



PROGRAM BOOK



The ARS at AAO - 59TH ANNUAL MEETING

SEPTEMBER 28, 2013
HYATT REGENCY VANCOUVER
VANCOUVER, CANADA





TODD KINGDOM, MD



Presidential Welcome to the 59th Annual Meeting of the ARS

On behalf of the Board of Directors, it is my great honor and pleasure to welcome you to the Annual Meeting of the American Rhinologic Society in beautiful Vancouver. Under the direction of Program Chairman, Tim Smith, MD, and his program committee, we hope to offer an exciting, valuable and enjoyable program. Once again the Kennedy Lecture highlights the Annual Program. This year our esteem colleague and friend, B.J. Ferguson, MD, will give the 9th Annual Kennedy Lecture. A world leader in rhinology, Dr. Ferguson will share with us her 25-year experience studying sinus disease. This year's program will also feature a collaborative panel with our colleagues in the American Academy of Otolaryngic Allergy and a session showcasing ARS research accomplishments and our flagship journal the International Forum of Allergy & Rhinology. It is our sincere goal to provide program content that is broad and timely as we recognize the wide array of interests and needs amongst our membership. On display during this program will be unparalleled scientific research, clinically relevant panel discussions, and invited speakers sharing their experiences.

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

I believe this Annual Meeting of the ARS, the 59th in our history, will prove to be our finest yet as an organization. Please enjoy your time in Vancouver and welcome to the ARS.

Todd T. Kingdom, MD
President, American Rhinologic Society



TIMOTHY L. SMITH, MD

Program Chair Welcome

Welcome to the ARS at AAO-HNS Vancouver!

I would like to welcome you to the ARS at AAO-HNS Vancouver 2013! The ARS is proud to provide this educational program to serve our members, all otolaryngologists, and allied health care providers from throughout the United States, North America, and the world.

At the ARS, we have worked very hard to arrange a program that has something for everyone. We've developed clinical debates, moderated panels that address the most pressing issues in our field, and a scientific program that is state-of-the-art, well rounded, and highly educational.

It is our sincere hope that there is "something outstanding" in this program for every attendee. Thank you for your continued support of the American Rhinologic Society. Please seek me out and provide me with your critical feedback about the program.

I'll see you at one of our corporate partners' coffee breaks!

Tim L. Smith, MD, MPH
ARS President-elect & Program Chair

P.S. If you think the ARS at AAO-HNS Program is great, wait until you see the program for the **ARS at COSM 2014!** Save the dates: May 14-18 Las Vegas!

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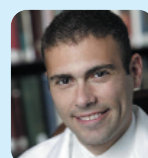
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ARS Mission Statement

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

Business/ACCME

Continuing Education

Accreditation Statement

The 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 6.50 *AMA PRA Category 1 Credits™*. 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 latest information on disease modifying agents available in the management of CRS and associated conditions.
2. Demonstrate an appreciation of developments in surgical techniques and technology used in nasal, sinus, and skull base surgery.
3. Show an appreciation of the postulated etiologies and factors related to disease progression in CRS and current directions of research.

