abscess in the longus colli muscle. The patient underwent endoscopic surgical management including drainage of the prevertebral abscess, and has since made a full recovery.

Conclusions:
This is the first reported case of direct extension of sphenoiditis into the prevertebral space. The findings highlight the importance of aggressive treatment of chronic sphenoid infections to prevent detrimental complications. CT imaging proved an advantageous imaging modality to demonstrate bony erosion and sinus tracts from the skull base to the deep neck space.

#D032

Combined Lid Crease and Endoscopic Approach - A Viable Approach for Lateral Frontal Sinus and Orbital Disease

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Introduction:
Endoscopic sinus surgery for frontal sinus disease has obviated the need for external approaches; however, special circumstances such as acute infection with orbital involvement or significant lateral frontal sinus disease frequently require adjunct access such as the frontal sinus osteoplastic flap and trephine techniques. We, herein, describe the clinical outcomes of a combined lid crease and endoscopic approach for lateral frontal sinus disease with orbital extension.

Methods:
A retrospective case series of 6 patients who underwent a combined lid crease and endoscopic approach for frontal sinus disease with orbital extension between April 2012 and October 2016 at West Virginia University was performed. All patients had the presence of lateral frontal sinus disease as well as orbital extension as seen on a pre-operative CT scan. Patient demographics, indications for surgery, pre-, intra-, and post-operative findings were examined.

Results:
All 6 patients with a total of 7 cases were male. Mean age was 62.2 years, and the indication for surgery was drainage of mucocele/mucopyocele, with 2 patients also having concurrent sinocutaneous fistula. The frontal sinus and orbit was successfully accessed, and the respective pathology was addressed in both locations. No intraoperative or post-operative complications were encountered. There was no post-operative ptosis or patient dissatisfaction with the lid crease incision.

Conclusions:
The combined lid crease and endoscopic approach is a safe and effective technique for accessing the lateral frontal sinus and orbit with the added benefit of a good postoperative aesthetic outcome.

POSTERS

#D033

Community-Acquired Methicillin-resistant Staphylococcus Aureus Abscesses of the Nose: Comparing Populations at a Community Hospital and Tertiary Hospital in a Major City

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Introduction:
Rates of community-acquired Staphylococcus aureus (CA-MRSA) vary between populations. This study compares MRSA of the nose between two distinct geographic and socioeconomic populations from a major city and contrasts nasal versus other anatomic sites of head and neck abscesses.

Methods:
ICD-9 codes were used to search the electronic medical record at a community medical center (CMC) from 2007-2012 and a tertiary medical center (TMC) from 2007-2015. Inclusion required abscess of the head or neck and culture result. Co-morbidities were recorded, including Diabetes Mellitus and Human Immunodeficiency Virus.

Results:
Of 4,761 charts reviewed, 415 were included, 70 of which were nasal. Mean age was 40 years for nasal abscesses versus 35 years for non-nasal abscesses (p=0.05). There were 130 women (31%) and 285 men (69%). Women had significantly more nasal abscesses (43% women) than non-nasal abscesses (30% women) (p=0.04). The nasal MRSA to methicillin sensitive Staphylococcus aureus (MSSA) ratio between centers was insignificant (p=0.86), as was nasal versus non-nasal location (p=0.52). MRSA:MSSA ratio did not increase over the study period (TMC p=0.17, CMC p=0.09, combination p=0.18). High erythromycin resistance at TMC (13/17 nasal abscesses) was not significantly different than at CMC. MRSA was significantly more resistant than MSSA to erythromycin (p=0.0016) but not other antibiotics.

Conclusions:
Two thirds of head and neck abscesses occurred in men. Women had significantly more nasal than non-nasal abscesses. Nasal abscesses occurred at an older age than other head and neck abscesses. No difference was exhibited concerning MRSA:MSSA ratio between medical center or anatomic location.

#D034

Comprehensive Literature Review and Improved Classification System to Better Understand and Treat Barosinusitis

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Background:
Barosinusitis, or sinus barotrauma, may arise from changes in ambient pressure that are not compensated by force equalization mechanisms within the paranasal sinuses. This is most commonly seen with altitude changes during flight or diving. Understanding and better classifying the pathophysiology, clinical presentation and management of barosinusitis is essential to improve patient care.

Methods:
A broad literature search using the terms “barosinusitis”, “sinus barotrauma”, and “aerosinusitis” was conducted, and all identified titles were reviewed for relevance to the upper airway and paranasal sinuses. All case reports and review articles that were identified from this search were included. Two cases of sinus barotrauma from our institution were included to illustrate classic signs and symptoms.

Results:
Fifty-one articles were identified as specifically relevant to, or referencing, barosinusitis and were comprehensively reviewed. It was also noted that most articles focused on barosinusitis in the context of a single specific etiology, rather than independent of etiology. From analysis of current publications combined with clinical experience, three distinct types of barosinusitis are proposed: 1) acute, isolated barosinusitis, 2) recurrent acute barosinusitis and 3) chronic barosinusitis, with distinct treatment recommendations.

Conclusions:
Barosinusitis is a common but potentially overlooked condition that is primed by shifts in the ambient pressure within the paranasal sinuses. The pathophysiology of barosinusitis has various causes, which may contribute to the misdiagnosis, even underdiagnosis, of this disease process. Available literature compelled proposed modifications to existing classification systems, which may yield better awareness and management strategies of barosinusitis.

#D035

Correlations Between Cystic Fibrosis Genotype And Sinonasal Disease Phenotype in Patients with Chronic Rhinosinusitis

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Introduction:
Cystic fibrosis (CF) patients commonly develop chronic rhinosinusitis (CRS). The impact of the most common Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) mutation, F508del, on the severity of sinonasal disease remains inconclusive. The objective of this study is to evaluate the impact of CF genotype on sinonasal disease phenotype as determined by various outcome variables.

Methods:
Retrospective chart review of patients with CF who underwent endoscopic sinus surgery for chronic rhinosinusitis from 1998 to 2015. Patients were divided into two groups on the basis of homozygosity for the F508del CFTR mutation versus heterozygosity for F508del and a combination of two non-F508del CFTR mutations. The primary outcome was the 22-item Sino-Nasal Outcome Test (SNOT-22) score. Secondary outcomes included endoscopic scores, extent of surgery performed, presence of polyposis, and Lund-MacKay computed tomography (CT) scores.

Results:
Twenty-seven patients were homozygous for F508del and 22 had either heterozygosity for F508del or non-F508del mutations. The latter group was termed non-homozygous. On bivariate analysis, the homozygous cohort had significantly higher CT scores (p=0.037), but significantly better preoperative psychologic (p=0.043) and sleep subdomain scores (p=0.048) than their non-homozygous counterparts. These relationships were not maintained to a statistically significant level after adjusting for age and gender on multivariate linear regression analysis. There was no association between F508del homozygosity and sinonasal endoscopy scores.

Conclusions:
Homozygosity for the F508del mutation in CRS patients, when compared to non-homozygous forms of CF, is not associated with sinonasal disease outcome measures after adjusting for confounding factors.

#D036

Cox-2 Overexpression in Primary and Recurrent Inverted and Oncocytic Schneiderian Papillomas

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Introduction:
Cyclo-oxygenase-2 is undetectable in most cells, but elevated levels occur during inflammation and tumorigenesis. Our objective was to determine the incidence of Cox-2 overexpression in subtypes of Schneiderian papillomas and in recurrence of disease

Methods:
Immunohistochemistry for Cox-2 was performed on samples obtained during surgical resection of inverted papillomas between January 2012 and October 2016. A positive stain was defined as having 10% or more of all tumor cells or a focal area with more than 10% of cells exhibiting immunoreactivity.

Results:
44 tumor samples from 16 females and 28 males were included, with an average age at surgery of 60.5. Tumor site of attachment included maxillary(19), ethmoid(9), frontal(5), and sphenoid(3) sinuses; nasal cavity(4); internal nasal valve(1); and multiple attachments(3). There was no significant difference in the proportion of patients with inverted (18 of 40) and oncocytic (2 of 3) papillomas (p=0.35); or with prior (12 of 23) or primary (8 of 21) surgery (p=0.15) who had Cox-2 expression. Average follow up time was 13.1 months, during which 5 patients had recurrence (60% Cox-2 positive, no significant difference compared to patients without recurrence, p=0.29). Four patients had evidence of dysplasia, 50% of patients with dysplasia had Cox-2 positive papillomas.

Conclusions:
Schneiderian papillomas are benign but locally aggressive tumors with few nonsurgical treatment options. Cox-2 overexpression was identified in 45.5% of samples, and the proportion was stable across subtypes and recurrent versus primary tumors. Pharmaceutical targeting of Cox-2 may provide an additional therapeutic option for tumors which overexpress the enzyme.

POSTERS

#D037

CRS and Immunosuppression Suppressants Agents

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Objective:
Chronic rhinosinusitis(CRS) can co-exist in patients requiring immunosuppressant therapy. There is a paucity of literature on the effect of immunosuppressive medications on the development of sinonasal infections. The objective of this case series is to describe our clinical experience in this cohort.

Methods:
This is a retrospective case-series report of patients on immunosuppressive medication, diagnosed with CRS from 2011-2016, at a tertiary rhinology practice. Patient demographics, concurrent autoimmune disease, immunosuppressant therapy, diagnostic findings, treatment, and results are described. Exclusion criteria included absence of rhinosinusitis(RS), odontogenic RS, allergic fungal RS, aspirin-exacerbated respiratory disease, sinus tumor, vasculitic disorders , cystic fibrosis, primary immune deficiency.

Results:
55 patients on immunosuppressive therapy were identified, only 14 patients met inclusion criteria. Indications for immunosuppressant medications were either autoimmune disease (80%) or transplant (20%). Staphylococcus aureus was the most common organism identified. Oral antibiotics were used in 13/14 patients; topical steroid rinse(11/14), topical antibiotic(6//14), oral steroids(13/14) and sinus surgery(12/14). Following treatment, sinonasal symptoms improved in 6 patients, were stable in 5 patients and worsened in 3 patients. There was a tendency for methotrexate in the setting of rheumatoid arthritis to be associated with refractory CRS.

Conclusion:
CRS is rarely described in the setting of medicated immunosuppression. This patient population can present with refractory disease, and may experience variable results requiring persistent monitoring and medical therapy. These immunosuppressant medications mechanisms may have implications for elucidating various endotypes in CRS.

#D038

Delivering Solutions to the Anterior Ethmoid Region: Evaluation of a Lacrimal Diversion Device in a Cadaver Model

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Background:
Topical therapies to the sinus cavity are primarily administered via a transnasal route with inherent limitations of distribution. Here we describe an alternate method of sinus access via lacrimal sinus diversion using a novel lacrimal diversion device (LDD).

Methods:
A cadaveric study was performed using 12 disarticulated fresh heads. The LDD was implanted in 23 sides meeting insertion criteria. Time to placement was recorded and patency was assessed via nasal endoscopy. Methylene blue was administered via the LDD and 16 sides underwent surgical ethmoidectomy to assess distribution of mucosal staining. Two cadavers underwent CT imaging to demonstrate stent position.

Results:
Mean time of placement was 3.66 min (SD = 2.37 min). Patency rate was 100%. Six sides (37.5%) had anterior ethmoid staining, six sides (37.5%) had posterior ethmoid staining, and the remaining four sides (25%) had mixed anterior and posterior ethmoid staining. Stents placed optimally resulted in anterior ethmoid staining without complication. Malpositioned stents resulted in posterior ethmoid staining and inadvertent ethmoid vertical lamella trauma in two instances.

Conclusions:
Solution can be delivered to the ethmoid sinuses directly via a lacrimal diversion stent. Technique modification or image-guidance may be helpful in ensuring optimal placement.

#D039
Development of a 3D Printed Skull Base Task Trainer for Teaching Extended Endoscopic Sinonasal Approaches
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Introduction:
Resident training during endonasal skull base approaches is often limited. We sought to describe the development and teaching efficacy of 3D printed skull base models for teaching extended endoscopic skull base approaches.

Methods:
A de-identified CT sinus was printed on a Stratasys Connex polyjet in VeroWhite. Unique material blocks were printed using Polylactic acid (PLA) on a fused deposition modeling printer and MED610 on a polyjet printer. Medtronic Fusion comparing the original CT scan to the model was used for anatomic validation. A fellowship trained skull base surgeon taught modified endoscopic Lothrop, endoscopic anterior craniofacial resection, transpterygoid, and transclival approaches to Otolaryngology residents. Likert scale questionnaires (1-5) were used to detail whether the anatomy was accurate and the haptic feel of the material similar to bone.

Results:
Four procedures were performed by each resident. Likert scale average for haptic feedback of the following instruments were; diamond bur 4.67, cutting bur 5, through cutting instrument 4.67. Average Likert ratings for the anatomic accuracy of the procedure were: modified Lothrop 4.67, sphenoidotomy 4.33, removal of anterior cranial base 4.33. For the transclival exposure; removal sphenoid floor 4.66, removal of clivus 3.67. For the transpterygoid exposure; maxillary antrostomy 4, posterior maxillary wall cuts 3, superior pterygoid cuts 2.67. Haptic accuracy rating of VeroWhite was 4.67, Med610 was 4, PLA 2.67.

Conclusions:
3D sinonasal printing offers an alternative method for teaching extended endoscopic sinonasal approaches that provides realistic tactile feedback. The drilling of VeroWhite 3D printed material was rated as most realistic.

#D040
Developmental Anomaly – A Duplicate Fronto-ethmoidal Sinus Complex
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Introduction:
Fronto-ethmoidal sinus tumors can be benign or malignant. In our clinical practice, we encountered a patient with a seemingly aggressive frontal sinus lesion, who underwent extensive surgery, and was eventually found to have a development anomaly of the frontoethmoidal sinus. This case report presents the first known case of a duplication of the ethmoid sinus, adding to the literature of unusual skull base tumors.

Methods:
We present a case of a patient encountered in our clinical practice, with a frontal sinus lesion who presented with seizures, and initial imaging findings were suggestive of malignancy.

Results:
The patient underwent craniofacial resection, and intraoperative findings revealed a lesion with architecture similar to the morphology of the ethmoid sinus, hence suggesting that the patient had a duplication of the ethmoidal sinus during development.

Conclusion:
This case report highlights the first known case of a duplication of the ipsilateral ethmoid sinus. This aids clinicians in the future to clinch the diagnosis in patients who present similarly, hence avoiding extensive surgical procedures with significant risk of mortality and morbidity.

POSTERS

#D041 WITHDRAWN

#D042

Ectopic Olfactory Neuroblastoma: Systematic Review and Report of New Case

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Objective:
Olfactory neuroblastoma (ONB), or esthesioneuroblastoma, is an uncommon malignant tumor arising from the olfactory neuroepithelium in the sinonasal cavity. Ectopic origination of ONB is exceedingly rare and therefore has not been well characterized. This review aims to familiarize clinicians with its unique diagnostic and therapeutic issues.

Methods:
PubMed/MEDLINE and EMBASE were searched for publications related to ectopic olfactory neuroblastoma. Demographics, tumor origin, clinical presentation, radiographic findings, treatment approaches, and outcomes were analyzed. We also present a new case of ONB arising from the right maxillary antrum.

Results:
Twenty-six cases of ectopic ONB were identified over twenty-two published reports including the one new case reported herein. The mean patient age at the time of presentation was 44 (range: 12-89 years), and the disease showed no significant sex predilection (58% female). The most common location of ectopic ONB was the maxillary sinus (27%), sella turcica (19%), sphenoid sinus or sphenoclival (19%), nasopharynx (8%), ethmoid sinus, inferior meatus, nasal floor, dento-alveolar, pterygopalatine fossa, and multifocal (4% each). The most common symptoms were obstruction (35%) followed by headache and epistaxis. The treatment approach most utilized was endoscopic surgical resection (77%) with complete resection portending the best prognosis. Of the surgical cases, 90% were disease-free at the time of publication with one report of recurrence.

Conclusions:
Though rare, ectopic ONB should be considered in the differential of sinonasal tumors as it can pose a significant therapeutic challenge. Gross total resection with adjuvant therapy, when feasible, is advocated in the successful treatment of this tumor.

#D043
Effects of an Exercise Program on Olfaction in Patients with Alzheimer's Disease
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Introduction:
Olfactory dysfunction has been well-described in Alzheimer's disease (AD). Options for improving olfaction are limited, and few studies have prospectively attempted to improve hyposmia. A previous meta-analysis has shown that exercise provides global benefit to patients with AD. We hope to prospectively evaluate what effect exercise has on olfaction and general cognition in patients with AD.

Methods:
This sub-study was an adjunct to a randomized, controlled, 26-week study of supervised exercise comparing aerobic vs. stretching (comparison / control group) in individuals with early-stage AD. Patients completed the UPSIT (University of Pennsylvania Smell Inventory Test) and MMSE (Mini-Mental State Examination) prior to and after the program.

Results:
This study included 18 patients with 9 patients in the control arm and 9 in the exercise arm. The groups showed no statistical difference (p=0.537) between pre-treatment and post-treatment olfactory scores. There were 3 patients in the exercise arm versus 1 patient in the control arm that had an improvement in olfactory score (p=0.288). The groups showed no significant difference in post-intervention average MMSE (p=0.884), though more patients improved in the exercise arm.

Conclusion:
Although more patients in the exercise arm versus the control arm improved in gross and normative olfactory score and MMSE scores, it may be hard to predict statistical significance due to small sample size. This is suggestive that exercise may play a role in aiding certain patients. Reproduction of this study with a larger sample size and shorter intervention length may provide further clarity.

#D044
Efficacy of Transnasal Endoscopic Dacryocystorhinostomy with Ultrasonic Bone Aspirator in Revision Dacryocystorhinostomy
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Introduction:
To determine the efficacy of endoscopic dacryocystorhinostomy (endoDCR) with ultrasonic bone aspirator (UBA) in the setting of revision dacryocystorhinostomy

Methods:
A retrospective institutional review board approved chart review of 550 endo DCR with UBA over a four-year period performed by a single otolaryngologist. Data included demographics, type of previous surgery, intraoperative findings, and post operative results.

Results:
51 patients undergoing revision endoDCR with UBA after previous DCR and with no other co-morbidities associated with nasolacrimal duct obstruction were identified. The average age was 57 years old. 78.4% were females. 56.1% of patients had previous endoscopic DCR without UBA, 28.1% had an external DCR and 15.8% had previous balloon dacryocystoplasty. Topical mitomycin was used in 35.3% of revision endoDCR with UBA. Approximately, 3.9% of patients had persistent epiphora at 6 months. 3.9% of patients reported postoperative epistaxis. 5.8% of patients reported postoperative sinusitis that required medical treatment. 7.8% of patients who underwent revision endoDCR with UBA in the setting of previous intervention required an additional procedure. 11.1% of patients who underwent revision endoDCR with UBA and intraoperative mitomycin use required an additional revision surgery. There was no statistical significance between the type of previous DCR surgery and rate of revision after endoDCR with UBA.

Conclusion:
Our growing experience with the endoDCR with UBA shows reasonable efficacy in patients who need revision DCR. While this population remains difficult to manage, the postoperative predictors of patency in this group show patients do well.

POSTERS

#D045

Endoscopic "Puncture and Dilate" Hybrid Frontal Sinusotomy Technique for Type 3 Frontal Cell Excision

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Introduction:
Obstructive type 3 frontal cells are known anatomic variants that can contribute to refractory chronic frontal sinusitis. Endoscopic removal of these cells when the frontal sinus outflow tract (because of scarring or inflammation) can be visualized is technically difficult.

Methods:
A retrospective review of patients presenting to a tertiary rhinology practice was conducted of a novel endoscopic "puncture and dilate" hybrid frontal sinusotomy technique performed for type 3 frontal cells in patients with refractory chronic sinusitis. In cases in which the natural outflow tract could not be identified (because of scarring or inflammation), this technique was performed in which the roof of the type 3 frontal cell is punctured with an image guidance probe and then balloon dilated to allow adequate access for frontal giraffe instrumentation to perform a wide frontal sinusotomy. Nasal endoscopy utilizing video endoscopy was used to assess postoperative patency. Symptom score analyses were performed using SNOT-22 scores preoperatively and at 3 months postoperatively.