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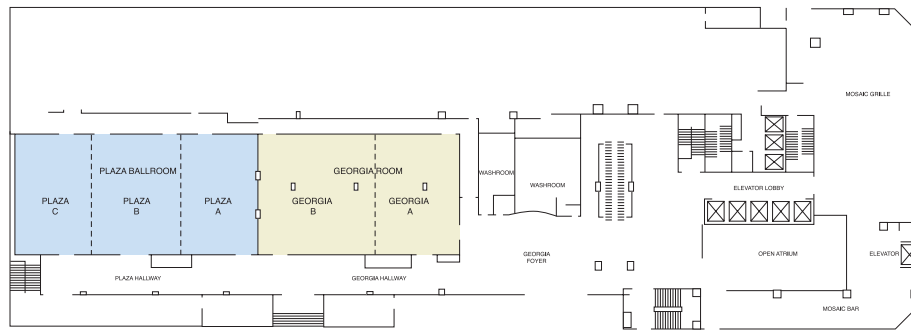
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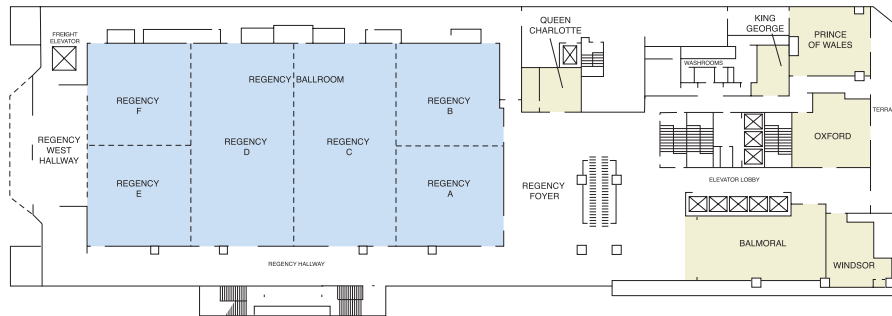
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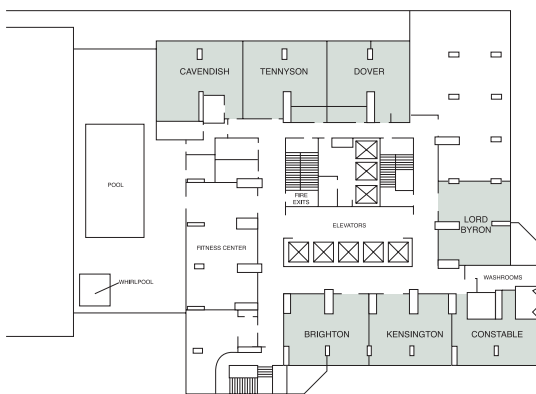
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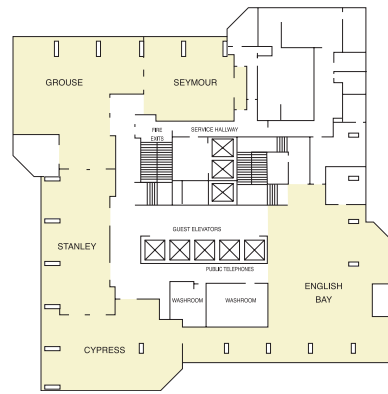
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SATURDAY, SEPTEMBER 28, 2013

Session Descriptions

MORNING PLENARY SESSION

Regency Ballrooms C&D

8:00 am - 12:00 pm

8:00 am

Welcome

Tim L. Smith, MD, MPH
President-Elect and Program Chair

8:05 am

Panel: What is Happening in the World of Rhinology: An International Forum of Allergy & Rhinology

Moderator: PJ Wormald, MD
Panelists: Wytse Fokkens, MD; Martin Desrosiers, MD

8:45 am

Presidential Address and ARS Business

Todd Kingdom, MD

9:00 am

An Insightful Discussion: In hindsight, I would have handled this differently. Lessons learned the hard way...

Moderator: Peter Hwang, MD
Discussants: Martin Citardi, MD, Donald Leopold, MD, Jim Stankiewicz, MD

9:30 am

Break with Industry Partners (Regency E/F)

10:00 am

The 9th Annual Kennedy Lecture

Berrilyn J. Ferguson, MD
Twenty-five Years of Sinus Study: learning and unlearning

Introduction of Dr. Ferguson by: Carl Snyderman, MD

10:30 am

Showcasing ARS Research and The International Forum of Allergy & Rhinology

Moderator: David Kennedy, MD, Editor-in-Chief

10:33 am

Steroid-Eluting Sinus Implant for In-Office treatment of Recurrent Nasal polyposis: A Prospective, Multi-Center Study

François Lavigne, MD, Steven Miller, MD, Andrew Gould, MD, Brent Lanier, MD, Lewis Romett, MD
Montreal, Quebec

Introduction:

Treatment options for chronic rhinosinusitis with recurrent polyposis after endoscopic sinus surgery (ESS) are limited, and include frequent use of systemic steroids and revision surgery. A bioabsorbable, steroid-eluting implant was studied for its ability to dilate sinuses obstructed by polyps and provide localized, controlled steroid delivery to re-establish sinus patency. This study assessed the initial safety and efficacy of steroid-eluting implants placed in the office setting in patients who were candidates for revision ESS.

Methods:

Prospective, multi-center trial enrolling 12 patients who had prior ESS but experienced recurrent polyposis refractory to medical therapy. Implants were placed bilaterally under topical anesthesia in-office. Follow-up through 6 months included endoscopic grading, patient-reported outcomes (SNOT-22) and need for revision ESS.

Results:

Implants were successfully inserted in 21 of 24 (88%) ethmoid sinuses, resulting in 11 evaluable patients. No serious adverse events occurred. Within one month, mean bilateral polyp grade was reduced from 4.5 at baseline to 2.3 ($p=0.008$) and sustained through 6 months (2.4; $p=0.004$). Mean SNOT 22 score was significantly improved from 2.19 at baseline to 0.90 within one month (1.00; $p=0.001$) and sustained to 6 months ($p=0.003$). 64% of patients were no longer revision ESS candidates at 6 months.

Conclusions:

The study provided initial clinical evidence of the feasibility, safety and efficacy of in-office steroid-eluting implant placement in CRS patients with recurrent polyposis after ESS. While further studies are needed, the results suggest this therapy may provide a cost-effective, office-based option for the treatment of obstructive polyposis.

10:40 am

Sinus Surgery and Postoperative Treatment can Reduce Pathogens in the Lungs of Patients with Cystic Fibrosis; A One Year Prospective Follow-Up Study

Kasper Aanas, MD, PhD, Helle Johansen, DMSc
Christian Buchwald, DMSc, Niels Hoiby, DMSc
Marianne Skov, DMSc, Tania Pressler, DMSc
Copenhagen

Background:

The paranasal sinuses are often colonized with lung pathogenic bacteria in patients with Cystic Fibrosis (CF). Sinus bacteria can initiate or maintain deleterious pulmonary infections. Whether sinus surgery has any impact on colonization/infection of the lower airways is controversial.

Aim:

Various clinical outcomes of sinus surgery followed by two weeks of intravenous antibiotics and six months of local antibiotics by nasal rinsing were assessed; treatment modalities were otherwise unchanged. Design: A prospective non-randomized intervention study.

Methods:

The following data were evaluated: One year pre- and postoperative frequencies of lower airway cultures positive for CF-pathogenic Gram-negative bacteria, lung function, BMI, serum antibodies to *P. aeruginosa*, pre- and postoperative SNOT-22 and quality of life questionnaires.

Results:

106 patients were included. A reduction in frequencies of pulmonary cultures with CF-pathogenic bacteria irrespective of preoperative pulmonary infection status was accomplished ($p < 0.01$). Furthermore, self reported symptoms of chronic rhinosinusitis (SNOT-22) decreased ($p < 0.01$), and quality of life increased. Sinus surgery had no effects on lung function, BMI or specific antibodies to *P. aeruginosa*.

Conclusion:

Combined sinus surgery and postoperative antibiotic treatment reduce the frequency of pulmonary samples positive for CF-pathogenic bacteria six months and one year after surgery. Thus, we are the first to show that treatment of the sinuses can improve lung infection status in intermittently colonized CF patients. In addition, we substantiate that sinus surgery relieve symptoms of chronic rhinosinusitis in CF patients and improve quality of life. However, randomized case-control studies are needed for better level of evidence.