Results:
This review identified 9 subjects and 11 frontal sinuses in which the procedure was successfully performed. All frontal sinus surgical sites remained patent throughout the study period. There were no CSF leaks or other complications.

Conclusions:
Surgical intervention of obstructive type 3 frontal cells is technically challenging, particularly when no frontal sinus outflow tract can be identified. The endoscopic "puncture and dilate" hybrid frontal sinusotomy technique is a safe procedure for excision of type 3 frontal cells when performed using image guidance and careful proper anatomic preparation.

#D046

Endoscopic "Unzip" Frontal Sinusotomy Technique for Excision of Type 3 Frontal Cells

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Introduction:
Type 3 frontal cells represent a difficult-to-management anatomic variant in patients with chronic frontal sinusitis. Improper management can lead to synechiae and frontal sinus mucocele formation. This report reviews experience with a novel technique to "unzip" the frontal cell along the frontal sinus natural outflow tract.

Methods:
A retrospective review of a tertiary rhinology practice was conducted of patients with refractory chronic frontal sinusitis who underwent the endoscopic "unzip" frontal sinusotomy technique and excision of type 3 frontal cells. This novel technique utilizes careful identification of the natural outflow tract of the frontal sinus adjacent to a type 3 frontal cell, which often is a narrow tract along the cribriform plate, to gently but effectively perform a wide frontal sinusotomy. Nasal endoscopy utilizing video endoscopy was used to assess postoperative patency. Perioperative SNOT-22 scores and complications were analyzed.

Results:
This review identified 8 subjects and frontal sinuses in which the endoscopic "unzip" frontal sinusotomy with type 3 frontal cell excision procedure was successfully performed. All frontal sinus surgical sites remained patent throughout the study period. There were no CSF leaks or other complications.

Conclusions:
The endoscopic "unzip" frontal sinusotomy with type 3 frontal cell excision technique is a safe and effective procedure for type 3 frontal cells in which the natural outflow tract can be identified. The technique is mucosal sparing and can provide long-term frontal sinus patency in patients with this difficult-to-manage anatomic variant.

#D047
Endoscopic Approaches for Intraorbital Dissection
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Objective:
To quantify the medial orbital surgical field afforded by a range endoscopic approaches using cadaveric dissection and computer software analysis of computed tomography (CT) scans.

Methods:
4 cadaveric heads were dissected for access to the bilateral intraorbital contents. Heads were dissected in a stepwise manner beginning with an endoscopic ipsilateral removal of the lamina papyracea, then a transseptal approach from contralateral nostril, then an ipsilateral modified Denker's removal and then finally a combination of the transseptal approach with a modified Denker's maneuver. Axial CT scans obtained through the paranasal sinuses on 4 live patients undergoing workup for chronic sinusitis were obtained. Fixed anatomic landmarks were used to define access points for the separate approaches, and the area of lamina papyracea accessible on 3 contiguous CT cuts was calculated to quantify the amount of surgical access provided by each approach. An analysis of variance was used to compare the mean area of surgical access by approach.

Results:
There was a statistically significant difference between the amount of access provided by each approach ($p=<0.05$). Ipsilateral endoscopic approach provided 105.6m2 of access, ipsilateral modified Denker's provided 186.3mm2, transseptal approach provided 173.2mm2, and modified Denker's with a transseptal approach provided 255.6mm2.

Conclusions:
Increased endoscopic access to the lamina papyracea and orbital contents can be achieved with different endoscopic approaches. This analysis indicates that a transseptal approach combined with an endoscopic Denker's modification achieves the greatest amount of surgical access to the medial orbit.

#D048
Endoscopic Decompression of Pott's Puffy Tumor in an Adult
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Introduction:
Pott's puffy tumor (PPT) presents as glabellar swelling secondary to frontal bone subperiosteal abscess and osteomyelitis. It is most common in adolescents due to increased diploic venous flow, but rare adult cases have been reported. Prompt diagnosis and surgical treatment of PPT may prevent intracranial complications, but there is little evidence regarding outcomes in purely endoscopic management of this disease. We present an adult patient with PPT who underwent endoscopic surgical decompression, and aim to discuss the diagnosis and current treatment outcomes for this disease entity.

Methods:
Case report

Results:
A 35-year-old male presented with 2 days of glabellar swelling. Head computed tomography (CT) demonstrated left frontal subperiosteal abscess with anterior and posterior table frontal sinus erosion, consistent with PPT. Magnetic resonance imaging (MRI) demonstrated mass effect on the frontal lobes, although the patient did not demonstrate neurologic deficits. Intravenous antibiotics were initiated, and transnasal endoscopic drainage of the frontal sinus was performed. Post-operative CT confirmed decompression of PPT, and a patent frontal sinus outflow tract. Decreased frontal lobe mass effect was noted on postoperative MRI. The patient was sent home on a prolonged course of intravenous antibiotics. He had no cosmetic defect and remained disease-free at 5 month follow-up.

Conclusions:
PPT requires accurate imaging diagnosis and prompt surgical intervention to prevent intracranial complications. A transnasal endoscopic surgical approach to PPT can result in a favorable functional and cosmetic outcome, so long as an adequate drainage pathway is established and post-operative antibiotics are continued.

POSTERS

#D049

Evaluating Simulator-based Teaching Methods for Endoscopic Sinus Surgery

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Introduction:
In the realm of endoscopic sinus surgery (ESS), a multitude of simulator systems are used as training tools for residents preparing to enter the operating room. These include human cadavers, virtual reality, realistic anatomic models, and low-cost gelatin molds. While these models have been validated and evaluated as independent tools for surgical trainees, no study has directly compared these different systems.

Objectives:
This study aims to evaluate the utility of the anatomic (high-fidelity) and gelatin (low-fidelity) molds as compared to traditional (no training device) for trainees acquiring basic ESS skills.

Methods:
33 first-year medical students were randomized to three groups and taught basic sinus anatomy and instrumentation. Eleven received additional training with either the high-fidelity or low-fidelity trainer. Afterwards, these groups used cadaveric specimens to demonstrate their anatomic knowledge and surgical skills. These sessions were recorded and graded on a Likert-type scale by a blinded expert. ANOVA tested differences among the mean graded scores and times for the three training groups.

Results:
There was no significant difference between the three study groups with regards to identification of anatomy, endoscopic competency, completion of basic tasks (exposure of the middle meatus, injections, or foreign body removal), or time to completion.

Conclusion:
While previous studies have validated simulator training systems, our comparison yielded no statistical difference between the different methods. Simulation has been shown to improved trainee comfort as reported in feedback surveys, however our data suggest the continued important of non-simulator, real patient encounters for developing ESS skills for surgical trainees.

#D050

Evaluation of Patient Nasal Saline Irrigation Practices following Endoscopic Sinus Surgery and its Effects on Short-term Outcomes

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Introduction:
Endoscopic sinus surgery (ESS) is an effective treatment for chronic rhinosinusitis. Post-ESS management strategies vary from surgeon to surgeon; the recent International Consensus Statement on Allergy and Rhinology recommends saline irrigation 24-48 hours following ESS. Though many surgeons recommend nasal saline irrigation following ESS, patient adherence has not been formally evaluated. The purpose of this study is to evaluate post-ESS nasal irrigation practices and effects on short-term outcomes.

Methods:
Eighty-two patients were followed prospectively after ESS at a tertiary academic medical institution for three post-operative visits. Patients were surveyed on their irrigation practices (start date, frequency, volume per irrigation per side), and adherence to prescribed antibiotic and steroid regimens. At each visit, a SNOT-22 questionnaire was completed and an endoscopic examination was evaluated by the Lund-Kennedy Endoscopy Score. Demographics, pre-operative Lund-Mackay scores, pre-operative SNOT-22 scores, comorbidities, extent of procedure, and use of nasal packing and/or spacers were assessed.

Results:
Compliance to irrigation instructions was 82.9%. Factors significantly associated with irrigation compliance included Caucasian ethnicity ($p=0.018$), younger age ($p=0.002$), prior irrigation experience ($p<0.001$), and revision surgery ($p=0.001$). Patients were more likely to irrigate with larger volumes if they were younger ($p=0.041$), irrigated previously ($p<0.001$), or had revision surgery ($p=0.013$). Presence of polyposis or extent of surgery did not predict improved compliance ($p>0.05$). Greater change in SNOT-22 scores were noted with increased frequency of irrigation ($p=0.012$).

Conclusions:
Patient adherence to nasal irrigation following ESS is high. Identification of factors associated with non-compliance can aid pre-operative counseling to improve adherence rates.

#D051

Evolution of the Endoscopic Modified Lothrop Procedure in Frontal Sinus Disease: A Systematic Review and Meta-analysis

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Introduction:
Since the endoscopic modified Lothrop procedure (EMLP) was first described in the 1990s, indications for its use have expanded. We performed a systematic review to: 1) compare the indications, efficacy, and complications of EMLP as described in an early cohort (1990-2008) versus a contemporary cohort (2009-2016); 2) assess differences in results of EMLP in a short-term follow-up cohort (<2 years follow-up) vs. long-term cohort (=2 years).

Methods:
An English language search of the PubMed and Ovid databases was conducted to identify publications from the years 1990-2016 examining EMLP and clinical outcomes. Inclusion criteria included papers with = 6 subjects, = 6 months follow-up, description of individual patient data and clinically measurable outcomes. Any discrepancies regarding which studies to include were resolved by discussion and consensus. Meta-analysis was performed using random effect models to examine the relationships between covariates and outcomes.

Results:
A total of 1567 patients were abstracted from 32 papers. In the contemporary cohort compared to the early cohort, EMLP was used more often for frontal tumors ($p < 0.001$), had longer mean follow–up time ($p = 0.005$) and better subjective and objective outcomes ($p = 0.005$; $p < 0.001$). In the long-term cohort, no statistically significant differences in outcomes were noted compared to the short-term cohort.

Conclusions:
In the last decade, the indications for EMLP have expanded. Outcomes in the contemporary cohort of studies demonstrate improved objective and subjective results when compared to results of studies prior to 2008.

#D052

Extranodal Natural Killer/t-cell Lymphoma Presenting with Dacryocystitis: A Case Report and Review of Literature

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Introduction:
Extranodal natural killer/T-Cell lymphoma, nasal type (NKTCL-NT) is a rare type of non-Hodgkin's lymphoma. It is endemic to East Asia and Central/South America. It commonly presents with a destructive lesion in midline sinonasal tissue or upper aerodigestive tract. Patients present with nasal obstruction, epistaxis, or sinusitis. Epstein-Barr virus (EBV) has been implicated in its pathogenesis and is associated with poorer prognosis. Definitive diagnosis is based on immunohistochemistry analysis. Although treatment of NKTCL is non-surgical, otolaryngologic evaluation with tissue biopsy plays a critical role in the management algorithm.

Methods:
A case report and review of current literature.

Results:
A 64-year-old Caucasian female was referred from Ophthalmology with right epiphora and right nasal congestion and drainage for 5 months. She additionally developed progressive edema over the right medial canthal region. On physical exam, her right medial canthus was displaced laterally due to soft tissue edema, and a friable mass was seen in the right anterior nasal cavity on endoscopy. CT/MRI revealed right nasolacrimal duct obstruction by a soft tissue mass and cystic dilatation, and opacification of right-sided paranasal sinuses. Immunohistochemistry on in-office biopsy specimen confirmed a diagnosis of NKTCL-NT, positive for EBV RNA. Patient is referred to medical oncology for chemotherapy.

Conclusions:
ENTCL-NT is a rare but aggressive form of lymphoma affecting sinonasal tissue and the upper aerodigestive tract. We report a case of ENTCL-NT presenting with dacryocele and dacryocystitis. We aim to increase diagnostic awareness of this rare disease entity and highlight a critical role of otolaryngologist in its diagnosis.

POSTERS

#D053

Feasibility, Cost, and Anatomic Accuracy of 3D Printed Paranasal Sinus and Skull Base Model

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Introduction:
Use of additive manufacturing in the creation of anatomic models for patient education, resident training, and operative planning has become widespread in Otolaryngology. Use in sinus surgery has been limited due to difficulty printing details of sinus anatomy. In this study, we determined the feasibility, time, cost, and accuracy of a 3D printed paranasal sinus and skull base model .

Methods:
High resolution CT scan of the paranasal sinuses was used to create a 3D model (Vero White material) using open source software (Slicer™ and MeshMixer™) and 3D printer (Stratasys Connex™ Polyjet). Software formatting time, print time, post-processing time, and cost were collected. Anatomic accuracy of the model CT scan was evaluated using seven anatomic landmarks and compared to the original CT scan. Intraoperative navigation using Medtronic Fusion™ system was used to confirm accuracy of thirteen surgically relevant landmarks.

Results:
Conversion and formatting to a 3D printable STL file took 52 minutes. Print time was 18 hours with 45 minute post-processing time. Cost was $800. Details of the 3D printed model were captured on CT. Differences in measurements from the model CT compared to patient's CT were less than 5 percent. Image guided navigation confirmed pinpoint accuracy of all important surgical landmarks.

Conclusions:
3D printed paranasal sinus and skull base modelling demonstrate high anatomic accuracy. While time investment and cost of individual models need improvement, 3D modelling offers an alternative to classic cadaveric dissection and may be useful in patient education, surgical training, and pre-operative planning.

#D054

Fibrous Dysplasia of the Lateral Nasal Wall Presenting as Inferior Turbinate Hypertrophy

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Introduction:
Inferior turbinate hypertrophy is a familiar cause of nasal obstruction in many patients and is a condition that is commonly treated medically by otolaryngologists and primary care physicians alike. Although inferior turbinate hypertrophy is commonly perceived as a "straightforward" diagnosis in our community, underestimating the pathology that looms beneath the surface may be detrimental. We present a case of fibrous dysplasia of the right inferior turbinate as well as the right middle turbinate and the right ethmoid labyrinth in a patient who originally presented with inferior turbinate hypertrophy.

Case:
A 27 y.o. female presents to our clinic with symptoms of chronic nasal obstruction. Examination was significant for right inferior turbinate hypertrophy and nasal septal deviation. In the operating room the inferior turbinate was found to consist of solid bone and could not be reduced. Postoperative imaging was significant for findings consistent with fibrous dysplasia. Final pathology was consistent with the diagnosis of fibrous dysplasia.

Conclusion:
Imaging is not typically obtained for isolated inferior turbinate hypertrophy and septal deviation without signs or symptoms of sinusitis. In the future, preoperative imaging of patients with severe turbinate hypertrophy should be considered to determine the best operation to reduce the turbinate and to avoid missing an unexpected underlying pathology.

#D055
Idiopathic CSF Oculorrhea: An Unusual Case Report
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Introduction:
Cerebrospinal fluid leakage into the orbit (CSF orbitorrhea) or through the orbit to the exterior (CSF oculorrhea) occurs when there is a communication between orbit and subarachnoid space.

Case Report:
We report an unusual case of 47 year female who presented with sudden onset clear watery discharge from the eyes since four days. She was on follow up for management of CSF rhinorrhea which had stopped spontaneously until 4 days later when she started having complaint of heaviness , redness and passage of clear watery discharge from right eyes. There was no prior history of trauma. On local examination, there was conjunctival chemosis and proptosis. There was no alteration in her vision. On nasal endoscopic evaluation, there was no evidence of watery discharge. Discharge from the eyes was collected and sent for CSF evaluation which came out to be positive. Radiological investigation was done. MRI cisternography confirmed the leak and revealed small defect in right cribriform plate and inferior displacement of right olfactory nerve. NCCT nose and PNS showed defect in cribriform plate and fluid in right frontoethmoidal recess. Intraoperatively, it was found that there was a defect in cribriform plate and breach in right lamina papyracea with normal anatomic anterior and posterior ethmoid cells missing. Repair was done with fascia lata and tissel glue. Post operatively, patient has been bearing well so far.

Conclusion:
Although oculorrhea rarely develops, suspicion should nevertheless be maintained to facilitate more prompt diagnosis and management.

#D056
Incidence and Survival of Sinonasal Adenocarcinoma: Analysis by Site and Histologic Subtype
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Objectives:
To identify the incidence and survival of sinonasal adenocarcinoma (SNAC) by subsite and histologic subtype.

Study Design:
Retrospective database analysis.

Methods:
Using the Surveillance, Epidemiology, and End Results database, we identified cases of SNAC diagnosed between 1973 and 2013. Demographic, histopathologic, clinicopathologic traits, and determinants of disease specific survival (DSS) were analyzed.

Results:
A total of 797 patients with SNAC were identified. The median age at diagnosis was 64 years. Overall incidence was 0.43 per million, and incidence was higher among blacks (O.R.:1.02-1.78:1) and males (O.R.:1.47-2.13:1). Incidence did not change significantly in the past 40 years. Adenocarcinoma NOS (58.2%) was the most common, and intestinal-type was the 5th most common (4.3%) histology. The nasal cavity (38.8%) was the most common site, followed by the maxillary (23.8%), and ethmoid (15.5%) sinuses. Intestinal-type adenocarcinoma was less likely than adenocarcinoma NOS to be found in the maxillary sinus (8.8% vs. 30.6%, $p<0.05$). Stages I (34.7%) and IV (38.5%) were the most common. Histological grade II (37.7%) was the most common grade. Surgery and radiotherapy (42.6%) was the most common treatment modality, followed by surgery alone (38.5%), and radiotherapy alone (11.4%). DSS at 5, 10, and 20 years were 62.3%, 56.0%, and 45.8% respectively. DSS was higher for nasal cavity SNAC, lower grade, lower stage, younger age, and those receiving surgery only.

Conclusions:
SNAC is more common among men and blacks. Incidence has not changed significantly in the past 40 years. Survival varies with grade, stage, age, treatment, and subsite.

POSTERS

#D057
Incidence of Sphenoid Mucoceles After Endoscopic Transsphenoidal Approach with Sphenoid Obliteration
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Introduction:
Historically, the frontal sinus was obliterated in cases of trauma obstructing the outflow tract. Frontal sinus mucocele is a known complication of fat obliteration in such circumstances, and may occur in up to 10%. The sphenoid sinus is often obliterated with fat after endoscopic transsphenoidal approach (TSA) to the pituitary gland. Subsequent development of sphenoid sinus mucocele has been described in case reports. However, the complication is simply described as rare, without documented incidence in large series. The purpose of our study is to estimate the incidence of sphenoid mucocele following TSA with fat obliteration, as well as other complications.

Methods:
A retrospective chart review was performed looking at all patients who underwent sphenoid obliteration with fat after TSA for pituitary excision by a single surgeon at a single institution from 2001 to 2003. Data was collected regarding the operation performed, method of sphenoid sinus obliteration, method of reconstruction, follow up period, and all documented complications.

Results:
We identified 95 patients who underwent TSA with sphenoid fat obliteration. The average follow up time was 6.1 years (SD +/- 4.4 years). Of these patients none developed a sphenoid mucocele (an incidence of at least less than 1.1%). The most common complications were recurrence of disease and residual disease (10.5% and 7.4% respectively). Other rare complications included sinusitis, endocrine abnormalities such as hyponatremia, hematoma, and the need for placement of ventriculoperitoneal shunt postoperatively.

Conclusion:
Our data suggests that the incidence of sphenoid mucocele after sphenoid fat obliteration following TSA is negligible.

#D058
Infective Organisms in Chronic Rhinosinusitis with Nasal Polyps.
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Background:
Infections comprise a significant factor in chronic rhinosinusitis (CRS) pathogenesis. While mucin and mucopurulence are frequently encountered in CRS patients, it is not clear these findings are associated with different organisms. Furthermore, it is not clear if the history of prior surgery impacts the organism distribution.

Aim:
1. Compare the intraoperative pathologic and microbial findings between patients with mucin and mucopurlence.
2. Compare intraoperative pathologic and microbial findings between revision and primary sinus surgery

Methods:
Retrospective review of CRSwNP patients who underwent endoscopic sinus surgery between 11/2015 to 11/2016. Patients with intraoperatively documented mucin or mucopurlence included. Patients without pathology findings or microbiology cultures were excluded.

Results:
72 patients met inclusion criteria. Average age and gender were similar between the 31 mucopurlence patients (57 years, 52% female) and 41 mucin patients (52 years, 51% female). The study has 80% power to detect a 30% difference. Mucin group has significantly more revision cases (49% vs 0% in mucopurlence, $p<0.001$). Mucopurlence group had more pathologic inflammation (70% vs. 30% in mucin group) thought the difference was not statistically significant ($p=0.07$). All groups had similar distributions of aerobic, anerobic, gram-negative, and fungal flora with gram-positive aerobes accounting for over 40% in each group. Fungal organisms were cultured in 19% patients with mucin.

Conclusion:
Gram-positive bacteria play a major role in CRSwNP pathogenesis, however, the presence of mucin or mucopurulence and the history of prior surgery may not determine the causative organism.

#D059
Invasive Fungal Sinusitis After Maxillary Sinus Inverted Papilloma Resection
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Michael Shohet, MD
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Introduction:
Invasive fungal sinusitis has a wide range of presentations and requires a low threshold for diagnosis. We describe an unusual presentation of invasive fungal sinusitis two weeks after endoscopic resection of sinonasal inverted papilloma.

Methods: Case report

Results:
A 63-year-old male with right maxillary inverted papilloma underwent a right medial maxillectomy. His post-operative course was complicated by nausea, vomiting, hyperglycemia, leading to a new diagnosis of diabetes mellitus (DM). He presented to two different outside hospitals during his second postoperative week with significantly elevated blood glucose levels and right eye discharge, and was discharged from each with antibiotics. Upon presenting to our facility, he was diagnosed with orbital cellulitis. After twenty-four hours of intravenous antibiotics and strict glucose control, the patient's clinical exam worsened with restriction of extraocular muscles. He subsequently underwent emergent right orbital decompression. Intraoperative findings included fibrinous debris within the sinuses and dehiscence of the lamina with exposed periorbita. Intraoperative periorbital frozen section biopsies were consistent with Mucormycosis. He was then taken for an endoscopic-assisted orbital exenteration. Repeat debridement of the skull base was necessary. Shortly after, he suffered a significant cerebrovascular event resulting in declining neurological status. He was eventually discharged to hospice care.

Conclusion:
All clinicians should maintain a high index of suspicion for IFS especially in those with an immunocompromised condition given the rapidly progressive and poor prognosis of the condition. Endoscopic exams may be unreliable in the context of recent sinus surgery, and in such scenarios, clinical suspicion should be high.

#D060
Itraconazole in Refractory Chronic Rhinosinusitis with Nasal Polyposis: A Retrospective Review
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Introduction:
Chronic rhinosinusitis with nasal polyposis (CRSwNP) is an inflammatory disease with a multifactorial etiology. While bacteria are often offending pathogens, fungal colonization may also be seen and contribute to disease burden. Itraconazole, an antifungal agent with both antiangiogenic and steroid potentiating properties, has been prescribed at our institution for refractory CRSwNP patients. This study reviews the effect on this subset of patients.

Methods:
A retrospective review of CRSwNP patients refractory to other treatment regimens prescribed itraconazole from 2010 through present was performed. Patients were initially continued on maintenance steroid treatment, and oral steroids were tapered with medication response. Results from the 22-item Sino-Nasal Outcome Test (SNOT-22) were collected before and after treatment with itraconazole for all eligible patients. Longitudinal linear mixed effects modeling was used to examine SNOT-22 scores over time.

Results:
From 2010 until present, a total of 21 patients with CRS were treated with itraconazole. A significant decrease in total SNOT-22 scores following treatment was found ($p= 0.024$), with an average decrease of 16.4 points after approximately 6 months for those continued on treatment. Significant decreases were also seen in the SNOT-22 subdomains of rhinologic ($p = 0.006$) and extranasal rhinologic symptoms ($p = 0.002$). Furthermore, 43% of patients were completely weaned from baseline oral steroid use.

Conclusions:
In a subset of patients with refractory CRS who have failed other forms of medical and surgical management, itraconazole may be an additional treatment option for quality of life improvement and means of reducing oral steroid use.

POSTERS

#D061

Long-term Follow Up of Patients Undergoing 3 vs. 6 Weeks of Antibiotic Therapy for Chronic Rhinosinusitis

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Introduction:
Chronic Rhinosinusitis (CRS) patients generally receive a trial of "maximal medical therapy" prior to surgical intervention, which may differ significantly between otolaryngologists. A prior study from our institution randomized patients to 3 vs 6 weeks of maximal medical therapy and determined there was little difference in clinical outcome. In this follow up, we hypothesized that there would be little difference in long-term quality of life in patients treated with either 3 vs 6 weeks of antibiotics.

Methods:
In this IRB approved retrospective study, patients enrolled in the initial study were contacted for verbal consent to be included in this follow-up study. All initial patients charts were reviewed to determine if they underwent surgery and to determine RSDI scores at various time-points post treatment. Patients were contacted by telephone to undergo an additional "long term" RSDI.

Results:
There was no association found between weeks of antibiotics taken and surgery recommendation or surgery received, Fisher's exact= 1.00 and 0.185 respectively. There was a mean follow up of 44 months and the mean RSDI total (higher means worse quality of life) at the most recent follow up for patients who had undergone 3 weeks of antibiotics was 28.2 [10.5, 45.8] and those who had undergone 6 weeks of antibiotics was 8.5 [4.7, 21.8] (P=.21).

Conclusions:
Increased duration of antibiotic treatment can lead to more serious side effects. In our comparison, there were no statistically significant differences in long-term quality of life outcomes in patients treated with 3 vs. 6 weeks of antibiotics.

#D062

Lower Scores on Preoperative Snot-22 Evaluation Does not Necessarily Imply Lack of Benefit from Endoscopic Sinus Surgery

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Objectives:
There is literature to suggest that endoscopic sinus surgery (ESS) is not beneficial for patients with chronic rhinosinusitis and a sinonasal outcome test-22 (SNOT-22) score less than 20. The objective of this study was to further evaluate the effectiveness of ESS in reducing symptoms in this selected group of patients.

Methods:
Retrospective analysis of 501 patients. SNOT-22 and endoscopic scores were recorded at preoperative and postoperative evaluations. Patients with preoperative SNOT-22 scores less than 20 were analyzed separately. A one-way ANOVA was performed on the absolute and percent reduction in SNOT-22 score at a significance level of 0.05.

Results:
For patients with a preoperative SNOT-22 score less than 20, the mean was 14.7. The score improved to 9.13 (37.8% reduction) at 3 weeks and 6.8 (51.9% reduction) at 6 weeks. The mean score rebounded to 12.7 at 2 years postoperatively. For patients with a preoperative SNOT-22 score greater than 20, the mean was 46.4 and improved to 23.3 at 3 weeks (48% reduction), and 21.8 at 6 weeks (51.6% reduction).

Conclusion:
Our results support that surgery may be beneficial because of the comparable reduction in SNOT-22 scores in patients with a preoperative SNOT-22 score less than 20 and greater than 20, 51.8% and 51.6%, respectively, at 6 weeks post operatively. The decision to operate should be based on the clinical picture as a whole, taking into consideration the relative progression of symptoms as well as physical exam findings.

#D063

Malignancies as a Surprising Result of FESS in an Italian Tertiary Care Center

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We analyzed the case histories of 530 consecutive Functional Endoscopic Sinus Surgery performed at our institution for chronic rhinosinusitis and found a multiform variety of unexpected aggressive benign/malignant disease as a result of standard histologic examination, starting from various locations in the naso-sinusal area. Definitive histology consisted of 45 inverted papillomas, 3 NH lymphomas, 1 minor salivary carcinoma, 2 ethmoid adenocarcinoma, 8 polyps from inclusion of amorphous material, 7 mycetomas. The analysis showed an origin prevalence of the inverted papillomas in the maxillary sinuses, while the distribution of the remaining neoplastic disease is uneven. Patients age was between 20 and 84 years. Prior to surgery all patients underwent CT scan of paranasal sinuses and MR in suspected cases: despite that, in some cases where CT was not particularly engaged the histological result was not consistent. Therapy was obviously wide different depending on the histology: hadron therapy, chemotherapy, peace meal endoscopic resection followed by radiation therapy, reoperation in case of uncomplete resection/recurrence of the inverted papilloma. While usually woodworkers are at high risk for sinonasal carcinoma, in the 2 cases in this serie we didn't find any correlation with this risk factor. All patients are alive without disease with a mean follow-up of 4 years except 1 case of lymphoma and 1 case of nasal carcinoma which are died. We can therefore confirm the importance of histologic examination in all cases presenting with also marginal, undefinite suspect clinical/radiological signs to avoid dangerous risk of misdiagnosis and uncorrect treatment.

#D064

Management of Epistaxis in Patients with Ventricular Assist Device

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Introduction/Objectives:
Patients with a ventricular assist device (VAD) are at risk for epistaxis due to anticoagulation requirements. In addition, these patients can develop acquired von Willebrand disease (vWD) secondary to device placement. Management is complicated by the high risk of thrombotic events if anticoagulation is reversed. This study sought to characterize the clinical features and management of epistaxis in this high-risk patient population.

Methods:
Retrospective review of 49 patients at a tertiary care hospital. Adults with VAD and epistaxis necessitating consultation with the otolaryngology service were included.

Results:
A supratherapeutic INR (> 2.0) was present in only 18 patients (36.7%). However, all patients had a diagnosis of acquired vWD. Anticoagulation was held in 14 (28.6%) patients, though active correction was not performed. Multiple interventions were required in 16 (32.7%) patients. Spontaneous epistaxis was associated with multiple interventions (Chi-square = 5.345 P-value = 0.02). The use of nasal packing was associated with a lower likelihood of bleeding recurrence (Chi-square = 3.743 P-value = 0.05). Surgery or embolization was not required urgently for any patient. Endoscopy under general anesthesia was performed for one patient electively.

Conclusion:
Acquired von Willebrand disease, rather than a supratherapeutic INR, was the primary contributor to epistaxis in our patient cohort with VAD. While these patients are at high risk for recurrent spontaneous epistaxis, nonsurgical treatment without active correction of INR or vWD was largely successful. Otolaryngologists should suspect acquired vWD in patients who are at risk for this poorly-described disease entity.

POSTERS

#D065

Management of Odontogenic Cysts by Endonasal Endoscopic Techniques: A Systematic Review and Case Series

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Background:
Odontogenic cysts and tumors of the maxilla may be amendable to management by endonasal endoscopic techniques. This may reduce the morbidity associated with open procedures, and avoid difficult reconstruction. A systematic review was performed to evaluate the feasibility and outcomes of endoscopic techniques in the management of different odontogenic cysts, and is accompanied by a case series of our experience.

Methods:
Preferred Reporting Items for Systematic Reviews were used to identify English-language studies reporting the use of endoscopic techniques in the management of odontogenic cysts. Publications were evaluated for the technique used, histopathology, complications, recurrences, and follow-up period. A case series of patients undergoing treatment of odontogenic cysts by an endoscopic technique was assembled.

Results:
Systematic review identified 16 case reports or series describing the use of endoscopic techniques for the treatment of odontogenic cysts, including 46 total patients. Histopathologies encountered were radicular and dentigerous cysts, keratocystic odontogenic tumor, and odontogenic myxoma. There were no reported recurrences or complications for a mean follow up of 29 months. A case series of patients in our institution identified 8 patients with 1 recurrence at a mean follow-up of 9 months.

Conclusions:
Endonasal endoscopic resection of various odontogenic cysts has been described in the literature, and has been associated with effective treatment of these lesions for an average follow-up period of over 2 years. This has the potential to reduce morbidity associated with the resection of these lesions, although comparative studies would better define specific indications.

#D066

Management of Pediatric Chronic Rhinosinusitis: Comparisons of Practice Patterns Between the American Rhinologic Society and the American Society of Pediatric Otolaryngology

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Objective:
To compare treatment practices of American Rhinologic Society (ARS) members to those of American Society of Pediatric Otolaryngology (ASPO) members in the management of pediatric chronic rhinosinusitis (PCRS).

Methods:
A 25-item web-based survey on PCRS was electronically distributed to the ASPO membership twice in September-October 2016. These data were compared to previously published data from a parallel survey conducted among the ARS in March-April 2016.

Results:
The ASPO survey completion rate was 22% (115/521). For both ARS and ASPO respondents, the most common initial medical therapies were topical steroids (93% vs. 90%, p=0.49), saline irrigations (90% vs. 88%, p=0.68) and oral antibiotics (52% vs. 57%, p=0.51). ARS members more commonly obtained CT imaging prior to performing adenoidectomy (40% vs. 18%, p=0.001). Both ARS and ASPO respondents almost always performed adenoidectomy as part of initial surgical management (90% vs. 94%, p=0.34), with ARS members less commonly performing adenoidectomy alone (43% vs 70%, p<0.001). If initial surgical treatment were to fail, both ARS and ASPO members frequently performed ESS (85% vs. 88%, p=0.58). In patients with pansinusitis receiving ESS, the frequency of surgical treatment of the sphenoid (63% vs. 70%, p=0.36) and frontal (43% vs 50%, p=0.21) sinuses were similar between both groups.

Conclusions:
PCRS management is relatively similar between ARS and ASPO. However, ARS members are more likely to obtain CT prior to adenoidectomy and to concomitantly include additional procedures with adenoidectomy for initial surgical treatment. Both groups commonly perform ESS with similar surgical extent if prior surgical treatment fails.

#D067

Mapping and Comparing Fungal Microbiota in the Sinonasal Cavity of Healthy, Allergic Rhinitis, and CRS Subjects

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Background:
Despite the importance of fungi as disease mediators, the fungal communities (mycobiome) of the sinonasal cavity are not well understood. Here, we characterize the middle meatus (MM) and inferior-meatus (IM) mycobiota within and across healthy, allergic rhinitis (AR) and chronic rhinosinusitis (CRS) subjects.

Methods:
Subjects were prospectively classified into subgroups using standard clinical criteria. Endoscopically-guided swab samples were obtained from the MM and IM bilaterally, protecting MM swabs with sterile speculums. The fungal microbiome was elucidated by sequencing the ITS2 rRNA gene (Illumina MiSeq). QIIME and R statistical software were used for sequence and statistical analyses.

Results:
Patient-matched MM and IM samples were studied from 65 subjects (n=227 total specimens from 7 controls, 11 AR, 23 CRSwNP and 24 CRSsNP). 79 high-quality fungal OTUs were observed across all samples. Malassezia was the most commonly detected fungal genus, present in 88% of subjects at an average relative abundance of 64.9%, followed by Candida, Alternaria, and Sporobolomyces. Although Shannon diversity of fungal communities were elevated in CRS, this did not reach significance (p=0.10; nonparametric t-test). Canberra distances were calculated to compare inter- and intra-individual diversity. Fungal communities were significantly more similar within subjects than between subjects (p=0.001, nonparametric t-test).

Conclusions:
We assessed intra- and inter-individual fungal diversity in a large cohort of CRS, healthy, and allergic rhinitis patients. Fungal communities were subject-specific and were characterized by abundant Malassezia, confirming previous findings in smaller patient cohorts. Future work will aim to elucidate the role of the mycobiome in CRS pathogenesis.

#D068

Morphometric Analysis of Pyriform Aperture Width and its Correlation with Age, Sex, Race, BMI and Post-operative Nasal Obstruction Score

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Introduction:
There are marked variations in the facial skeleton between people of different age, sex, race, and BMI. Limited information on pyriform aperture (PA) width is available in the adult literature. The purpose of this study is to examine the correlation between PA width and age, sex, race, BMI as well as post-operative nasal obstruction score (PNOS).

Methods:
We performed a retrospective review of 447 patients between 2010 and 2016 from a single institution. Demographic information, pre-operative diagnosis, surgical details and PNOS from SNOT-22 or NOSE surveys were gathered. PA width was measured through Vitrea Enterprise Suite system (V 6.7.3) by generating triplanar reformats of pre-operative sinus CT scans. Analysis was performed through univariate linear regression.

Results:
A significant correlation between age, sex, race and PA width was found ($p < 0.001$). Male patients on average have a wider PA than female and Caucasians have the smallest PA. With each year increase in age, there is an increase of 0.025 mm in PA. With each unit increase in BMI, there is an increase of 0.061 mm in PA ($p = 0.002$). The mean PA width for patients with and without post-operative nasal obstruction is 24.27 and 24.52mm respectively. No significant correlation between PA width and PNOS was found (p=0. 427). A PA width calculator was created with our analysis.

Conclusion:
PA width was significantly correlated with sex, age, race and BMI. A prospective study with a larger cohort is required to analyze the association between PA width and PNOS.

POSTERS

#D069

Morphometric Analysis of the Orbital Process of the Palatine Bone and its Relationship to Endoscopic Orbital Apex Surgery

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Introduction:
Endoscopic approaches to the orbit improve the ability to directly access apical lesions while minimizing manipulation of normal structures. Inferomedial orbital access is limited by the orbital process of the palatine bone (OPPB) which prevents dissection and retraction in the inferolateral vector. The purpose of this study was to study the morphometric characteristics of the OPPB and quantify the benefit of complete resection to surgical access.

Methods:
Morphometric osteologic measurements of the OPPB were performed in 59 human skulls. A radius subtended by the OPPB was calculated in order to generate a hemispheric dissection corridor achievable by complete resection of the OPPB. Cadaveric and live surgical dissections were then performed on 15 orbits to develop discreet endoscopic surgical landmarks which could be used to both identify the OPPB and verify complete resection.

Results:
The mean(+/- SD) radius of the OPPB was 0.47+/-0.28 cm. Complete OPPB resection provided an additional 0.36 ± 0.42 cm3 of surgical exposure within the inferomedial apex. Relative to the Caucasian(n=27) skulls, the radii in the Asian(n=27) and African(n=5) skulls were significantly smaller($p<0.001$ and $p=0.02$, respectively).

Conclusions:
The OPPB significantly limits surgical access to the inferomedial orbital apex during endoscopic approaches. Complete surgical resection of the OPPB improves surgical exposure facilitating retraction of the inferior rectus muscle and circumferential dissection of lesions within this space. Knowledge of the morphology and clinical relevance of this structure provides an opportunity to improve surgical exposure for relevant pathology and optimize endoscopic surgical outcomes.

#D070

Mucosal Magnetic Resonance Characteristics in the Post-Tumour Sinonasal Cavity

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Introduction:
The current “gold-standard” imaging modality for inflammatory sinonasal pathology is Computerised Tomography (CT), however it exposes patients to high levels of ionising radiation and is poor at characterising soft tissue lesions. Magnetic Resonance Imaging (MRI) evaluation of sinonasal mucosal disease mitigates these concerns, and may allow the clinician to better quantify the disease burden. Thus, the diagnostic utility of MRI in assessing mucosal inflammation was examined.

Methods:
A cohort study was undertaken upon patients undergoing endoscopic tumour resection with no prior history of chronic rhinosinusitis. A modified Lund-MacKay Endoscopic Score (MLMES) and a Sino-Nasal Outcome Test-22 (SNOT-22) were measured 3 months post-operatively. These outcomes were correlated to MRI measures of mucosal thickness. Using a MLMES of 3 or greater to indicate the presence of mucosal inflammation, a receiver operating characteristic (ROC) curve analysis was conducted to determine the test characteristics of MRI detection of mucosal inflammation by quantifying mucosal thickness.

Results:
72 patients (58.1±17.8 years, 50% female) were assessed. MRI correlated with endoscopic evaluation ($r=0.731$, $p<0.001$) but not with SNOT-22 ($r=-0.015$, $p=0.901$). ROC curve analysis (AUC 0.678, 0.581–0.776 95% CI, $p<0.001$) defined 4mm of mucosal thickening as the optimal threshold for indicating mucosal inflammation on MRI, with a negative predictive value of 77.0% and a positive likelihood ratio of 2.69.

Conclusions:
MRI is a useful diagnostic indicator of post-surgical sinonasal mucosal inflammation. Mucosal thickening on MRI of less than 4mm is unlikely to represent mucosal inflammation.

#D071

Navigate 1: Eds-flu (exhalation Delivery System for Fluticasone) for Symptoms of Crswnp (Chronic Rhinosinusitis with Nasal Polyps)

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Introduction:
EDS-FLU uses a new intranasal delivery technology capable of greater posterior/superior deposition than standard nasal sprays, particularly to the ostiomeatal complex where sinus ostia drain and ventilate and where polyps typically originate.