10:47 am**Probiotic Manipulation of the Chronic Rhinosinusitis Microbiome**

Edward Cleland, MBBS, Amanda Drilling, BBtech (Hons), Craig James, MBBS, Sarah Vreugde, MD, PhD Peter-John Wormald, MD
Woodville South, South Australia

Introduction:

Staphylococcus aureus (SA) is a key pathogenic component of the chronic rhinosinusitis (CRS) microbiome and is associated with increased disease severity and poor post-operative outcomes. Probiotic treatments

potentially offer a novel approach to the management of pathogenic bacteria in these recalcitrant patients through supporting a healthy community of commensal species. This study aims to investigate the probiotic properties of *Staphylococcus epidermidis* (SE) against SA in a mouse model of sinusitis.

Methods:

20 C57/BL6 mice received intranasal inoculations of phosphate buffered saline (PBS), SE, SA or a combination of SE and SA (SE+SA) for 3 days. Following euthanasia, the mouse snouts were harvested and prepared for histological analysis. Goblet cell hyperplasia was the primary outcome measure.

Results:

Goblet cell counts were significantly higher in both the SA and SE+SA groups compared to those receiving PBS or SE alone ($P < 0.05$). However, the SE+SA group demonstrated significantly lower goblet cell counts compared to the SA group ($P < 0.05$). Mice receiving SE alone did not show a significant difference to those receiving PBS ($P > 0.05$). The presence of *S. aureus* post-inoculation was confirmed by culture in both the SA and SE-SA groups.

Conclusion:

This study confirms the probiotic potential of SE against SA in a mouse model of sinusitis. Whilst the interactions that occur between many probiotic species and pathogens are yet to be fully understood, studies such as this support further exploration of ecologically based treatment paradigms for the management of CRS.

10:54 am**An Immunologic Test for Chronic Rhinosinusitis Based on Free Intranasal Eosinophilic Major Basic Protein**

Jens Ponikau, MD, Hirohito Kita, MD, David Sherris, MD, Eugene Kern, MD
Buffalo, NY

Introduction:

The histologic hallmark of Chronic Rhinosinusitis (CRS) is an eosinophilic inflammation, which is present with and without nasal polyposis and independent of atopy. However, eosinophils travel through the epithelium into the nasal airway mucus, where they form clusters and degranulate, releasing their toxic major basic protein (eMBP). Specific biomarkers for CRS, which could be used as a diagnostic test for CRS with a high sensitivity and specificity, are presently lacking. Recently, an ELISA based test for eMBP in nasal airway mucus received regulatory approval.

Methods:

A newly developed assay was specifically developed to detect released eMBP in airway mucus. eMBP levels of 85 randomly selected CRS patients diagnosed by endoscopy, CT scans and symptoms were compared to

12 healthy controls and 5 disease controls (allergic rhinitis).

Results:

Overall, 92% (78/85) of CRS patients were positive for eMBP versus 0/12 of healthy controls and 0/5 of allergic rhinitis patients. The mean [eMBP] for all confirmed CRS positive patients was found to be 7722ng/ml, whereas the eMBP levels in both the control were all <7.8ng/ml which was the detection limit of the assay ($p < 0.000000000002$).

Conclusion:

The results give this novel eMBP assay a 92% sensitivity and 100% specificity for CRS. EMBP can be used as a biomarker to diagnose CRS, and represents the first immunologically based test to distinguish CRS from the eosinophilic inflammation in allergic rhinitis.

11:01 am

Discussion and Q&A

11:10 am

ARS/AAOA Combined Panel: Changing Your Practice: Strategies to Manage Your Patients with Recalcitrant Rhinosinusitis

Moderator: Richard Orlandi, MD

Panelists: John DelGaudio, MD; Matthew Ryan, MD; Noam Cohen, MD; Erin Wright, MD

12:00 PM

Lunch with Industry Partners - Regency E/F

**AFTERNOON
BREAKOUT SESSION 1
Regency A/B
1:00 pm - 5:00 pm**

1:00 pm

Welcome

Michael Setzen, MD, Regency A/B Chairperson

Session Topic: Skull Base Surgery

Moderators: Adam Zanation, MD and Stacey Gray, MD

1:05 pm

Early and Late Complications of Endoscopic Haemostatic Techniques on Different Carotid Artery Characteristics