Methods:
Randomized, 24-week (16 double-blind+8 open-label), placebo-controlled study. CRSwNP subjects (N=323, mean age=45.1, 94.5% prior intranasal steroids) with moderate-severe congestion were randomized to EDS-FLU 93mcg, 186mcg, or 372mcg or EDS-placebo, all BID. Subjects rated severity of all 4 defining symptoms of cd (nasal congestion/obstruction, rhinorrhea, facial pain/pressure, and hyposmia) daily in both AM and PM. Polyps were graded by nasoendoscopy using a standard polyp grading system.

Results:
EDS-FLU was significantly superior to placebo on both co-primary endpoints (AM congestion, polyp grade; $p<0.001$ vs placebo, all doses). EDS-FLU improved both instantaneous and reflective assessments (both AM and PM) of all 4 defining symptoms of CRS vs placebo ($p<0.05$) with 186mcg and 372mcg doses producing the most consistent response at week 4. The percentage of subjects with ?0.5-point improvement in AM instantaneous score for congestion/obstruction was highest with EDS-FLU 372mcg (83.8%, 73.5%, 70.3% for 372mcg, 186mcg, and 93mcg, respectively; $p<0.05$ vs placebo all comparisons). Notably, EDS-FLU 186mcg and 372mcg also significantly improved sense of smell, which is particularly difficult to treat ($p<0.05$, week 16). The incidence of adverse events was similar to conventional intranasal steroids in CRSwNP, with epistaxis being most common.

Conclusions:
EDS-FLU produces significant all-day improvement in all principal defining symptoms of CRSwNP, including loss of smell, in patients most of whom previously used conventional intranasal steroids.

#D072

Necrotizing Sinonasal Gangrene in a Patient with Intranasal Opioid Abuse

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Introduction:
Sinonasal complications from nasal inhalation of drugs range from septal perforation to osteocartilagenous necrosis. We report a case of gangrenous necrosis due to infection by Pseudomonas fluorescens, an unusual human pathogen, as a complication of intranasal opioid use.

Methods:
This case report was performed by chart review.

Results:
We present the case of a 24-year-old woman with long-standing intranasal drug use – including cocaine, heroin, and combined opioid-acetaminophen medications – who presented with several weeks of progressive right facial swelling, nasal obstruction, rhinorrhea, and ulceration of the right nasal vestibule. Exam was notable for right facial cellulitis, a large anterior septal perforation, and ulcerative erosion and diffuse inflammation of the right nasal sill, vestibule, and anterior nasal cavity. Computed tomography demonstrated opacification of the anterior nasal cavity and right facial cellulitis. She underwent endonasal debridement and biopsies and began broad-spectrum intravenous antibacterial and antifungal medications. Surgical pathology demonstrated inflammatory infiltrate with gangrenous necrosis and no fungal elements. Wound cultures grew Pseudomonas fluorescens, a gram-negative rod associated with catheter-related blood stream infections in immunocompromised patients. The patient improved on antibiotic therapy and was discharged to a drug rehabiltation facility.

Conclusion:
Chronic opioid use and opioid withdrawal have been shown to suppress immune function and increase susceptibility to opportunistic infections. This case demonstrates a severe gangrenous infection arising in the context of local trauma and immune suppression related to intranasal drug use.

POSTERS

#D073

Neurovascular Sequelae of Invasive Fungal Sinusitis

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Introduction:
Invasive fungal sinusitis (IFS) is an aggressive and deadly opportunistic infection occurring in the immunocompromised host. Neurologic complications include ophthalmoplegia, visual loss, and perifacial numbness as the infection spreads through neurovascular structures. Mycotic aneurysms and internal carotid artery stenosis resulting in strokes have been infrequently reported in the literature. A recent case of a mycotic aneurysm prompted a retrospective review of IFS cases.

Methods:
A retrospective review of pathologically confirmed cases of IFS since 1999 was conducted. Clinical courses were reviewed for neurologic sequelae including stroke and subarachnoid hemorrhage. If available, MRI and MRA were analyzed for evidence of carotid artery abnormalities and neurovascular events.

Results:
20 cases were identified from the pathology database. Two ischemic strokes were identified and confirmed with MRI. One of the stroke patients had stenosis of the proximal internal carotid artery. One patient was found to have a mycotic aneurysm of the ICA. One other patient was found to have a left cavernous sinus thrombosis with compression and encasement of the cavernous carotid artery. Three of these four patients died from direct complications of IFS.

Conclusions:
Invasive fungal sinusitis has the potential to create grave neurovascular complications in addition to the locally destructive effects in the paranasal sinuses. The rate of these neurologic sequelae may be higher than what is reported in the literature. Clinicians should consider MRI/MRA in the absence of neurologic findings to guide treatment. Consultation with neurosurgery and interventional neuroradiology is warranted in these cases given their grave prognosis.

#D074

New Insights into Predictors of Survival for Sinonasal Melanoma

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Introduction:
Sinonasal melanoma is a rare and aggressive malignancy. Previous population-based studies have examined predictors of survival. We expand on this analyze using the Surveillance, Epidemiology, and End Result (SEER) database to describe the incidence and independent determinants of survival of patients with sinonasal melanoma.

Methods:
The SEER registry was utilized to calculate survival trends for patients with sinonasal melanoma between 1973 and 2012. Patient data was then analyzed with respect to age, sex, race, histology, modified Kadish stage, grade, and treatment modalities (surgery and radiation therapy). Overall (OS) and disease-specific survival (DSS) were calculated.

Results:
935 cases of sinonasal melanoma were identified. Median OS and DSS were 22.1 and 25.5 months, respectively. Nearly half (49.3%) of patients presented with Kadish stage C or D disease, with 42.6% presenting with T4 disease. 25% of patients presented with distant metastases. The prevalence of nodal metastases was 7.8%, with levels I and II metastases being most common (each 3.5%). On multivariate analysis, non-nasal cavity primary site and advanced Kadish stage were associated with worse OS and DSS (all $p<0.001$). Surgery (both $p<0.001$), but not radiation ($p=0.44$ and 0.99), was associated with improved OS and DSS.

Conclusions:
Sinonasal melanoma portends a dismal prognosis. Surgery, but not radiation therapy, appears to improve survival significantly, though a large proportion of patients will develop distant metastases. Given the low prevalence of nodal metastases, no recommendations could be made about elective treatment of the neck. Likely many sinonasal malignancies, advanced Kadish stage is a negative prognosticator.

#D075
Non-intestinal Type Sinonasal Adenocarcinoma: A Case Report and Review of the Literature
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Introduction:
Sinonasal adenocarcinomas are rare malignant neoplasms encountered in the head and neck. The World Health Organization (WHO) has subdivided sinonasal adenocarcinomas into salivary and non-salivary types, with the latter further divided into intestinal and non-intestinal types. Non-intestinal type sinonasal adenocarcinomas are rare and infrequently reported in the literature.

Methods:
A case is reported of a 48 year old female with a right sided hypervascular and polypoid mass. Operative intervention was undertaken with a final diagnosis of a non-intestinal type sinonasal adenocarcinoma. A comprehensive literature review was performed to evaluate other reported cases, associated histology, and management options.

Results:
Most adenocarcinomas encountered in the sinonasal cavity can be categorized under non-salivary, intestinal type adenocarcinomas resulting from intestinal metaplasia. Non-intestinal type sinonasal adenocarcinomas have marked heterogeneity in their histologic appearance, making this essentially a diagnosis of exclusion based on the recent WHO criteria. Immunohistochemistry (IHC) may also play an important diagnostic role. Our patient's IHC staining profile was positive for CK7 but negative for CK20 and CDX2, which is the opposite of an intestinal type IHC profile. Grading may be different based on the number of mitoses or presence of necrosis. The limited data suggest that low grade tumors can be treated with excision alone whereas high grade tumors may require adjuvant radiation.

Conclusions:
Non-intestinal type adenocarcinomas are histologically distinct from other sinonasal adenocarcinomas. However, current treatment remains the same with surgery being the gold standard and adjuvant radiation offered in cases of high grade tumors.

#D076
Nose and Tongue: Bitter Taste Receptor mRNA Expression in Nasal and Fungiform Papillae Biopsy
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Introduction:
The bitter taste receptor gene TAS2R38 responds to the bitter ligand phenylthiocarbamide (PTC). However, nasal ciliated cells of the nose also express this gene where it has a role in innate immunity. There are two common forms of the TAS2R38 gene and inborn genotype accounts for the ability of some people to taste PTC at millimolar concentrations (three variant sites, haplotype =PAV) whereas others are insensitive at much higher concentrations (haplotype=AVI). We wondered whether TAS2R38 mRNA abundance was similar between the two tissues, whether those with higher mRNA expression in taste tissue also had higher expression in nasal tissue.

Methods:
We biopsied two tissues from 28 surgical patients (fungiform taste papillae and nasal epithelium). Overall, mRNA expression was evaluated for a housekeeping gene (GAPDH), and cell-type specific markers (GNAT and CFTR) as well as three allele-specific variants of TAS2R38.

Results:
RNA quality from fungiform papillae was significantly higher than from nasal epithelium [p=0.0000424; RIN 6.3 vs. 2.2 on average]. Despite lower RNA quality, 21 of 28 samples had detectable levels of nasal epithelium cell-specific mRNA (CFTR); and 14 of 28 of fungiform taste papillae had detectable amounts of cell-specific mRNA (GNAT3). We detected TAS2R38 mRNA in over half of the nasal and taste tissue samples, although there was variation among the three variant sites.

Conclusions:
Taste and nasal tissue yielded RNA of sufficient quality to measure the abundance of cell-specific markers and allele-specific TAS2R38 expression.

POSTERS

#D077

Nose Blowing After Sinus Surgery Does not Adversely Affect Outcomes

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Introduction:
Patients are frequently advised to abstain from nose blowing following endoscopic sinus surgery (ESS), despite a lack of evidence for its benefit. This randomized study assessed whether postoperative nose blowing affected outcomes.

Methods:
40 patients who underwent ESS were randomized to either an interventional arm and blew their nose at least twice-daily for the first 7 postoperative days, or a control group and refrained from nose blowing. All patients were allowed to blow their nose after 7 days. At 1 and 4 weeks postoperatively, Nasal Obstruction Symptom Evaluation (NOSE) and Sino-nasal Outcome Tests (SNOT-22) were collected, and endoscopies were recorded for blinded Lund-Kennedy scoring. Epistaxis requiring medical attention was also documented.

Results:
Both groups were similar in terms of age, gender, prior ESS, and nasal polyposis. Baseline NOSE and SNOT-22 scores were also similar (p=0.48 and p=0.23, respectively). Postoperatively, there were no differences in the median improvement in symptom scores at 1 week (NOSE: -40 in the interventional group vs. -20 in the control group, p=0.5281; SNOT-22: -17 vs. -18, p=0.8898); and at 4 weeks (NOSE: -50 vs. -35, p=0.2571; SNOT-22: -22 vs. -28.5, p=0.2751). Lund-Kennedy scores were statistically similar (p=0.2340). No bleeding events were noted in either group after 1 week; one episode of epistaxis in the interventional arm required medical attention at postoperative week 3.

Conclusions:
Refraining from nose blowing after routine ESS does not appear to confer significant patient benefit. Judicious nose blowing may be feasible in the absence of orbital or skull base injury.

#D078

Optimization of Intranasal Drug Deposition in Postoperative Sinuses of Patients with Chronic Rhinosinusitis

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Introduction:
Optimizing distribution of topical corticosteroid to the postoperative sinus cavity may improve outcomes by reducing persistent or recurrent mucosal inflammation. QVAR® is a pressurised metered dose inhaler known to produce smaller particles compared to nasal sprays. This study aims to compare simulated deposition characteristics of a standard pump device and the QVAR® asthma inhaler.

Methods:
A virtual three-dimensional model was created from a CT scan of a patient with CRS following comprehensive sinus surgery. Computational fluid dynamics (CFD) were used to simulate the release of spray particles from a standard pump nasal spray and QVAR®. A custom nose-piece was created for the QVAR® inhaler. The effect of changes in particle size, speed and inhalational flow rate were also investigated. A cast model of the sinuses was constructed using three-dimensional printing and drug deposition was compared to CFD results using high performance liquid chromatography.

Results:
Greater maxillary sinus deposition was seen with the smaller particle sizes from QVAR®, although smaller particles were also associated with higher nasopharyngeal loss. Maxillary sinus deposition for QVAR® was up to twice that of standard pumps. This result was replicated in the 3D cast model. Greatest sinus deposition (13.4%) was achieved when particles were intrinsically slower (5 m/s) smaller (20 µm) at higher rates of inhalation (15 L/min).

Conclusions:
Smaller particles from QVAR® may allow greater sinus deposition while keeping the convenience of standard pumps. Deposition performance of a device could be optimized by changing its deposition characteristics.

#D079

Optimizing Cell Harvest from Nasal Brushings for Determining Local Allergy Responses

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Background:
Rhinitis is often a benign and highly common conditions that passes unnoticed and heavily misdiagnosed. With with allergic and non-allergic pathophysiologies, it can be a benign irritation. Highly effective, reproducible, accurate and affordable non-invasive tests need to be performed with minimal discomfort to the patient. The aims of this research was to identify the efficiency and efficacy of various brushes in order to determine their ability to identify nasal rhinitis.

Methods:
Strict nasal swabs were taken with three brushes (cytology brush, dental brush and a Rhinoprobe) under local anaesthesia to then be washed with phosphate buffer solution and suspended cells sonicated. Half the samples were centrifuged. Protein content was assessed by BCA assay and measured using a Nanodrop machine.

Results:
With means for the cytology brush (0.751mg/mL 0.449mg/mL), dental brush (0.430mg/mL 0.284mg/mL) and Rhinoprobe (0.071mg/mL 0.55mg/mL), a significant difference in levels of collected protein between all of the brushes was found at $p < 0.001$. No significant difference between allergic patients (0.820mg/mL 0.487mg/mL) and non-allergic patients (0.738mg/mL 0.454mg/mL) in the cytology brush sample was found. There was no significant difference between sample centrifugation (0.771mg/mL .464mg/mL) and not centrifuging (0.783mg/mL .453mg/mL) on the total protein levels.

Conclusion:
The cytology brush was the optimal tool for protein collection. Further studies are underway to assess IgE concentration within the total protein content and determine whether it can directly diagnose rhinitis. Total protein content in the nasal mucosa did not significantly show differences between allergic and non-allergic patients.

#D080

Orbital Apex Syndrome Following Expanded Endonasal Resection of Infrasellar Craniopharyngioma

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Introduction:
Craniopharyngiomas account for roughly 2-4% of all brain tumors, with the majority in children. Most craniopharyngiomas are suprasellar, with infrasellar origin being extremely rare. An expanded endonasal approach (EEA) provides direct access for surgical resection. While there are known complications from the approach, orbital apex syndrome secondary to nasal packing has not been reported.

Methods:
Case Report and literature review

Results:
A 7-year-old boy presented with a three-month history of left retroorbital pain and decreased visual acuity. On imaging he was found to have a large sphenoid mass causing sellar compression and extensive erosion of the clivus, anterior cranial base, and medial orbital apex. The patient underwent an EEA with nasoseptal flap reconstruction for a gross total tumor resection. Bilateral merocel packing was placed and the patient remained intubated postoperatively. Following extubation on postoperative day one, the patient immediately reported worsened vision. An ophthalmologic exam showed a left afferent pupillary defect, bilateral sixth and left partial third & fourth cranial nerve palsies and decreased visual acuity consistent with orbital apex syndrome. He was urgently taken back for exploration and packing removal with rapid resolution of postoperative deficits. A literature review found multiple complications secondary to nasal packing, but orbital apex syndrome is a unique and rare complication.

Conclusion:
Postoperative nasal packing is routinely used for many roles, and while there are many complications that we characteristically associate with them, orbital apex syndrome and ocular changes should remain on our differential.

POSTERS

#D081
Orbital Subperiosteal Hematoma, a Rare Complication of Pediatric Acute Rhinosinusitis
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Acute rhinosinusitis (ARS) is known to be associated with orbital complications ranging from orbital cellulitis to abscess. These complications can be severe and may lead to blindness, cavernous sinus thrombosis, and rarely death. Literature has shown that immediate surgical intervention may not always be necessary when managing subperiosteal abscess. Orbital complications of ARS are common in children but orbital subperiosteal hematoma (SH) is exceedingly rare. Literature review reveals 13 cases of orbital SH, only 2 of which were in children. Typically, immediate surgical intervention is required due to rapid progression and severe onset. Here we review the literature for previous cases of orbital SH to identify symptoms that might predict this process. We also share the presentation and management of a case of rapidly progressing SH in a 7-year-old female. These patients present with sudden onset orbital swelling and orbital symptoms with few signs of systemic illness. The symptoms progress more rapidly and severe than other orbital complications of ARS. In our case, the patient presented with decreased extra ocular movement, increased orbital pressure, and decreased visual acuity. Surgically, both endoscopic and external approaches have been described. We chose a combined approach due laterality of the SH and desire to clear the causative sinus disease. Nearly all patients reported, including ours, experience complete resolution of ocular symptoms with expedient surgical intervention. Although rare, a high index of suspicion should be maintained for SH and if suspected, surgery should be first line due to rapid progression and severity of symptoms.

#D082
Outcomes and Algorithms for Contemporary, Endotype- Directed Therapy for Chronic Rhinosinusitis
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Background & Objectives:
Contemporary understanding of Chronic Rhinosinusitis (CRS) has expanded beyond simple phenotyping based on the presence (CRSwNP) or absence (CRSsNP) of nasal polyps. Revision surgery rate reported following endoscopic sinus surgery (ESS) is 10-20%. Our practice utilizes an individualized endotype-based approach to CRS patients, using paradigms evolving with regular literature review. This study reviews our results from ESS for CRS to evaluate the benefit of such approach.

Methods:
Retrospective review of CRS patients undergoing ESS with a single surgeon (October 2010–2015).

Results:
Surgery was performed in 540adults. Of these, 225 (42%) had CRSwNP. For patients following-up, 18 (3%) required revision ESS (5 CRSwNP; 13 CRSsNP). All CRSwNP patients underwent revision surgery for polyp recurrence. In the 13 CRSsNP patients, revision ESS procedures performed included: mega-antrostomy for recalcitrant maxillary sinusitis (8); revision frontal sinusotomy with extended approaches for stenosing frontal ostia (6), sphenoid sinus drillout (4), and additional sinuses addressed for disease progression (2). For 82 patients who had surgery at least 5 years ago, revision ESS surgery was performed in four (5%). Mean follow-up for this group was 26.5 months. Algorithms for endotyping and treating recalcitrant CRS are presented.

Conclusions:
In CRS patients undergoing ESS, we report an overall revision ESS rate of 3%. Revision ESS with those who had surgery 5 years or earlier was 5%. While these rates are based on patients following-up, they are lower than currently reported rates. A clinical approach that adopts endotype directed therapy may reduce the need for revision ESS.

#D083

Outcomes of Endoscopic Septoplasty without the Use of Postoperative Packing or Splinting

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Introduction:
The use of intranasal packing and splinting following endoscopic septoplasty (ES) has been well documented in the literature. Outcomes of ES with without nasal packing or stent placement, however, remain incomplete. The aim of this study was to investigate the efficacy and complication profile of ES without the use of nasal packing or splints.

Methods:
Adult patients undergoing ES without intraoperative packing or splint placement were prospectively enrolled into this study. Exclusion criteria included the presence of a neoplasm, granulomatous disease, cystic fibrosis, and septal perforation. Patients were followed for 3 months for complications. Disease-specific quality of life was investigated with preoperative and 3-month postoperative SinoNasal Outome Test (SNOT-22).

Results:
135 patients met inclusion criteria and underwent ES without intraoperative nasal packing or splint placement. The rate of complications was exceedingly minimal, with 1 (0.7%) case of intranasal synechiae requiring excision, 1 (0.7%) case of postoperative epistaxis requiring packing. Two patients (1.4%) had postoperative septal perforation while no patients had postoperative CSF leak or vision loss. The SNOT-22 score reduced from 34.9 to 15.9, and the nasal congestion subscore dropped from a mean of 2.8 to 1.5.

Conclusion:
Current evidence regarding the use of splints or nasal packing following endoscopic septoplasty remains incomplete. In the present study, we show that endoscopic septoplasty may be effectively and safely performed without the use of nasal packing or silicone stent placement, with a low rate of complications and improvement in disease-specific QOL.

#D084

Outcomes of the Endoscopic Modified Lothrop Procedure Following Failure of Primary Functional Endoscopic Sinus Surgery: A Meta-analysis

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Introduction:
The endoscopic modified Lothrop procedure (EMLP), also known as the Draf III procedure, has traditionally been used as a salvage technique for persistent frontal sinusitis in cases in which prior functional endoscopic sinus surgery (FESS) has failed. We aim to examine the safety and efficacy of the EMLP following failure of primary FESS.

Methods:
A search of all English publications from 2000 to 2016 regarding the use of EMLP after primary FESS was conducted. Fourteen studies met inclusion criteria. Data collected included surgical outcomes such as re-stenosis rates, quality-of-life scores, and complications. Data were analyzed using a random effects statistical model.

Results:
Nine hundred seventy nine patients were analyzed. The mean age was 49.9 years (range, 19-83). The majority of patients were male (46.4%); 37.6% were female, and the remaining 16% were unreported. The complication rate was 2.83%. Cerebrospinal fluid leak occurred in 1.95% of cases. Re-stenosis of the frontal sinus ostium, defined as less than 50% of baseline patency, occurred in 23.8% of cases. Re-stenosis resulting in the need for revision surgery occurred in 15.8% of cases. Thirty patients failed revision surgery and underwent osteoplastic frontal sinus obliteration. Of all patients who underwent EMLP, 85.4% reported a significant improvement in symptoms while the remainder of patients reported a worsening of symptoms or no improvement. The average length of follow-up was 19.9 months.

Conclusion:
The EMLP is a safe and effective salvage procedure for refractory frontal sinusitis following the failure of primary FESS when performed by an experienced surgeon.

POSTERS

#D085

Outfracture: Managing the Recalcitrant Turbinate in the Office Based Setting

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Introduction:
The field of Otolaryngology is transitioning more and more towards office based procedures. With this shift, the comfort and safely of the patient is paramount. Oral sedation with local anesthetic agents allow for safe and comfortable surgery in a vast array of procedures previously thought to require general anesthetic. Turbinate reduction and out-fracture is one of these. Still, a number of patients can be difficult to out-fracture comfortably in the awake patient due to the robustness of the underlying conchal bone leading to either an uncomfortable patient or more likely an inadequate out-fracture.

Methods:
With many surgeries now being done with balloon techniques, we have adopted this tool to simplify out-fracture allowing most all patients to be successfully done in the office setting. Our technique utilizes a balloon to produce an in-fracture, thus weakening the conchal bone first, simplifying the subsequent out-fracture.

Conclusions:
This newer application of a dilation balloon has allowed for a satisfactory, comfortable turbinate out-fracture in even the most refractory patients in the office based setting.

#D086

Perception of Empty Nose Syndrome and its Impact on Inferior Turbinate Management: Survey of Attendees of the American Rhinologic Society Meeting at AAO

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Background:
Empty Nose Syndrome (ENS) is a controversial disease entity whose basis is debated in the otolaryngology and rhinology communities. We hypothesized that personal biases regarding ENS may influence how aggressively or conservatively surgeons manage inferior turbinate hypertrophy (ITH).

Methods:
A 25-item survey was distributed to 525 otolaryngology registered physician attendees to the 2016 American Rhinologic Society meeting at AAO. Questions regarding ENS were placed at the end of the survey to minimize chances of response bias regarding ITH management asked at survey outset.

Results:
Ninety-nine physicians (18.8%) completed the survey. Results were dichotomized into 2 cohorts: Believers in ENS (57.6%, ENS-Yes), and skeptics (33.3%) plus non-believers (8.1%) in ENS (ENS-No). 56.1% of ENS-Yes were academic surgeons, while 51.2% of ENS-No were private practice surgeons. 63.2% of those who completed rhinology fellowship were ENS-Yes, while 51.2% who had not were ENS-No. The diagnosis and medical management of ITH was similar between cohorts. In both groups, radiofrequency ablation was the preferred office procedure, while submucosal resection was the most common OR technique to treat ITH. Both groups also had equivalent respondents who performed complete turbinectomy; however, turbinate trim procedures were more common in the ENS-No (29.3%) than in ENS-Yes (17.5%).

Conclusion:
The ENS-Yes and ENS-No groups overlap in conservative management of ITH. This highlights a discordance between perceptions of ENS compared to the overall management of ITH among ENS-No respondents. This disconnect is potentially attributable to the post-surgical correlation with ENS and poor understanding of ENS symptoms and associated findings.

#D087

Polypoid Change of the Middle Turbinate and Paranasal Sinus Polyposis are Distinct Entities

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Edward McCoul, MD, MPH, FARS
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Background:
Polypoid change of the middle turbinate (PCMT) is a finding on intranasal examination whose significance is not well understood. We present a comparison of the clinical characteristics of PCMT with paranasal sinus polyposis (PSP), a common condition with potentially similar appearance.

Methods:
Parallel case series were prospectively compiled from consecutive patients presenting to a tertiary rhinology practice during an 11-month period with either PSP arising from the middle meatus or PCMT limited to the middle turbinate as identified on nasal endoscopy. Recorded data included comorbidities, the 22-Item Sinonasal Outcome Test (SNOT-22), Nasal Obstruction Symptom Evaluation (NOSE) score, Lund-Mackay score (LMS) from CT imaging, and total eosinophil levels.

Results:
There were 20 patients in the PCMT group and 41 patients in the PSP group. The PSP group was predominantly male (78% vs 45%, $p<0.0002$) with an older mean age (53.8 vs 35.3, $p<0.0001$). PCMT was highly associated with allergic rhinitis (95% vs 68%, $p<0.0001$), whereas PSP was universally associated with chronic rhinosinusitis (100% vs MT 10%, $p<0.0001$). Mean eosinophil count (6.94 vs 2.91, $p=0.085$) was not significantly different between groups, whereas mean LMS was higher in PSP (14.9 vs 2.4, $p<0.0001$). Mean NOSE score was greater in PSP (64.9 vs 42.9, $p=0.010$), whereas SNOT-22 score was comparable between groups (40.6 vs MT 32.9, $p=0.180$).

Conclusion:
PCMT is a unique physical finding with clinical associations that distinguish it from PSP. PCMT has a strong association with allergic rhinitis, and both PCMT and PSP are associated with impaired quality of life.

#D088

Posterior Inferior Turbinate Hypertrophy (PITH): A Role in Postnasal Drip

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Background:
Chronic posterior nasal discharge is a common presenting complaint in clinical practice. Although associated with sinusitis and rhinitis, the exact origin of postnasal drip remains obscure. Hypertrophy of the posterior soft tissue of the inferior turbinate (PITH) has been observed in some patients, though the clinical significance is unknown. We investigated the relationship of postnasal drip and PITH using clinical parameters.

Methods:
A case series was prospectively compiled from all patients having baseline nasal endoscopy between January 2016 and June 2016. Subjects reported the presence or absence of postnasal drip and completed 22-Item Sinonasal Outcome Test (SNOT-22) and Nasal Obstruction Symptom Evaluation (NOSE) questionnaires. Subjects electing turbinate reduction for the treatment of nasal obstruction were offered concurrent PITH resection. Surgical cases were evaluated at 3 months postoperatively with patient-reported measures.

Results:
PITH was identified in 62 of 354 subjects for a prevalence of 17.5%. Postnasal drip was self-reported in 59 (95.2%) cases and directly visualized as mucus flowing from the turbinate in 61 (98.4%) cases. Neither allergic rhinitis (50.0%), chronic sinusitis (24.2%) nor reflux disease (29.0%) were present in a majority of cases. Mean SNOT-22 score was 39.0 and NOSE score was 53.4. Twelve subjects underwent PITH resection, with significantly improved postoperative SNOT-22 (27.3, $p=0.020$) and NOSE (22.5, $p=0.002$) scores.

Conclusions:
PITH is a common entity that is highly associated with postnasal drip. Relationships with allergic rhinitis, sinusitis and reflux remain unclear. Surgical resection of PITH is associated with resolution of postnasal drip and improved patient-reported quality of life.

POSTERS

#D089

Post-transplant Lymphoproliferative Disorder Presenting as Retropharyngeal Abscess

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Introduction:
Post-transplantation lymphoproliferative disorder (PTLD) is a widely recognized complication of solid organ transplantation, arising in the context of the immunosuppression that allows long-term survival of transplanted organs. We report an unusual presentation of PTLD in a patient status-post lung transplantation.

Methods:
This case report was performed by chart review.

Results:
We present the case of a 26-year-old woman with a history of double lung transplantation for cystic fibrosis who developed throat pain and swelling after endoscopic sinus surgery. She was prescribed antibiotics for presumed tonsillitis and improved initially, but then developed nasal obstruction and snoring. Subsequent nasal endoscopy revealed nasopharyngeal swelling and mucopurulent drainage, and computed tomography revealed a rim-enhancing fluid collection in the retropharyngeal space extending from the nasopharynx into the oropharynx. She began broad-spectrum intravenous antibiotics and was taken urgently to the operating room for a presumed retropharyngeal abscess. Intraoperative examination revealed tissue necrosis, and surgical pathology demonstrated EBV-positive, monomorphic PTLD with a diffuse large B-cell lymphoma phenotype. Further workup revealed disease limited to the nasopharynx and oropharynx, and she was started expeditiously on a chemotherapeutic regimen, with complete response after 5 cycles of therapy.

Conclusion:
PTLD is thought to be clinically and histopathologically distinct from analogous blood cell neoplasms in immunocompetent patients, exhibiting more aggressive behavior and resistance to conventional therapies. Thus, the diagnosis should be carefully considered in transplanted patients with atypical symptoms or findings, as early recognition and treatment are critical in this vulnerable patient population.

#D090

Practice Patterns in Office-based Rhinology: Survey of the American Rhinologic Society

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Background:
Recent years have witnessed significant expansion in office-based rhinology. This study assesses the impact of office-based rhinologic procedures on the practice patterns of the American Rhinologic Society (ARS) membership.

Methods:
A 24-item survey vetted by the ARS Board of Directors was disseminated to the ARS membership from March 15th to May 31st, 2016.

Results:
157 physicians (11.9%) completed the survey. Office-based rhinologic procedures were performed by 99% of respondents, with sinonasal debridements (99%), polypectomy (77%), and balloon ostial dilation (56%) being the most common. During a typical month, the number of sinonasal debridements were 0-10 in 23%, 11-20 in 34%, 21-30 in 26%, and >30 in 18%. For polypectomy, 57% utilized a microdebrider (reusable electric-24%, disposable vacuum-powered-21%, both-12%), 36% endoscopic forceps, and 7% a combination of both. With respect to balloon ostial dilation, the frontal sinuses were the most frequently addressed (53%) followed by the maxillary (46%) and sphenoid (39%) sinuses. In-office ethmoidectomies, antrostomies, sphenoidotomies, and frontal sinusotomies without use of the balloon were performed by 35%, 31%, 24%, and 21% respectively. 30% used steroid-eluting sinus implants and 10% used computer-assisted surgical navigation in the office setting. Overall, 63% of respondents reported that the number of office-based rhinologic procedures they performed had increased over the last 5 years.

Conclusions:
The present study illustrates the widespread integration of office procedures into rhinologic clinical practice among survey respondents. With ongoing technologic innovations, the scope of office-based rhinology will likely continue to expand in the years to come.

#D091

Predictors of Unanticipated Admission within 30 Days of Outpatient Sinonasal Surgery

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Introduction:
The objective is to identify predictive factors of readmission after day-case rhinologic surgery. As ambulatory surgery accounts for an ever-increasing share of surgical procedures, advances in endonasal surgical techniques and anesthetic management allows to perform more complex surgeries on higher-risk patients in a day-case setting. Our goal is to better target those patients whose treatment would be suitable for outpatient surgery.

Methods:
A 2-year retrospective chart review of patients scheduled for ambulatory sinonasal surgery under general anesthesia in a tertiary medical center was conducted. The operating room and the anesthetic files were screened to identify comorbidities, types of procedure and post-operative complications. The primary outcome of interest was unanticipated admission within 30 days of surgery.

Results:
From January 2014 to January 2016, 924 outpatient sinonasal procedures were performed. Functional endoscopic sinus surgery (FESS) with or without ethmoidectomy accounted for 53% of the cases. The overall readmission rate within the 30-postoperative days was 5.1% (2.9% for immediate hospitalization, 2.2% for unplanned post procedure visit to the hospital emergency room within 30 days of discharge) and was mainly due to bleeding (30%). Age above 50 years old, surgical duration of more than 80 minutes, endoscopic sinus surgery procedures and postoperative nasal packing were identified as significative negative predictive factors of readmission.

Conclusion:
Sinonasal surgery and FESS are safe when performed as outpatient procedures, with only few complications. Careful scheduling of those higher-risk patients undergoing sinonasal surgery and appropriate postoperative observation should be implemented to improve healthcare quality in an outpatient setting.

#D092

Prevalence and Burden of Rhinitis Medicamentosa in a Tertiary Rhinology Setting

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Introduction:
Rhinitis Medicamentosa (RM) is an iatrogenic disease caused by rebound engorgement of the nasal mucosa after prolonged/over-use of nasal decongestants. Little has been published regarding its prevalence or severity. The purpose of this study is to compare RM patients' symptom scores and presentations to those of a control group.

Design:
Case control study.

Methods: A prospectively-gathered database of symptom surveys and exam findings pertaining to all patient visits in our institution's rhinology practice was queried for cases of RM. Patients with RM and septal deviation (SD) were compared to controls with SD alone. Patients with other causes of nasal obstruction were excluded.

Results:
Among 3,366 unique patients, 63 were diagnosed with RM, an incidence of 1.9%. 15 patients with RM and SD were compared to 30 controls with SD. RM presented with similar overall symptom (p=0.77) and nasal obstruction severity, (p=0.86) SD type (p=0.70) and SD severity (p=0.65), but were significantly older (61.35 vs. 39.37, p=0.01) and less likely to undergo surgery (1/15 vs. 11/30, p=0.038).

Conclusion:
RM is uncommon, but has increasing prevalence with age. SD severity and type was similar between those with and without RM, but surgery is uncommon after resolution of RM. It is prudent to complete treatment for RM prior to discussing surgery for additional diseases or symptoms that afflict these patients. Investigation into the clinical course of RM is complex, given that decongestants are used to alleviate symptoms from another pre-existing source, whether it is transient or chronic in nature.

POSTERS

#D093

Prevalence of Frontal Cells According to the International Frontal Sinus Anatomy Classification (IFAC)

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Introduction:
The International Frontal Sinus Anatomy Classification (IFAC) is a recently published consensus document that has updated the nomenclature of cells in the frontal recess and frontal sinus. Although the prevalence of frontal cells by prior classifications has been well described, normative data regarding prevalence of IFAC frontal cells has not been characterized. The current study was undertaken to describe the radiologic prevalence of IFAC frontal cells in patients without sinusitis.

Methods:
Three independent reviewers examined maxillofacial CT scans using a tri-planar viewing program to characterize the cells of the frontal recess according to IFAC criteria. CT scans were excluded for sinus opacification, previous sinus surgery, sequelae of maxillofacial trauma/congenital defect, or slice thickness >2mm. Inter-rater reliability was measured. In cases of discordant interpretation, cases were re-reviewed by the panel to achieve consensus.

Results:
Fifty CT scans (100 sides) were examined. Of the 100 sides examined, 94% contained an agger nasi cell, 32% contained a supra agger cell, 15% contained a supra agger frontal cell, 67% contained a supra bulla cell, 7% contained a supra bulla frontal cell, 37% contained a supraorbital ethmoid cell and 18% contained a frontal septal cell. The inter-rater reliability was 82%. Discordant interpretations were most common when differentiating cells that extended into the frontal sinus.

Conclusions:
The IFAC nomenclature allows description of frontal anatomy with high inter-rater reliability. Establishing the normative prevalence of frontal recess cells by IFAC criteria is a necessary step towards advancing future clinical research in diseases of the frontal sinus.

#D094

Prevention of Epistaxis and Preservation of Olfactory Function Utilizing Bilateral Mucosal Preserving Nasoseptal Rescue Flap Approach in Skull Base Surgery: Prospective Analysis and Update

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Background:
Adequate surgical exposure and preservation of normal sinonasal function remain competing goals in endoscopic skull base surgery. This prospective study attempts to ascertain if preservation of the septal olfactory strip and the posterior nasal artery vascular pedicle impacts the incidence of olfactory dysfunction and postoperative epistaxis.

Methods:
A prospective analysis was performed in patients who underwent endoscopic endonasal skull base surgery between February 1, 2012 and October 2016. Two groups were studied, pre and post operative olfactory outcomes in the first 110 patients and post operative epistaxis in 466 patients. Olfactory function preoperatively and postoperatively was evaluated using the Brief University of Pennsylvania Smell Identification Test (B-UPSIT).

Results:
In the olfactory group, 110 patients completed the pre- and postoperative B-UPSIT. Seventy-eight patients required extended approaches. Bilateral nasoseptal “rescue” flaps were elevated in 150 patients (94.5%) and 21 patients had nasoseptal or middle turbinate flaps. 9 patients were excluded due to abnormal preoperative olfactory function with preservation of normal function in eighty-six (86) patients, ten (10) patients with improvement of pre-operative abnormal function to normal function, 5 patients (5.0%) with mild hyposmia and no anosmia. No postoperative occurrences of major epistaxis were encountered in the 466 patients. 2 patients had minor unrelated epistaxis.

Conclusions:
Mucosal preserving bilateral rescue flaps with Septal olfactory strip (SOS) preservation is effective in preserving olfactory function and preventing major epistaxis while not hindering surgical exposure. It allows the possibility of harvesting the nasoseptal flap in the future by preserving the posterior nasal septal pedicle bilaterally.

#D095

Primary Ciliary Dyskinesia: Management of Chronic Rhinosinusitis in the Adult Population

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Background:
Primary ciliary dyskinesia (PCD) may be an underlying factor in some cases of refractory chronic rhinosinusitis (CRS). However, clinical management of this condition is not well defined. This review examines the available evidence for the diagnosis and management of CRS in adults with PCD.

Methods:
Systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Pubmed, EMBASE, and Cochrane database were queried for studies pertinent to treatment of PCD in adults. Two investigators performed eligibility assessment for inclusion or exclusion in a standardized manner.

Results:
Of the 278 articles identified, 5 observational studies met the criteria for analysis. The level of evidence of those studies was low. Medical therapy included oral antibiotics and nasal saline rinses. Endoscopic sinus surgery (ESS) was described in 2 of 5 studies. Outcomes measures were limited and included non-validated questionnaire, subjective report of CRS symptoms, and decreased preciptins against pseudomonas following ESS. Recommendation for a standardized therapeutic strategies was not possible.

Conclusion:
A paucity of evidence is available to guide the treatment of PCD in the adult population. Prospective studies are needed to determine the optimal diagnostic and management strategy for this condition.

#D096

Probiotic Sinus Irrigations Side Effects in Patients with Refractory Chronic Rhinosinusitis

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Introduction:
Refractory chronic rhinosinusitis (RCRS) affects 450,000 Americans despite endoscopic sinus surgery and maximal medical therapy. One of the prevailing hypothesis for the underlying cause is an altered microbiome with a higher proportion of pathogenic bacteria and a reduction in protective bacteria. Although probiotics confer many health benefits in the GI tract, their use and safety in the sinuses through repeated irrigations has not been thoroughly investigated.

Methods:
Select patients seen at an academic rhinology clinic with RCRS and an appropriate comfort level of performing saline irrigations were given probiotic sinus irrigations and followed regularly. A retrospective case series was conducted of patients from June 2013 to September 2016 who used probiotic sinus irrigations and safety and side effects were assessed. Patients were instructed to irrigate their sinuses twice a day with 8 ounces of a probiotic (lactobacillus) saline mixture over 2 weeks.

Results:
A total of 30 patients were included in our case series with a mean age of 57 and an average follow up time of 290 days. 0% of patients reported any major complications including intracranial or orbital infections. 0% patients reported any minor complications including epistaxis, anosmia, or allergic reactions. No patient reported being unable to tolerate the irrigations.

Conclusion:
In this pilot study, no significant side effects were noted by patients with RCRS utilizing probiotic sinus irrigations. Their efficacy in improving disease severity and symptoms for patients with RCRS needs to be further investigated.