Vikram Padhye, MBBS, Rowan Valentine, MBBS, Sathish Paramasivan, MBBS, Camille Jardeleza, MBBS, Sarah Vreugde, MD, Peter-John Wormald, MD, FRACS

Woodville South, SA

Background:

The most dreaded haemorrhagic complication in endoscopic endonasal surgery is injury to the internal carotid artery (ICA). Current gold standard management of this scenario can result in complete occlusion of the ICA. Existing literature is limited to retrospective case reports and there is paucity in regards to prospective research. This study aims to compare the efficacy of the muscle patch, bipolar diathermy and aneurysm clip on hemostasis for different injury types in a sheep model of carotid bleeding.

Methods:

27 sheep underwent ICA dissection/isolation followed by the artery placement within a modified "sinus model otorhino neuro trainer" (SIMONT) model. Standardised linear, punch and stellate injuries were made. Randomization of sheep to receive 1 of 3 hemostatic techniques was performed (muscle, bipolar, clip). Specific outcome measures included attainment of primary hemostasis, time to hemostasis, blood loss, pseudoaneurysm formation and carotid patency on follow up MRI.

Results:

Bipolar achieved primary hemostasis in 7 cases; 2 cases of secondary hemorrhage. It was the quickest hemostat; no pseudoaneurysm formation. Carotid patency was 60% on follow up MRI. Muscle patch achieved 100% primary hemostasis. 22% rate of secondary hemorrhage; 22% rate of pseudoaneurysm.

100% patency rate on follow up MRI. Aneurysm clip achieved 100% primary hemostasis; one case of secondary hemorrhage. No pseudoaneurysm formation; 50% rate of carotid insufficiency on MRI.

Conclusions:

This study shows viable options to the current gold standard of treatment of IAC injury in endonasal surgery, with comparable if not reduced rates of complications.

1:12 pm

Mucosal Melanoma of the Paranasal Sinuses: Survival and Prognostic Implications Based on Site of Involvement

Mohammed Khan, MD, Alejandro Vazquez, MD, Vivek Kanumuri, BS, Satish Govindaraj, MD, Soly Baredes, MD, FACS, Jean Anderson Eloy, MD, FACS
Newark, NJ

Background:

Mucosal melanoma is a distinct subtype of melanoma that commonly presents at an advanced age with a slight male predominance. Local recurrence has been implicated as a major reason for treatment failure, and reported 5-year survival rates have all indicated a poor prognosis, with survival between 10% and 20%. We analyzed the impact of specific location within the sinonasal region on the survival of this rare malignancy.

Methods:

The United States National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) registry was utilized to extract data regarding sinonasal mucosal melanoma between 1973 and 2009. Disease-specific survival (DSS) and hazard ratios (HR) were calculated to compare the prognostic implications of involvement of varying areas of the sinonasal tract, as well as lesions with multiple sinus involvement.

Results:

567 cases were analyzed. Females constituted 56.44% of patients. DSS demonstrated 5-year survivals of 20.37% for patients diagnosed with nasal cavity disease, 15.62% for maxillary sinus involvement, and 7.32% for ethmoid sinus disease. Patients with multiple sinus involvement had a 1-year survival of 36.36%, and none survived beyond 49 months. HRs for maxillary sinus, ethmoid sinus, and multiple sinus disease were 1.34, 1.60, and 2.30, respectively. All DSSs and HRs were statistically significant ($p < 0.05$)

Conclusion:

Mucosal melanomas involving varying areas of the sinonasal tract have significantly different prognoses. Paranasal sinus involvement indicates a poorer prognosis when compared to nasal cavity disease. Patients presenting with multiple sinus involvement have a poorer prognosis when compared to nasal cavity or isolated sinus disease.