POSTERS

#D097

Quality and Readability of Online Rhinology Information by Internet Source

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Background:
The NIH and AMA recommend patient resources be written between the 3rd and 7th grade reading levels. We measured the readability and assessed the quality of consumer-oriented rhinology literature utilizing validated instruments.

Methods:
Internet searches were performed on five American Rhinologic Society patient education topics: endoscopic sinus surgery, septoplasty, functional rhinoplasty, adult sinusitis, and allergic rhinitis. Search results were classified by source category: Professional Society, Health Reference, US Hospital, Clinical Practice, and Commercial Entity. Articles were scored with five common readability scores. Three reviewers scored all articles using the DISCERN tool.

Results:
Across 244 articles analyzed, all average readability scores were above the tenth grade level. The Gunning Fog readability scores revealed some topics were significantly more difficult to read (e.g. Functional Rhinoplasty [14.4 ± 1.89] vs. allergic rhinitis [12.6 ± 2.94] or adult sinusitis [12.6 ± 2.94] $p < 0.05$.) Overall quality of information was similar between different sources, but specific components of the DISCERN quality scale demonstrated differences. “Explanation of how treatments work” was higher in US Hospital information, than that from clinical practices 3.39 ± 1.06 vs 2.25 ± 1.11, $p < 0.05$. “Impact of no treatment” was higher in Health Reference than US Hospital information 2.05 ± 1.09 vs 1.48 ± 0.98, $p < 0.05$.

Conclusion:
Consumer information on rhinologic disease and treatment continues to be published above the recommended reading level for health consumers. A difference in literature quality exists depending on the source.

#D098

Radiologic Phenotype of Chronic Rhinosinusitis with Atopic Predisposition

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Introduction:
The relationship between chronic rhinosinusitis(CRS) and atopy is controversial. Extensive polypoid oedema of the middle turbinate can be seen in atopic patients. When this extends, a limited and ‘central’ sinus disease is often present. The ‘central compartment atopic sinus disease(CCAD)’ with characteristic radiological features has been described by DelGaudio and colleagues. The validity of this CCAD among patients diagnosed with CRS as predisposing phenotype with atopic comorbidity is assessed.

Methods:
A case control study of patients diagnosed with CRS without prior surgery was assessed. Consecutive patients with allergy status and computed tomography(CT) scans were included. Patients with fungal ball, barosinusitis, or odontogenic sinusitis were excluded. All patients had at least diseased ethmoid mucosa. Allergy status was defined by serum or epicutaneous assessment. A blinded observer graded each sinus as either normal, roof or lateral wall sparing, diffuse mucosal thickening or complete opacification. The diagnostic characteristics of a radiological phenotype was determined.

Results:
106 patients representing 212 paranasal-sinus cavities were assessed (age 46.2±14.3yrs, 36.9% female, 41.5% asthma, 50.9% atopic). Several “central compartment” phenotypes predicted allergy status. The CCAD was best defined as diseased ethmoid AND normal or ‘spared’ frontal and sphenoid sinuses AND any maxillary sinus involvement except complete opacification. This phenotype predicted atopy (60% v 43%, $p=0.02$) with 72.2% specificity, 60.4% PPV and LR+ of 2.03.

Conclusion:
A central pattern of disease or CCAD radiologically is associated with atopy. Underlying allergic inflammation and associated immunotherapy may be more appropriate in this group of CRS patients.

#D099
Recurrent Nasal Polyposis in Cystic Fibrosis Treated with Propel Implants: A Case Report
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Introduction:
The prevalence of polypoid chronic rhinosinusitis (CRS) in cystic fibrosis (CF) patients increases with age. Prevalence in children less than 6-years-old is 18% increasing to 45% in adolescents between 13 and 18-years-old. After failure of maximal medical management, standard treatment for recurrent nasal polyposis (NP) in CF patients is periodic functional endoscopic sinus surgery (FESS) followed by saline irrigations and topical intranasal corticosteroids. We present the first reported case using Propel Implants, a mometasone-eluting biodegradable spring-like implant, to successfully treat recurrent NP in a CF patient previously refractory to surgical and medical therapy.

Methods:
We present the case of a 15-year-old boy with CF manifesting with recurrent NP since the age of three, including six sinus surgeries when his pulmonary function tests (PFT) and CRS became refractory to medical management.

Results:
In the two years since surgery, this patient has required neither hospitalization nor bronchoscopy, while maintaining stable PFTs and showing no signs of nasal polyp regrowth.

Conclusions:
While the histopathology of NP in patients with and without CF differs, topical corticosteroids have been shown to be effective in treating and retarding regrowth of NP in both groups. Propel Implants are better able to provide localized stable corticosteroid concentration for a prolonged period of time compared to traditional corticosteroid nasal sprays. Although Propel Implants are not FDA approved to treat NP in CF patients, we believe their suspected utility is a novel approach that warrants further investigation in this population.

#D100
A Rare Sphenoid Sinus Meningioma
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Introduction:
Meningioma represents 15-20% of all intracranial tumors and is the most common nonglial intracranial neoplasm. An estimated 20% of intracranial meningiomas develop extradural extracranial extension with the most common site being the orbit. We present one of the few reported cases of sphenoid sinus extension. We discuss the clinical presentation, diagnosis, and treatment of this case with a review of literature. We also discuss the increasing role of otolaryngologic consultation in treating tumors with intra- and extracranial involvement in collaboration with neurosurgery.

Methods:
A 49-year-old female presented with a prior history of an occipital meningioma, resected five and seven years ago, and a one-year history of worsening headaches and left eye swelling. CT scanning revealed a 3.5 x 2.4 cm lesion along the left lesser sphenoid wing with sphenoid sinus opacification initially reported as abscess. Endoscopic endonasal resection of circumscribed sphenoid lesion revealed World Health Organization grade I meningioma.

Results:
Neurosurgery removed the majority of the intracranial portion of the tumor in a separate operation. Radiation therapy then followed to treat residual tumor. At her latest 4.5 month follow up, MRI showed stable residual temporal skull base tumor.

Conclusions:
Meningioma of the sphenoid sinus is rare but should be considered in the differential diagnosis when sphenoid sinus opacification is present on imaging. Otolaryngological endoscopic endonasal techniques used in treating paranasal sinus tumors with contiguous intracranial connections can provide better visualization of ventral cranial base structures compared to traditional transfacial approaches, while having lower associated morbidity.

POSTERS

#D101

Relationship Between Specific Atopic Diseases and In-Vitro Allergen Tests

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Introduction:
The purpose of this study was to correlate positive allergy tests with co-morbid atopic-related conditions.

Methods:
Positive allergy tests by in-vitro ImmunoCAP® performed at a Midwestern United States reference laboratory from September 2014 until September 2015. A subset of 841 patients with tests performed and part of one large health plan where full medical records could be accessed to determine whether they had a clinical diagnosis of allergic rhinitis (AR), asthma (AS), atopic dermatitis (AD) or allergic conjunctivitis (AC). Comparisons were made to establish proportional relationships between positive tests and specific atopic diseases.

Results:
41.85% of AS, 28.13% of AR, 12.25% of AD, and 2.9% of AC patients had positive allergy tests. Overall and in each co-morbid conditions men were more likely to have positive allergy tests. Patients with AS and AD were younger than patients without. There was a strong association between both specific allergen and in-vitro Class of response for both AS and AD, with a weaker association with AR and no association with AD. Combining allergens into large categories revealed a strong association between AS, AR, AD with allergen type with molds the strongest association, but no association with AC. Dust mites had relatively low and cockroach the lowest association in all four disorders.

Conclusions:
There are strong associations between specific allergens and AS and AD, a less convincing association with AR. Molds followed by weeds and grasses appear to have the strongest association with AS and AR and molds and animal dander with AD.

#D102

Relationship of Peripheral Blood Eosinophilia to Computed Tomographic Findings of Middle Ear and Sinus Disease in Asthmatic Patients

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Introduction:
Eosinophilia is known to correlate with the severity of chronic rhinosinusitis. Literature remains sparse regarding the association between eosinophilia and ear disease. We examined the severity of comorbid sinusitis and middle ear disease in asthmatic patients with either high or low eosinophil counts.

Methods:
A retrospective chart review was conducted of asthmatic patients at a single institution who had CT scans from 2009 to 2016, which included imaging of the temporal bone and maxillofacial areas. Mastoid cavity, antrum, and middle ear opacification was quantified by 2 independent, blinded scorers for 15 patients with low eosinophil counts and 15 patients with high eosinophil counts. Sinus disease was also quantified using the Lund-Mackay (LM) scoring criteria.

Results:
Asthmatic patients with ear disease had elevated eosinophil to lymphocyte, eosinophil to neutrophil, and eosinophil + basophil to WBC ratios ($p=0.029$, 0.035, and 0.021, respectively) compared to asthmatics without ear disease. High eosinophil count ratios trended towards higher LM scores ($p=0.064$) and three asthmatics with high eosinophil count ratios had evidence of ear disease. These three patients also had evidence of increased sinus disease based on LM scores (12, 14, and 16, respectively) with ear disease being associated with higher LM scores ($p=0.048$).

Conclusions:
In this pilot study, elevated eosinophilic counts in asthmatic patients were associated with increased sinus disease based on LM scoring as well as increased likelihood of associated ear disease. Future studies will examine the association of aspirin sensitivity or Aspirin Exacerbated Respiratory Disease in these subjects.

#D103

Research Meteorological Environmental Factors and Ifn-??il-4 Dna Methylation in Cd4+t Cells from Patients with Ar Children

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Objective:
To investigate the possible effects of meteorological and environmental factors on AR of children and IFN-? (interferon-?)?IL-4 (interleukin-4) gene specific DNA methylation levels in CD4+ T cells of patients with AR.

Methods:
Undergoing follow-up on 35 pediatric AR patients (6-12 years) from the Department of Otolaryngology , Shanghai Children Medical Center through 2013. Data on daily particulate matter of diameter smaller than 10 micrometer (PM10) and particulate matter of diameter smaller than 2.5 micrometer (PM2.5) was available as average values derived from the data of 6 state-controlled monitoring stations distributed across Pudong district, Shanghai. We quantified IFN-??IL-4 gene specific DNA methylation levels in CD4+ T cells from 35 patients with AR and 30 healthy controls. mRNA levels gene were measured by real-time reverse transcriptase-PCR. Methods of personal exposure assessment of PM2.5 and PM10 were measured.

Results:
IFN-? promoter region was hypermethylated in AR CD4+T cells (p=0.042). Of all observed CpG sites in IFN-? promoter region, there was significant differences in CpG -299, CpG +119, CpG +168 (p=0.004,p=0.029,p=0.035). IFN-? mRNA expression was significantly increase in CD4+T cells (p=0.036). Both level of methylation in IL-4 promoter region and mRNA expression in IL-4 was found no significantly. After adjusting, level of long expoure PM2.5 was positively correlated with level of methylation in IFN-? promoter region.

Conclusions:
Meteorological and environmental factors have important effects on AR in children. Level of methylation in IFN-? promoter region may be affected by long expoure PM2.5.

#D104

Retrieval of Displaced Dental Implants from the Maxillary Sinus: Endoscopic vs. Open Approach

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Purpose:
The incidence of dental implants inadvertently entering the maxillary sinus is becoming more common as a consequence of the development of new techniques to restore missing teeth. This complication requires surgical removal of the foreign body, even in asymptomatic patients, to prevent subsequent inflammatory disease. This case series reports the authors' experience with removal of displaced dental implants. A literature review comparing endoscopic retrieval with traditional techniques was performed.

Materials and Methods:
A 5-year (2010-2015) retrospective analysis was performed in the senior authors' departments (Otolaryngology & Maxillofacial surgery)

Results:
Four patients (mean age 60.5 years) were managed using different surgical approaches to the removal of the foreign body from the maxillary sinus. Two patients underwent endoscopic retrieval via a middle meatal antrostomy. One patient was managed under local anaesthesia, using a lateral sinus buccal approach. One patient underwent the traditional Caldwell-Luc approach in retrieval of the displaced implant. No intraoperative or postoperative complications were observed.

Discussion:
The current literature supports the surgical retrieval of a displaced dental implant into the maxillary sinus, irrespective of a patient being asymptomatic. Previously, the open Caldwell Luc approach was considered the gold standard in the treatment of maxillary sinus pathology. However, a shift towards endoscopic retrieval has been observed with the continual development of minimally invasive FESS techniques.(1, 2)

Conclusion:
Endoscopic trans-nasal retrieval of displaced dental implants from the maxillary sinus using a middle meatal antrostomy is an effective, safe, rapid and minimally invasive procedure.

POSTERS

#D105
Sellar Abscess Following Endoscopic Sinus Surgery: A Case Series
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Background:
Sellar abscess is an uncommon finding, which can be caused by various sources including hematogenous spread to the pituitary gland, extension of a neighboring infection, and transphenoidal iatrogenic seeding. Sellar abscess as a complication of routine endoscopic sinus surgery (ESS) has not been reported in the literature. Here we report our experience with two cases of sellar abscesses following ESS.

Methods:
A review of the pituitary experience at our institution yielded two patients presenting with sellar abscess with extension to the cavernous sinus following uncomplicated ESS at an outside institution. Pertinent clinical details were reviewed and compared with previous reports in the literature.

Results:
Both patients presented within three weeks of their initial ESS procedures with septic shock, headache, visual changes, and cranial neuropathies. Neither patient had been diagnosed with sphenoid sinusitis or undergone sphenoid sinusotomy previously. MRI was performed which revealed fluid densities within the sella with extension to the left cavernous sinus in both cases. An endoscopic approach to the cavernous sinus for drainage was employed for both patients. Cultures yielded polymicrobial growth. To our knowledge, this is the first reported series of sellar abscesses following ESS without concurrent sphenoidotomy.

Conclusions:
Although rare, sellar abscesses can occur following endoscopic sinus surgery, resulting in significant morbidity and risk for mortality. Based on our case series, instrumentation of the sphenoid sinus is not a prerequisite for developing a sellar abscess, and additional study to determine the risk factors for this condition is necessary.

#D106
Short-term Morbidity Following Endoscopic Modified Lothrop (DRAF III) Frontal Sinus Surgery Compared to Endoscopic Frontal Sinusotomy (DRAF IIA)
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Objective:
The endoscopic modified Lothrop (Draf-III) is an effective procedure for patients with severe sinus disease recalcitrant to medical therapy and/or prior surgery. However, no studies have yet evaluated the short-term post-operative morbidity. This study seeks to compare the early post-operative burden of care and quality-of-life impact associated with the Draf-III to the Draf-IIA procedure.

Subjects and Methods:
A retrospective review of early (<8-week) post-operative recovery of patients who underwent Draf-III between 2014 and 2016 was conducted and compared to age- and radiographically-matched (Lund-Mackay) Draf-IIA controls. Primary outcomes included number of post-operative clinic visits, debridements, and steroid and antibiotic therapy days. Secondary outcomes included change in SNOT-22 score/sub-scores between pre-operative and last post-operative visits within the study period.

Results:
38 patients (19 Draf-III, 19 Draf-IIA) were included. Baseline SNOT-22 were similar (44.1±27.6 vs. 33.3±25.4, p=0.4). Subjects undergoing Draf-III required more post-operatively clinic visits (4.9±1.7 vs. 3.3±0.8, p<.05), debridements (4.2±2.0 vs. 2.3±0.8, p<.05), and antibiotic therapy days (24.4±11.8 vs. 15.6±6.3, p<.05). Aggregate SNOT-22 scores improved for both groups (9.7±24.4 vs. 26.8±27.0, p=.08) and sub-score analysis demonstrated greater improvement in ear/facial domain (3.5±3.5 vs. 1.0±3.0, p<.05) in Draf-IIA patients.

Conclusion:
Draf-III is associated with a higher frequency of post-operative clinic visits, debridements, and antibiotic therapy days. The ear/facial domain, which measures facial pain/pressure symptoms, demonstrated a faster rate of recovery for Draf-IIA patients. Counseling patients who may require Draf-III for long-term disease control should include a discussion of the increased burden of recovery.

#D107
Silent Sinus Syndrome After Facial Trauma: A Case Report and Systematic Review
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Introduction:
The accepted definition of silent sinus syndrome (SSS) excludes post-traumatic cases. In order to challenge current exclusion criteria of antecedent facial trauma, we have identified all published cases of post-traumatic silent sinus syndrome (SSS) in English literature including a new representative case from our institution.

Methods:
MEDLINE, EMBASE and Scopus databases were used for the literature review. PRISMA guidelines were then used to systematically identify all case reports and case series published in English literature from 1964 through August 2016. Authors of cases with missing information were contacted for completion.

Results:
Thirteen documented cases of post-traumatic SSS were identified through systematic literature review. An additional case from our institution was presented, bringing the total reported case count to fourteen. Time from initial trauma to presentation ranged from 2 months to 32 years with a median duration of 6 months. Endoscopic sinus surgery (ESS) with either concurrent or staged orbital floor implant repair was used to treat post-traumatic SSS in 64 percent of reported cases. Three patients had ESS alone with one case showing post-operative improvement in enophthalmos.

Conclusion:
Recent emergence of case reports of SSS post-orbital and facial trauma challenge the current exclusion criteria of precedent facial trauma. Post-traumatic SSS is rare, but the availability of cross-sectional imaging pre- and post-development of SSS makes a strong case for a causal relationship. Recognition of SSS in a post-traumatic setting is important as it ultimately changes surgical management – if treated early, it potentially abrogates the need for orbital floor augmentation.

#D108
Single Institution Outcomes Following Resection of Skull Base Esthesioneuroblastomas with Extended Follow-up
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Introduction:
Esthesioneuroblastomas present unique problems. Complex anatomy, frequent late diagnosis, and involvement of critical neurovascular structures present technical challenge. Late recurrences makes follow-up crucial. Image guidance enables complete resections with less morbidity. As tumor location generally precludes large marginal resection, early postoperative radiation is key.

Methods:
This study retrospectively reviews patients treated surgically for esthesioneuroblastoma over 26 years at a single institution utilizing endoscopic tools/ techniques to supplement transcranial/transfacial approaches. Patients lost to clinical follow up were contacted through online databases. Several clinicopathological parameters including histologic grade, tumor characteristics, microvessel density and Ki-67 proliferative activity may predict tumor aggression.

Results:
48 patients underwent surgical resection of esthesioneuroblastoma; 43 had adequate information for review. Mean duration of follow-up was 81 months. Thirty (70%) patients showed no evidence of disease at last follow-up. Twelve patients (34%) developed metastatic (N=8) or local recurrence (N=4), four who died related to complications from these. Thirty-three patients (75%) received postoperative radiation, 60% of these starting treatment within two months of surgery. There appeared to be a correlation between late radiation treatment and metastasis, as delays over ten weeks were associated with increased metastasis rate over patients who received radiation within ten weeks of surgery.

Conclusions:
Metastasis or local recurrence after initial resection is a poor prognostic factor. This is associated with delayed onset of adjuvant radiation therapy. Minimally invasive surgical resection with endoscopic techniques guided by clinicopathologic findings may reduce postoperative complications; allow more complete resection and shorter time to radiation, with potentially less metastatic potential.

POSTERS

#D109

Sinonasal Correlates of Infrasellar Giant Pituitary Adenomas

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Introduction:
Giant pituitary adenomas, defined as those greater than 4 cm, are often described as suprasellar lesions. However, infrasellar extenson has not been previously explored, and impact on sinonasal symptoms has yet to be described. Herein, we investigate the extent of infrasellar growth patterns of giant adenomas and their associated sinonasal clinical correlates.

Methods:
A retrospective analysis of all surgically excised pituitary adenomas from 2008-2016 was performed at a tertiary care academic medical center. The clinical manifestations and radiographic extent of all giant infrasellar tumors were analyzed.
Results: 37 of 415 patients who underwent resection of pituitary adenomas were found to have giant adenomas (mean 44.0 ± 6.8 mm). Of those tumors, 25 (68%) were found to have infrasellar extension, 19 tumors occupied the sphenoid sinus, and only 4 extended into the ethmoid sinuses. The most common sinonasal complaint was nasal congestion (n=4) and only one patient had endoscopic findings of sinusitis in the form of polyposis.