1:19 pm

Practice Patterns in Endoscopic Skull Base Surgery: Survey of the American Rhinologic Society

Jivianne Lee, MD, Timothy Smith, MD, MPH, Todd Kingdom, MD, Michael Setzen, MD, FACS, Seth Brown, MD, Pete Batra, MD, FACS
Irvine, CA

Background:

The introduction of advanced endoscopic techniques has facilitated significant growth in the field of endoscopic skull base surgery (SBS). The purpose of this study is to evaluate the impact of endoscopic SBS on the clinical practice patterns of the American Rhinologic Society (ARS) membership.

Methods:

A 23-item survey vetted by the ARS Board of Directors was electronically disseminated to the ARS membership from February 5th to March 31st, 2013. The target group encompassed 982 ARS members.

Results:

152 physicians (15.5%) completed the survey. Open and endoscopic skull base procedures were performed by 91% and 94% of the respondents, respectively. During a typical year, the number of endoscopic skull base cases ranged from 0-20 in 56%, 21-50 in 26%, 51-100 in 9%, and >100 in 8%. Endoscopic CSF leak repair (96%) and pituitary surgery (81%) were the most commonly performed procedures, followed by transcribriform (68.4%), transplanum (54.4%), and transclival (49.6%) approaches. Overall, 69.6% utilized endoscopy for resections of malignant sinus/skull base lesions. Considerable variation in coding philosophy was observed, with open SBS (32%), unlisted endoscopic (29%), sinus surgery (24%), and unlisted neurosurgical (15%) codes being employed by surgeons. Only 29% of physicians reported adequate reimbursement in =75% of cases. Eighty-five percent of respondents supported creation of dedicated endoscopic SBS codes.

Conclusions:

The present survey illustrates the widespread integration of endoscopic SBS procedures into rhinologic clinical practice. However, current variability in coding strategies and inadequate reimbursement may warrant development of specific guidelines to standardize coding and billing processes in the future.

1:26 pm

Spontaneous Sphenoid Lateral Recess CSF Leaks Arise from Intracranial Hypertension not Sternberg's Canal

Bradford Woodworth, MD, Joel Cure, MD, James Palmer, MD, Rodney Schlosser, MD
Birmingham, AL

Objectives:

Spontaneous CSF leaks/encephaloceles are proven to be associated with intracranial hypertension by objective measurements of CSF pressure during or following endoscopic repair. A common area of involvement is a pneumatized lateral recess of the sphenoid sinus (LRS) where prolonged intracranial pressures lead to arachnoid pits and subsequent development of skull base defects. Even though the LRS is never present at birth, a “congenital” cause of these leaks due to a persistent Sternberg’s (lateral craniopharyngeal) canal continues to be erroneously perpetuated in the literature. The objective of the current study was to eliminate the myths defining these leaks as congenital in nature.

Subjects and Methods:

Evaluation of LRS CSF leaks present within a multi-institutional case series was performed. Data regarding demographics, body mass index (BMI), radiologic evaluation of intracranial hypertension, and direct intracranial pressure measurements (when available) were collected.

Results:

Data evaluation identified 77 LRS CSF leaks in 59 patients (avg age 52). Obesity was present in 83% of individuals (avg. BMI 36) and 81% were females. Radiologic evidence of intracranial hypertension (e.g. slit ventricles, empty sella, dilated optic nerve sheaths, and scalloped/attenuated bone) was present on 96% of preop CT and/or MRIs. Opening or post-surgical lumbar drain or ventriculostomy pressure measurements were elevated in 95% of patients (avg. 27.7 cmH₂O, range 9-50).

Conclusions:

The current study provides objective evidence that LRS CSF leaks are secondary to erosions from intracranial hypertension and refutes the myth regarding a congenital origin from Sternberg’s canal.