Conclusion:
Infrasellar extension of giant pituitary adenomas is rare. Sinonasal symptoms and radiographic findings did not correlate with extrasellar disease extent. Further investigation including serology, endocrinopathy, and associated comorbidities would aid in clarifying the sinonasal symptoms with an exceedingly rare pathology.

#D110

Sinonasal Epithelial-myoepithelial Carcinoma: A Case Report of a Novel Subsite and Review of the Literature

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Objective:
To describe a novel case of epithelial-myoepithelial carcinoma of the frontal and ethmoid sinuses and review the literature regarding sinonasal epithelial-myoepithelial carcinoma.

Study Design:
Case report and review of the literature.

Methods & Results:
A 69 year-old man underwent combined open and endoscopic craniofacial resection of an epithelial-myoepithelial carcinoma of the right fronto-ethmoid region, a previously undescribed primary location for this tumor. This case is presented along with a comprehensive review of the literature regarding epithelial-myoepithelial carcinoma of the nose and paranasal sinuses.

Conclusion:
Epithelial-myoepithelial carcinoma is an extremely rare neoplasm predominantly occurring within the major salivary glands. Rare cases exist of this tumor within the nose and paranasal sinuses.

#D111
Sinonasal Osteoblastoma: Pre-operative Radiologic Diagnosis
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Background:
With the exception of osteomas, bone tumors occurring in the sinonasal cavities are seldom diagnosed on preoperative imaging due to lack of characteristic radiologic features. In this vignette, we describe the unusual occurrence of an osteoblastoma in the sino-orbital region and draw focus to its CT appearance. A highly specific imaging sign is suggested and its pathologic basis is explained. The sign is also corroborated by reviewing all previously reported cases of this rare entity.

Methods:
Report of a case of sinonasal osteoblastoma, radiologic-pathologic correlation and review of the existing literature.

Results:
A 16 year old female with no significant past medical history presented with three months of progressive left exophthalmos, frontal headaches, nasal congestion and blurred vision. Computed tomography demonstrated a mixed density fibro-osseous lesion centered in the anterior ethmoid region; the lesion showed an eccentric dense osseous cap. Osteoma and fibro-osseous lesion were the differentials offered. Endoscopic surgical resection however revealed osteoblastoma. The dense osseous cap seen on imaging corresponded to a rim of mature bone on histopathology.

Conclusion:
Peripheral rim of osteoblasts is a characteristic histologic trait of osteoblastomas; a unique finding not seen in other tumors. These osteoblasts deposit mature bone at the margins of the tumor, which is seen on imaging as an eccentric osseous cap. Review of literature confirmed the presence of this pathologically explained sign in all reported cases. Dense osseous cap can thus help in identifying osteoblastomas from the more frequently occurring osteomas and fibro-osseous lesions.

#D112
Sinus Pneumatization in Primary Ciliary Dyskinesia
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Introduction:
Primary ciliary dyskinesia (PCD) is a genetically diverse disease that results in pulmonary, otologic and rhinologic symptoms in affected patients. Multiple genetic mutations have been implicated in PCD that decrease patients' ability to clear mucous from the lungs, middle ear and sinonasal cavity, leading to chronic symptoms similar to cystic fibrosis (CF) patients. Patients with CF have a different defect in mucociliary clearance than PCD patients and are well documented to have high rates of aplastic or hypoplastic sinus cavities; however, little data exists regarding sinus development in patients with PCD.

Methods:
17 PCD patients who were greater than 13 years of age and had available CT scans were identified. Using iPlan (BrainLab, Germany) volumes for bilateral maxillary, sphenoid and frontal sinuses were calculated. A control population of patients who had preoperative CT scans for endoscopic endonasal resection of skull base pathology without sinonasal cavity involvement was also identified.

Results:
We identified 17 PCD patients with a mean age of 33 and a range of 13 to 54 years with sufficient imaging. The mean maxillary, sphenoid and frontal volume was 8.39, 1.59, and 1.28 cm3 in our PCD patients, respectively.

Conclusions:
Overall sinus volumes were decreased in patients diagnosed with PCD compared to our control population. Future studies, aimed at evaluating sinus development as a function of specific genetic mutations in PCD patients and better understanding the underlying unique pathophysiology will allow us to determine better treatment practices for this unique patient group.

POSTERS

#D113

Skull Base Regeneration After Chemoradiation In Nasopharyngeal Carcinoma

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Introduction:
Nasopharyngeal carcinoma (NPC) has an incidence of 0.5-2 per 100,000 in the United States. Nasopharyngeal tumors closely approximate bony structures such as the skull base, clivus and C1. Invasion of these structures poses a dilemma for treatment with chemoradiation, since tumor response can then lead to bony defects and instability. We report a case of an NPC patient with destruction of the clivus and erosion of the skull base who achieved a complete response to chemoradiation with clivus and central skull base regeneration.

Methods:
Case report and literature review

Results:
A 34 year-old African-American male presented with diplopia and nasal obstruction. Physical exam was notable for a right sixth nerve palsy and an ulcerated nasopharyngeal mass on endoscopy. Biopsy revealed poorly differentiated squamous cell carcinoma, Epstein-Barr Virus negative. The stage was T4N0M0 with tumor replacing the clivus and extending into the spinal canal, the petrous apices, carotid canals, posterior sphenoid sinus and sella turcica. Prior to treatment, he underwent neurosurgical evaluation regarding the stability of his spine and skull base, but did not undergo surgical intervention. He completed chemoradiation with 6800 cGY and weekly Cisplatin. A post-treatment CT scan revealed resolution of the mass with near complete re-ossification of the clivus, occipital condyles and central skull base.

Conclusions:
Bony regeneration in a patient with complete erosion of the skull base due to advanced NPC is rare. This case report illustrates an impressive response to chemoradiation and rapid bony regeneration in a young and otherwise healthy patient.

#D114

Strategic Placement of Frontal Sinus Trephination with Endoscopic Treatment for Endonasally Inaccessible Frontal Sinus Mucoceles

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Introduction:
Treatment of frontal sinus mucoceles has significantly transformed from predominately external approaches to endoscopic ones with recent advances in endoscopic sinus surgery; however, endoscopic therapy still has its limitations, one of the most important being that of laterally based lesions. A combined external trephination and intranasal endoscopic approach has been described to utilize the advantages of each approach, but a case series demonstrating the range of utility of this technique based on trephine placement is lacking.

Methods:
We present three cases that demonstrate the efficacy of frontal sinus trephination with endoscopic treatment through this new “porthole” with or without intranasal endoscopic therapy for the treatment of laterally based frontal sinus mucoceles. The goal of the technique in each case was to evacuate the mucocele and reestablish normal mucociliary flow within the diseased sinus by removing bony barriers with strategic trephine placement.

Results:
Each case exhibited complete remission of the frontal sinus mucocele with the only complication being transient forehead numbness. Follow up ranges from 2 to 27 months.

Conclusion:
This article alerts otolaryngologists to consider strategic placement of a frontal sinus trephine with or without a combined intranasal endoscopic approach for treatment of endonasally inaccessible frontal sinus mucoceles.

#D115
Surgical Management of Inferior Turbinate Hypertrophy: An Evidenced-based Review and Recommendations
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Background:
We performed an evidence-based comparison of approaches for the surgical management of inferior turbinate hypertrophy (ITH) as it is unclear which method is best.

Methods:
A systematic review of the literature on the surgical management of ITH was performed up to May 2016. The study inclusion criteria was: age > 18 years; documentation of subjective or objective outcomes; and a clearly defined endpoint to evaluate effectiveness. Evidence-based review was performed using an iterative process with 3 independent reviewers, and recommendations were provided for each technique.

Results:
Eight techniques were identified: turbinectomy, submucosal microdebrider resection (SMR), radiofrequency ablation (RFA), electrocautery, laser-assisted, cryosurgery, lateral outfracture, and ultrasound-assisted. All techniques yielded significant subjective and objective improvements in nasal obstruction. Turbinectomy and SMR were associated with greater and more durable improvement in nasal obstruction, with fewer revision procedures compared to thermal techniques. However, turbinectomy was associated with more complications compared to SMR. Of the thermal techniques, RFA demonstrated the greatest efficacy with the lowest rates of crusting and delayed mucociliary transport time. Outfracture, when performed in addition to other techniques, offered additive benefit in improving nasal obstruction. Ultrasound-assisted reduction did not have adequate data to support definitive recommendations.

Conclusion:
SMR with outfracture is recommended among all techniques. Among thermal techniques, RFA is recommended.

#D116
Surgical Management of Silent Sinus Syndrome: When is Orbital Floor Reconstruction Necessary?
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Introduction:
Silent sinus syndrome (SSS) is characterized by maxillary sinus atelectasis leading to inferior displacement of the orbital floor and presenting with enophthalmos. Treatment is surgical with wide maxillary antrostomy, with adjunct orbital floor reconstruction (OFR) required infrequently. We present one of the largest series of patients with SSS including details of presentation and management with specific emphasis on the role of CT findings in guiding treatment choices.

Methods:
Case series of 11 patients from 2012-2016.

Results:
Presenting symptoms included enophthalmos, facial pain, headache and nasal congestion. All patients were treated with maxillary antrostomy and ethmoidectomy. Of these, 63.6% (n=7) required posterior ethmoidectomy and 72.0% (n=8) required septoplasty. OFR at a later date was required in 27.0% (n=3). CT findings showed that 81.8% (n=9) had a deviated nasal septum, 54.5% (n=6) had upward middle turbinate displacement, and 100% (n=11) had an increase in maximum distance from the nasal cavity midline to the medial wall of the maxillary sinus on the affected side in comparison with the contralateral side. Posterior displacement of the eye was measurable on CT in 81.8% (n=9) and 90.9% (n=10) had inferior displacement of the orbital floor.

Conclusions:
This study supports existing literature that SSS can be appropriately treated by addressing the sinuses surgically which halts the disease process. Less than 1/3 of patient required a second procedure for OFR. In the current study, there were no definite presenting history or CT findings associated with the need for adjunct OFR.

POSTERS

#D117

Survey of Endoscopic Skull Base Surgery Practice Patterns Among Otolaryngologists

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Introduction:
Despite divergent reported preferences for reconstructive techniques and perioperative management following endoscopic skull base surgery (ESBS), limited data exist regarding contemporary practice patterns among otolaryngologists routinely performing ESBS.

Methods:
An anonymous electronic survey examining perioperative ESBS preferences was distributed to the American Rhinologic Society membership. Statistical significance between variables was determined utilizing Student t, chi-square, and Fisher exact tests as applicable.

Results:
63 otolaryngologists completed the survey, of which 60.3% were full-time academic surgeons. 73% of respondents had rhinology and/or skull base fellowship training while 25.3% denied any fellowship training. Respondents performed an average of 46 ESBS cases/year (56 in academics vs 31.1 in private practice, p=0.011*). Of these, 44.9% were expanded approaches in academics vs 38.4% in private practice (p=0.243). Most respondents were present for the entire case (74.6%). Significant variation was noted in CPT coding for expanded approaches. 30.2% of respondents never placed lumbar drains (LDs) preoperatively; 33.3% placed LDs for elevated intracranial pressure; 38.1% placed LDs for anticipated high-flow leaks. While reconstructive techniques varied, most respondents utilized vascularized pedicled flaps for intradural approaches (84.7%). Post-operative restrictions varied considerably, with activity limitations between 1-12 weeks and CPAP use for 0-8 weeks. Saline rinses were started 0-2 weeks postoperatively. While major complications are rare, 27.6% of respondents reported carotid injury and 41.3% reported cerebrovascular injury during their careers. There was one reported intraoperative death.

Conclusion:
Based on responses from fellowship- and non-fellowship-trained otolaryngologists in various practice settings, there remains significant variation in the perioperative management of patients undergoing ESBS.

#D118

Synchronous Inverted Papilloma and Recurrent Respiratory Papillomatosis: Case Report and Review of the Literature

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Introduction:
The pathogenesis of recurrent respiratory papillomatosis (RRP) and inverted papilloma (IP) are both associated with the Human Papillomavirus (HPV). This relationship is less clearly defined for IP than for RRP. We report a case of histopathologically proven IP occurring in a patient with laryngeal RRP, with the same strain of HPV confirmed in both sites. This represents the first report of IP occurring within RRP. A review of the literature was conducted to better understand the incidence of RRP in the nasal cavity and the role of HPV in the pathogenesis.

Methods:
Ovid Medline and PubMed databases search was conducted using the following keywords: “inverted papilloma”, “recurrent respiratory papillomatosis”, “Human Papilloma Virus”, and “sinonasal”. Reference lists were reviewed by all authors for relevance. Articles reporting IP in sites other than the sinonasal cavity were excluded.

Results:
No cases of concomitant RRP and sinonasal IP or sinonasal RRP were identified. Two cases of diffuse sinonasal papillomatosis without history of RRP were identified. We reviewed the data on the role of HPV in the pathogenesis of IP and found conflicting data. Previously published studies report HPV involvement in 0-75% of cases. The type-specific detection method was identified as a potential reason for the variability in studies.

Conclusions:
The exact role of HPV in the pathogenesis of IP continues to be debated. Recent isolated studies have shown a higher correlation between histopathologically proven specimens of IP and HPV. This case adds support for the role of HPV in the pathogenesis of IP.

#D119

Synchronously Occurring Exophytic and Inverted Schneiderian Papillomas

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Introduction:
Schneiderian papillomas are benign neoplasms divided in three subtypes: inverted, exophytic and oncocytic, each with unique clinical and histologic features. Surgical resection with histological analysis and postoperative surveillance is recommended. Schneiderian papillomas classically present as a single subtype with a distinct attachment site within the sinonasal cavity. The inverted and exophytic subtypes are the most common, arising from the lateral nasal wall and the nasal septum respectively, and both are associated with the Human Papilloma Virus. The oncocytic subtype is rare and emanates from the ethmoid sinus and lateral nasal wall.
This is the first reported case of a synchronously occurring inverted and expophytic papillomas treated with endoscopic resection.

Methods:
Case report and review of literature.

Results:
A 65 year-old female presented with nasal obstruction, anosmia and epistaxis. Rigid endoscopy demonstrated an exophytic mass with complete bilateral nasal obstruction. Preoperative biopsies were significant for exophytic papilloma. MRI revealed a bilateral sinonasal mass with cerebriform pattern. CT showed pansinus opacification with hyperostosis of the left anterior ethmoid, left medial maxillary wall and the anterior nasal septum. Intraoperative findings included an inverted papilloma based off the left medial maxillary wall and a synchronous exophytic papilloma emanating from the right anterior septum. Multiples additional focis of inverted papillomas were identified in the fossa of Rosenmüller, posterior septum, and lateral nasal wall nasal floor. Dysplasia or carcinoma was not identified on final pathology.

Conclusion:
Synchronous lesions with separate attachments should be considered in those undergoing surgery for extensive schneiderian papillomas.

#D120

The Condemned Sinus: Natural Disease or Surgical Sequella?

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Introduction:
Unilateral, mucopurulent drainage from an isolated paranasal sinus may be encountered in patients with a history of chronic rhinosinusitis (CRS). Static mucus is visualized on nasal endoscopy within the sinus lumen, moreover without significant disease in adjacent sinuses. The reasons for this phenomenon are unknown, though because it is sometimes seen in the setting of prior sinus surgery, an iatrogenic cause has been proposed.

Methods:
A case series was prospectively compiled from consecutive patients presenting for evaluation of CRS at a tertiary rhinology practice over a 16-month period. Computerized tomography and nasal endoscopy were performed and endoscopically-directed aerobic and anaerobic bacterial cultures were obtained. Previous surgical records were reviewed and comorbidities were identified.

Results:
Twenty-three of 426 cases (5.4%) had evidence of chronic unilateral drainage from either a maxillary (21) or sphenoid (2) sinus. All patients had a history of prior surgery, with 52.2% occurring more than 10 years earlier (range 1985-2014). A nonendoscopic transantral approach was reported in 57.1% of cases with chronic maxillary disease. The most common bacterial isolate was Pseudomonas aeruginosa (6 cases, 26.1%), followed by methicillin-resistant Staphylococcus aureus (5 cases, 21.7%). Six cases (26.1%) were polymicrobial and 6 (26.1%) were culture-negative. Tobacco use was reported in 8 (34.8%) cases and chronic obstructive pulmonary disease was present in 6 (26.1%) cases.

Conclusion:
The condemned sinus is a distinct entity that may represent a sequella of previous non-mucosal sparing surgery. Mucus stasis is characterized by chronic polymicrobial infection that differs in composition from acute sinusitis.

POSTERS

#D121

The Effectiveness of Topical Silver Colloid in Treating Patients with Recalcitrant Chronic Rhinosinusitis

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Background:
Recalcitrant chronic rhinosinusitis without polyposis (CRSsP) is a challenging condition to manage as traditional medical therapies and surgery fail to provide satisfactory clinical improvements. Colloidal silver (CS), a widely used naturopathic agent, has recently shown anti-biofilm properties both in vitro and within a rhinosinusitis animal model. To date, no trials involving humans have been published in world literature. The purpose of this study was to assess the efficacy of CS as a nasal irrigation in patients with refractory CRSsP.

Methods:
A pilot study was conducted using a convenience sample of 20 randomized patients with crossover methodology, comparing nasal irrigations with saline versus CS. Patients irrigated for six weeks with the first intervention and then switched to the second for the next six weeks, with measurements made at baseline and each time point. Primary outcomes were changes in SNOT-22 and Lund-Kennedy (LK) endoscopic scores. All analysis was non-parametric and was conducted using STATA 14.

Results:
Eleven patients completed the entire study. Mean SNOT-22 scores among patients randomized to Group A (saline first, n=5) and Group B (silver first, n=6) at baseline were 63.8 and 48.6, respectively. Similarly, mean LK scores among patients randomized to Group A and Group B at baseline were 7.2 and 5.7, respectively. Significant period effects were observed. No significant differences in mean SNOT-22 and LK scores were found between the groups, accounting for the crossover.

Conclusion:
CS nasal irrigation did not demonstrate any meaningful subjective or objective improvements in patients with recalcitrant CRSsP.

#D122

The Efficacy of Topical Intranasal Dexamethasone Versus Fluticasone in Patients with Chronic Rhinosinusitis with Nasal Polyps Following Surgery

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Introduction:
Topical nasal steroids are commonly prescribed to patients with chronic rhinosinusitis with nasal polyposis (CRSwNP) following endoscopic sinus surgery (ESS). They are found to be effective in improving symptoms and quality of life as well as reducing the incidence of nasal polyps recurrence. We sought to determine whether a higher concentration of topical nasal steroid spray is more effective than the standard nasal steroid spray in controlling symptoms and preventing recurrence of polyps in patients with CRSwNP who underwent ESS.

Method:
A double blind randomized controlled trial was performed on patients with CRSwNP after ESS. Patients were randomized into two treatment groups: one received topical nasal dexamethasone 0.032% and the other, fluticasone proprionate. The 22-item Sino-Nasal Outcome Test (SNOT-22) and Lund-Kennedy nasal endoscopy scores were measured at the initiation of topical nasal steroid treatment and then at approximately 4-, 8-, and 12-week intervals.

Results:
41 patients were enrolled in the study. There were 8 patients in the dexamethasone group and 10 patients in the fluticasone group. Both groups displayed improvements in the average SNOT-22 scores and Lund-Kennedy scores over time. The mean SNOT-22 value for the dexamethasone group at the 12-week follow up visit was significantly lower than that of the fluticasone group. The mean Lund-Kennedy values for the dexamethasone group were lower than those of the fluticasone group at each time point.

Conclusion:
After 12 weeks, patients w/CRSwNP who have undergone ESS and are placed on topical nasal dexamethasone appear to have fewer symptoms than those on fluticasone.

#D123

The Impact of Anti-ige Monoclonal Antibody Therapy in Aspirin Exacerbated Respiratory Disease

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Introduction:
Omalizumab, an anti-IgE monoclonal antibody, has previously been shown in a large randomized controlled trial to significantly reduce polyp size and disease-specific quality-of-life scores in sixteen patients with chronic rhinosinusitis with nasal polyposis and asthma. Its impact, however, on aspirin exacerbated respiratory disease (AERD) was unclear. The purpose of this study was to describe our experience with omalizumab in AERD.