1:33 pm**Discussion/Q&A****Session Topic: What about Biofilm?**

Moderators: Anne Getz, MD and John Lee, MD

1:40 pm**S. aureus Biofilm Activates the Nod2 Pathway and Proinflammatory Factors on a Human Sinonasal Explant Model**

Daniel Cantero, MD, Clare Cooksley, PhD, Ahmed Bassiouni, MD, Vreugde Sarah, MD, PhD, Peter Wormald, MD
Adelaide, SA

Objectives:

Staphylococcus aureus (SA) biofilms (SAB) have been

associated with recalcitrant Chronic Rhinosinusitis (CRS), but the innate immune response they trigger in the sinonasal mucosa is poorly understood. The “Nucleotide-binding Oligomerization Domain Containing 2” (Nod2) is a Pattern Recognition Receptor involved in innate defense against infections produced by planktonic bacteria, but its role in biofilm infections has not been studied. The aim of this study is to investigate the role of the NOD2 pathway upon mucosal exposure to SAB.

Methods:

Sinonasal mucosal explants from 4 non-CRS donors were cultured ex-vivo: (a) with SAB; (b) with planktonic SA (SAP); and (c) with neither, as a control. After 24 hours, tissue RNA was extracted and gene expression analyzed using a qRT-PCR gene array. Immunohistochemistry was performed to confirm the presence and localization of selected proteins.

Results:

CXC Chemokines ligand 1 and 2, IL-6, and Nod2-pathway-related genes (NOD2, RIPK2, NF- κ B1, NF- κ BIA) were significantly upregulated in SAB-treated explants compared with controls ($p < 0.05$). NF- κ BIA and RIPK2 were also upregulated in SAB-treated explants compared with the SAP-treated ones. Immunohistochemistry showed enhanced staining of Nod2 and NF- κ B1-mainly localized to epithelial and immune cells-in SAB-treated samples compared to controls.

Conclusions:

SAB exerted a proinflammatory response in the sinonasal mucosa and caused activation of the Nod2 pathway, indicating that Nod2 is involved in the innate immune response to SAB. Further studies are needed to understand the pathophysiological relevance of this pathway in CRS.

1:47 pm**Safety and Efficacy of Topical Bacteriophage and EDTA Treatment of Staphylococcus Aureus Infection in an Ovine Model of Sinusitis**

Amanda Drilling, BBtech (Hons), Sandra Morales, MSc, Sam Boase, PhD, Peter Speck, PhD, Sarah Vreugde, MD, Peter-John Wormald, MD FRACS
Adelaide, South Australia

Introduction:

Treatment of sinonasal bacterial biofilms continues to be a challenge in modern rhinology. This study’s objective was to assess the safety and efficacy of topically applied bacteriophage alone and in combination with ethylenediaminetetraacetic acid (EDTA) for treatment of Staphylococcus aureus biofilms in vivo.

Methods:

Using a sheep model of sinusitis, frontal sinuses (n=6 per treatment) were flushed once daily with a S. aureus bacteriophage cocktail (2x10⁶pfu/mL) with or without EDTA (0.075mg/mL) and compared to a control flush

containing saline and heat inactive bacteriophage. Safety was assessed using histology and scanning electron microscopy (SEM) following treatment for 3 days. Efficacy was assessed through generation of *S. aureus* biofilms in the frontal sinuses, followed by treatment for 5 days. Biofilm biomass was compared between the treatment groups and controls using LIVE/DEAD BacLight staining and confocal scanning laser microscopy to image the tissue sections. The software COMSTAT2 allowed computation of the biofilm biomass present on tissue sections.

Results:

Tissue morphology was conserved and histology indicated no significant signs of inflammation when comparing control and test treatments. Furthermore, SEM analysis indicated test treatments were not toxic or damaging to mucosal cilia. COMSTAT2 quantification of biofilm showed a significant reduction in biofilm levels when comparing the control with bacteriophage ($p = 0.0043$), EDTA ($p = 0.0095$) and bacteriophage-EDTA ($p = 0.0022$) treatments.

Conclusions:

Results indicate bacteriophage and EDTA to be safe and efficacious for use topically against *S. aureus* infection in a sheep sinusitis model, and have potential to be translated to a clinical setting.