Methods:
A retrospective study of AERD patients undergoing anti-IgE therapy for a minimum of four months, who initiated treatment after endoscopic sinus surgery (ESS), was performed. Outcome measures included the 22-item Sinonasal Outcome Test (SNOT-22) scores, Lund-Kennedy endoscopy scores (LKES), and use of oral corticosteroids. Pre-treatment scores were compared to post-treatment outcomes at the most recent follow-up.

Results:
Ten patients were reviewed. The average duration of anti-IgE therapy was 22.8 [11.4 – 39.3] months. Omalizumab was initiated at a mean of 17.3 months post-ESS when symptoms began to worsen or there was an increased frequency of infections. Our results demonstrated that while on Omalizumab, SNOT-22 scores stabilized and demonstrated a non-significant trend towards improvement (55.4 vs. 41.3; p=0.208). A similar trend was detected in LKES (4.2 vs. 3.6; p=0.892). Prior to treatment, six patients (60%) were dependent on oral corticosteroids. With anti-IgE therapy, three (50%) discontinued systemic corticosteroids and two (40%) reduced their dosage.

Conclusion:
Omalizumab stabilized SNOT-22 and LKES scores in AERD, and enabled some patients to cease or reduce systemic corticosteroid usage. To our knowledge, this is the largest reported series of AERD patients undergoing omalizumab treatment.

#D124

The Presence of Anatomic Variants are Associated with Worse Sinonasal Symptoms in Patients with Chronic Rhinosinusitis

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Introduction:
Anatomic variants such as agger nasi cells, supraorbital cells, concha bullosa, and Haller cells are known to potentially complicate sinus surgery and possibly influence surgical outcomes. This study examines the association between anatomic variants and sinonasal symptoms, endoscopy, and CT results preoperatively and postoperatively.

Study Design:
Prospective study.

Methods:
A patient´s database compiled at a tertiary referral institution in an academic rhinology practice was reviewed. A total of 60 patients with anatomic variants present on CT imaging were evaluated. A partial list of anatomic variants includes agger nasi cells, supraorbital cells, concha bullosa, Haller cells, and Onodi cells. Sinonasal Outcome Test (SNOT-22), Lund-Kennedy endoscopy scores, and Lund-McKay CT scores were compared pre-operatively, first post-operative visit, six months postoperatively, and one year postoperatively.

Results:
Sixty patients were identified with anatomic variants on CT imaging while 106 patients without anatomic variants on CT imaging were identified as a control. In general, anatomic variants presented with more severe sinonasal symptoms. Average preoperative SNOT-22 scores were 42.11 for the group with anatomic variants and 34.21 for the control ($p<0.05$). Worse sinonasal symptoms were seen one year postoperatively as well with SNOT-22 of 31.5 compared to 18.07 for the control ($p<0.05$). Objective endoscopy and CT scores did not reach statistical significance.

Conclusion:
Anatomic variants were found to be associated with worse sinonasal symptoms in patients with CRS compared to those who did not have anatomic variants. The presence of anatomic variants may influence the degree of symptom relief in patients who undergo surgery.

POSTERS

#D125

The Role of Sinus Cultures in Children with Blood or Marrow Transplants

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Introduction:
Sinus imaging in pediatric blood/marrow transplant patients often reveals non-specific findings of possible sinusitis. This often leads to a request for sinus cultures. Studies have looked at the utility of imaging, but there has been little evaluation of the clinical influence of sinus cultures. The purpose of this study is to evaluate the association of culture results on further sinus interventions and clinical outcomes in these patients.

Methods:
Retrospective case series of 24 blood/marrow transplant patients <18 years old seen by otolaryngology at an academic medical center for abnormal sinus computed tomography during 1/1/2010-6/1/2016.

Results:
There were 16 umbilical blood, 7 bone marrow and 1 peripheral blood transplant recipients. Bacterial sinus cultures were positive in 83%. The most common bacteria isolated were mixed/non-speciated in 38%, streptococcus viridans in 21% and coagulase negative staphylococcus in 17%. Of the 21 subjects for whom fungal cultures were obtained, 7 were positive. Invasive fungal infections were caused by rhizopus in 2 and exserohilum in one. The four other positive fungal cultures were not associated with invasion. No acid-fast bacilli and 2/11 viral cultures were positive. Positive bacterial cultures were significantly associated with all-cause mortality, but fungal cultures were not. There was no association between positive cultures and undergoing sinus surgery or between sinus surgery and death.

Conclusion:
Compared to the general population, coagulase negative staphylococcus sinusitis is also common and streptococcus viridans maybe more prevalent. Positive bacterial sinus cultures, but not fungal cultures, are associated with death in the pediatric blood/marrow transplant population.

#D126

The Role of Statins in CRS Presentation and Surgical Severity

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Introduction:
Prior studies have shown statins to have a significant anti-inflammatory role outside of the known cholesterol lowering effect. Specifically, the anti-inflammatory role of statins may be associated with down-regulation of pro-inflammatory cytokines, which may have impact on chronic inflammatory conditions. Recent studies have proposed statin drugs may impact chronic pulmonary diseases, including asthma and COPD, which have inflammation mediated organ injury. Investigation of the role of statins in chronic sinus disease, however, has been limited and warrants further investigation given the hallmark of this disease is chronic inflammation.

Methods:
A retrospective cohort study has been designed including adult patients seen for chronic sinusitis and proceeding to primary surgical intervention from June 2010 - January 2015. Cohorts were stratified based on use of statin medication on initial presentation. To determine the impact of statin use on CRS, we evaluated SNOT-20 and nasal congestion visual analog scores (VAS) at initial presentation as well as radiographic and surgical endoscopic severity scores at the time of surgery. Cohorts were compared with Student's t-test or Fisher's Exact test.

Results:
Statistical analysis of SNOT-20 and VAS scores showed no difference in presentation symptom severity between cohorts. No significant associations were identified between either radiographic or endoscopic severity scores and statin use.

Conclusions:
While statins have been theorized to impact chronic sinusitis, mainly via in vitro experiments, the clinical effect on patient presentation and surgical severity appears limited. Continued investigation into the anti-inflammatory nature of statins in chronic sinusitis should be performed.

#D127

The Role of the Osteomeatal Complex in Chronic Rhinosinusitis: An Anatomic Study of Maximal Medical Therapy

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Minimal literature exists investigating anatomic factors associated with the main nasal cavity (MNC) in chronic rhinosinusitis (CRS), and whether certain disease patterns influence clinical success or failure of maximal medical therapy (MMT). We hypothesized that resolution of mucosal disease associated with the osteomeatal complex (OMC) influences clinical response to MMT and direct visualization of the OMC from the external nares may be associated with success of MMT. Analysis of 12 pre- and post-MMT sinus-CT scans from 6 patients with CRS was performed. Three patients clinically succeeded with and three patients failed MMT. Mimics™ software was used to create 3D-reconstructions of the CT scans and to evaluate anatomical changes.
In three failures, there was worsening of mucosal obstruction at the OMC or no improvement in mucosal disease. In three successes, OMC patency was achieved or there was reduction in inflammation surrounding the OMC. With regard to the turbinates, changes in turbinate hypertrophy were noticed throughout, but did not correlate with clinical response to MMT. Visualization of the OMC using digitally created “line-of-sight” demonstrated that successful responders to MMT had more patent MNC with direct access to the OMC. Overall, MMT has an impact on changes in the sinonasal cavity. Although turbinate changes in the MNC didn’t distinguish clinical successes from failures, resolution of mucosal disease at the level of the OMC appeared to predict response to MMT. “Line-of-sight” models suggest that direct access to the OMC may impact response to MMT, however, additional investigation of anatomic changes after MMT is required.

#D128

The SNOT-NOSE Assessment in Endoscopic Sinus Surgery

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Background:
Nasal obstruction is a common complaint in patients undergoing endoscopic sinus surgery (ESS). Improvement of nasal obstruction is anticipated for nasal airway surgery such as septoplasty but has not been well-defined for ESS. Nasal polyposis and tissue eosinophilia play an unclear role.

Methods:
Consecutive adult patients undergoing ESS, septoplasty, or septoplasty plus ESS in a tertiary rhinology practice were prospectively enrolled between November 2015 and August 2016. Patients completed pre- and post-intervention 22-item Sinonasal Outcome Test (SNOT) and Nasal Obstruction Symptom Evaluation (NOSE) questionnaires. The presence of polyps was recorded and tissue eosinophilia was quantified from surgical specimens.

Results:
One hundred seventy-eight consecutive patients were included for analysis. Baseline NOSE score was greater for patients requiring ESS plus septoplasty than those requiring septoplasty alone (63.2 vs. 46.7, p=0.02). The NOSE score of patients undergoing ESS plus septoplasty improved significantly more than patients undergoing septoplasty alone (change scores 36.6 vs. 10.9, p=0.039). Comparable improvement in total and subdomain SNOT scores were observed 3 months postoperatively for patients undergoing ESS with or without septoplasty (25.4 vs. 17.5, p=0.118). Polyposis had a positive effect on change scores, whereas tissue eosinophilia did not affect the scores. SNOT and NOSE scores demonstrated strong correlation (r=0.640), which was highest within the ESS plus septoplasty group.

Conclusion:
The combined SNOT-NOSE assessment predicts differential improvements after ESS. Moreover, ESS appears to have a modifying effect on patient perception of nasal obstruction independent of nasal airway surgery. Disease factors that contribute to these differences will require further study.

POSTERS

#D129

Three Year Review of Chronic Rhinosinusitis Microbiome Using DNA Analysis

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Background:
Bacteria and fungi appear to play a role in chronic rhinosinusitis (CRS); their role as instigator versus propagator remains poorly understood. With technological advances such as DNA analysis becoming less expensive and more readily available, an opportunity arises to more thoroughly examine this complex bacterial and fungal microbiome.

Objective:
To examine the distribution of bacteria and fungi in patients with chronic rhino sinusitis with or without nasal polyps.
Design/ Method: All patients who underwent DNA analysis of sinus cultures at least twice from August 2013 to August 2016 were included.

Setting:
Tertiary Rhinology Practice.

Results:
From 108 longitudinal patients with a total of 571 DNA analysis reports, 543 (95%) were conclusive. Of the total reports, 220 (39%) demonstrated fungi, 531 (93%) demonstrated bacteria, 12 (2%) demonstrated fungi without bacteria, and 208 (36%) demonstrated both fungi and bacteria. At a threshold level set at 80% for dominance, 215 (40.5%) were gram negative dominated and 199 (37.5%) were gram positive dominated. Since screening for resistance genes, 161 of 531 reports (30%) demonstrated mecA gene and 0 of 531 (0%) demonstrated VanA gene. 60 reports demonstrated Methicillin resistant Staph aureus (MRSA); 58 reports demonstrated Methicillin resistant Staph epidermidis (MRSE); 107 reports demonstrated MRSA or MRSE; 11 reports demonstrated MRSA and MRSE; and 80 reports demonstrated mecA with fungi.

Conclusions:
This is the largest series of CRS culture data using DNA analysis. These data may help elucidate subsets of CRS with and without polyps with regards to the microbiome in recalcitrant CRS patients.

#D130

Time, Not Supply or Resident Involvement, is the Greatest Driver of Cost Variability in Septoplasty with Inferior Turbinate Surgery

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Introductions:
Reducing variability among surgeons is a powerful method to reduce costs and increase quality. The impact of resident involvement on surgical cost and variability is poorly understood. Using a nationally recognized accounting system that records actual costs for operative room time and supplies at an academic medical center, we studied these costs for septoplasty and inferior turbinate submucous resection (Septo+ITR) surgeries. We examined variability among surgeons and the impact of resident involvement.

Methods:
Surgical costs for adult patients undergoing Septo+ITR between December 2014 and August 2016 were reviewed. Cases where additional procedures were performed were excluded. Operative supply costs, operative time and cost, and resident involvement were analyzed.

Results:
The study included 65 patients with a mean age of 39 years and 4 attending surgeons. Supply costs ($p=0.006$) and time costs ($p<0.0001$) varied among surgeons. Operative time was the more variable factor, accounting for a mean of 68% of total costs. A resident was involved in 40% of cases with no overall difference in mean operative time compared to cases where no resident was involved ($p=0.225$). Differences were seen, however, when resident year was sub-analyzed. No-resident and senior-resident cases had nearly identical mean times while junior-resident case mean time were 17% greater and approached statistical significance ($p=0.06$).

Conclusions:
For Septo+ITR, the greatest driver of cost variation is operative time. Supply costs had a much smaller impact. Resident involvement had a no significant impact overall, with only junior resident-involved cases approaching statistical significance.

#D131

Transoral Finger-Retraction for Endonasal Endoscopic Resection of Masseteric and Buccal Space Lesions

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Introduction:
Lesions involving the masseteric and buccal spaces have traditionally required transoral or transcervical approaches. Herein, we describe the successful endonasal endoscopic resection of a juvenile nasopharyngeal angiofibroma (JNA) with significant extension into the masseteric and buccal spaces facilitated by transoral finger retraction. JNAs are hypervascular tumors originating in the pterygopalatine fossa (PPF) with complex relationships to critical structures relative to the sinonasal cavities and skull base. Endoscopic approaches have allowed for resection of JNAs with excellent visualization and without traditional transfacial approaches, decreasing morbidity and reducing incidence of facial deformity with similar outcomes as open approaches. While the endonasal endoscopic approach to the masseteric and buccal spaces is unconventional, encapsulated tumors in these regions can be delivered into the nasal cavity through the maxilla and PPF with the use of transoral finger-retraction.

Methods:
Case report.

Results:
A 10-year-old male was referred to our tertiary care center with left sided epistaxis, nasal obstruction, and facial swelling. Imaging demonstrated a vascular lesion in the PPF involving the left nasal cavity and paranasal sinuses, with extension into left middle cranial fossa, infratemporal fossa, orbit, and deep spaces of the neck including the masticator, masseteric, and buccal spaces. The patient underwent pre-operative embolization and endoscopic endonasal surgical resection with transoral finger-retraction without complication.

Conclusion:
Transoral finger-retraction represents a supplemental technique that allows for encapsulated lesions involving the masseteric and buccal spaces to be delivered into the nasal cavity for endoscopic resection in a safe and effective fashion, preventing the need for transfacial incisions.

#D132

Treatment of Oral Telangiectasia with Sodium Tetradecyl Sulfate - A Novel Use

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Introduction:
Hereditary hemorrhagic telangiectasia (HHT) is a disorder affecting the development of blood vessels characterized by mucocutaneous telangiectasias, visceral arteriovenous malformations, and familiality. Oral telangiectasias is a source of high morbidity in these patients including chronic anemia, iron deficiency, dependence on transfusion, and pain. Multiple treatment options exist including sclerosing agents, laser ablation, and surgical resection. In recent years, sodium tetradecyl sulfate (STS) have been applied to nasal telangiectasia with high success. Advantages include rapid onset of action, low spread, and high tolerability. We present a patient with significant morbidity from oral telangiectasias who underwent a novel treatment option with STS foam sclerotherapy.

Methods:
Case report.

Results: Patient is a 64 yo F with a history of HHT. She previously underwent STS sclerotherapy of her nose for recurrent epistaxis with good result. She subsequently started to develop increased bleeding from her oral telangiectasia associated with significant decrease in hemoglobulin. She was evaluated and noted to have multiple telangiectasia on her dorsal tongue with two dominant lesions. Foam sclerotherapy using 3% STS was administered to the dominant lesions. She tolerated the procedure well. On followup, the lesions were well reduced with no further bleeding.

Conclusions:
This case illustrates a novel application of STS for use in foam sclerotherapy of oral mucosal telangiectasia. Advantages include small-volume injection, rapid action, high efficacy, and low side effects. This is a technique that an otolaryngologist should have in their arsenal.

POSTERS

#D133

Unilateral Abducens Nerve Palsy Secondary to Sphenoid Sinus Fungal Ball

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Introduction:
Isolated sphenoid sinus disease (ISSD) is a relatively infrequent diagnosis with potential neurovascular and cranial repercussions. Indistinct symptoms such as generalized headaches and facial pain may make clinical diagnosis difficult. Intervention varies depending on the etiology and may range from antibiotic therapy to surgical intervention to prevent injury to nearby critical neurovascular structures. We present a case of unilateral abducens nerve palsy in the setting of isolated sphenoid sinusitis secondary to compression of Dorello's canal from an Aspergillus mycetoma.

Methods:
Case report and literature review.

Results:
An 83-year-old female presented to the emergency department with a severe generalized headache, unilateral diplopia and right lateral rectus palsy. She reported two similar episodes over the preceding nine months, lasting approximately four days, with resolution of symptoms in the interim. MRI obtained to rule out ischemic causes demonstrated complete opacification of the right sphenoid sinus with extension up to the posterior fossa dura in the region of Dorello's canal. She was referred to Otolaryngology and underwent an endoscopic sphenoidotomy with removal of an aspergilloma. Post-operatively, the patient's headaches immediately resolved with complete resolution of diplopia and lateral rectus palsy three weeks later.

Conclusion:
Involvement of the sixth cranial nerve in isolated sphenoid sinus disease is unusual. A high index of suspicion for ISSD is warranted given the potential for devastating complications. Endoscopic sphenoidotomy with removal of the associated lesion is one viable surgical option to prevent permanent disability in select pathology.

#D134

Using Fixed Bony Landmarks to Identify the Anterior Aspect of the Olfactory Fossa

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Introduction:
The anterior aspect of the olfactory fossa (AAOF) is a high-risk site for cerebrospinal fluid (CSF) leak during endoscopic sinus surgery. Predicting the location of the AAOF endoscopically is challenging. The first olfactory fila has been used as a correlate of the AAOF, but it is an imperfect landmark. The purpose of this study was to explore using fixed bony landmarks to predict the location of the AAOF. Specifically, relationships between the AAOF and orbital floor, and between the AAOF and pyriform aperture (PA) at the edge of the nasal floor were assessed.

Methods:
Fifty coronal and sagittal sinus CT scans were reviewed from a single center sinus surgery database. Left and right assessments allowed for 100 of each of the following measurements: distance from the AAOF to PA, angle between the AAOF and PA, and angle between the AAOF and orbital floor. Endoscopic Draf IIIs plus craniotomies were also performed on three cadavers to illustrate the aforementioned relationships.

Results:
Average patient age was 54, 44% were male, and 56% were female. The average distance from the AAOF to PA was 52.8 mm (40.9-79.0 mm). The average angle between the AAOF and PA was 67° (45°-82°). The average angle between the AAOF and orbital floor was 55° (37°-75°).

Conclusion:
Relationships between the AAOF, PA, and orbital floor can be assessed on sinus CT scans, and these relationships can be applied endoscopically. These relationships could help surgeons predict the location of the AAOF during endoscopic sinus surgery.

#D135

Validation of Perfusion-based Human Cadaveric Simulation Training for Carotid Artery Injury in Endoscopic Sinus and Skull Base Surgery

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Objective:
To assess the validity of an innovative perfused cadaveric simulator model developed to prepare trainees for arterial catastrophes during endoscopic skull base surgery

Methods:
This was a prospective evaluation study. Artificial blood substitute was perfused at systolic blood pressures to fresh human cadavers and a parasellar carotid injury was deliberately created. Otolaryngology and neurosurgery trainees at our institution were recruited to attempt endoscopic control of hemorrhage using suction, cottonoids, and muscle grafts. Each participant attempt was scored for time to hemostasis and blood loss, and trended for improvement. All participants completed validated questionnaires using a 5-point Likert scale to assess the domains of confidence gain, face validity, content validity, and curriculum applicability.

Results:
For all trainees (n=23), time to hemostasis and blood loss were significantly improved across all subsequent trials from the initial attempt ($p < 0.03$). All trainees reported a realistic experience enhanced by the perfusion model which achieved median face validity 5 (95% confidence interval [CI]: 4.80-5.0) and median content validity 5 (95% CI: 4.83-5.0). There was no significant differences between trainees with different levels of experience in skull base surgery. Average pre-procedural confidence was 1.36 (95% CI: 1.04-1.69) and average post-procedural score was 3.16 (95% CI: 2.66-3.66, $p<0.01$).

Conclusions:
As endoscopic skull-base surgery gains wider adoption, competency in controlling vascular catastrophes such as a carotid injury will be essential to otolaryngologic and neurosurgical training alike. The perfusion-based human cadaveric carotid injury model achieves face and content validity and enables safe, realistic simulation for standardized skull base training.

NOTES

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