1:54 pm

Methylglyoxal-augmented Manuka Honey as a Topical Anti-*S.aureus* Biofilm Agent: Safety and Efficacy in an in Vivo Model

Sathish Paramasivan, MBBS, amanda Drilling, BBtech (Hons), Camille Jardeleza, MD, Joshua Jervis-Bardy, MBBS, Sarah Vreugde, MD, Peter Wormald, MD
Woodville, South Australia

Introduction:

Bacterial biofilms are thought to contribute to recalcitrance in chronic rhinosinusitis (CRS) patients. Manuka honey (MH) and its active component methylglyoxal (MGO) have demonstrated anti-biofilm activity in vitro. This study evaluated safety and efficacy of these agents in an in vivo model.

Methods:

To assess safety, ovine frontal sinuses were flushed twice daily for 14 days. In each sheep, one sinus was flushed with a panel of MGO concentrations ranging from 0.5mg/ml to 7.2mg/ml, alone and with 16.5% w/v MH. Contralateral sinuses were flushed with saline control. Tissue morphology was assessed histologically and with scanning electron microscopy. Efficacy was tested by developing *Staphylococcus aureus* biofilms in sheep sinuses. Twice daily irrigation for 5 days was commenced with either saline control or 16.5% MH with MGO (0.5 - 3.6mg/ml). Biofilm biomass was compared between the groups ($n=4$) using Live/Dead BacLight staining and confocal scanning laser microscopy.

Results:

Safety: Sinuses treated with MGO alone or MGO-enriched MH up to 1.8mg/ml showed normal pseudostriated epithelium and cilia structure. Conversely, higher concentrations caused cilia denudation and squamous metaplasia. Efficacy: When compared to saline flush, treatment with MH + MGO at 0.9mg/ml (0.608 ± 0.110 vs. $0.316 \pm 0.197 \mu\text{m}^3/\mu\text{m}^2$; $p = 0.015$) and 1.8mg/ml (0.676 ± 0.079 vs. $0.114 \pm 0.033 \mu\text{m}^3/\mu\text{m}^2$; $p = 0.001$) significantly reduced biofilm biomass.

Conclusion:

Sinus irrigation with MGO-augmented manuka honey at MGO concentrations between 0.9mg/ml and 1.8mg/ml is both safe to mucosa and efficacious against *S.aureus* biofilm. Combined MH/MGO irrigation could represent a viable treatment option for recalcitrant CRS.

2:01 pm

Topical Probiotics as a Therapeutic Alternative for CRS: A Pre-clinical Proof of Concept

Joseph Schwartz, MD, Adam Peres, Bsc, Leandra Endam, Msc, Benoit Cousineau, PhD, Joaquin Madrenas, MD, PhD, Martin Desrosiers, MD
Montreal, Quebec

Introduction:

Chronic rhinosinusitis (CRS) patients have been shown to manifest a high inflammatory phenotype with a sinus microbiome deficient in gram-positive bacteria (GPB). GPB are capable of downregulating pro-inflammatory host responses via an IL-10 mediated response and may represent a potential therapeutic alternative for CRS. We wished to i) immunoprofile the IL-10 secretory capacity of two industrially important, gram positive probiotic strains and ii) verify their tolerance by the sinus epithelium.

Methods:

A peripheral blood mononuclear cell (PBMC) challenge model was employed to document probiotic induction of IL-10 and TNF α responses at various bacterial dilutions. Epithelial cell tolerance was demonstrated using a primary epithelial cell model derived from patient biopsy specimens (6 patients total, 3 CRS and 3 controls). Following an incubation period with either a live or heat killed probiotic strain, cell viability was assessed using microscopy.

Results:

Both probiotic strains induced high IL-10 secretion with differing profiles of TNF α production. Microscopic evaluation following probiotic incubation demonstrated intact cell viability for all cell cultures.

Conclusion:

We have identified well tolerated, nonpathogenic, Generally Recognized as Safe (GRAS status) gram positive probiotics with anti-inflammatory properties.

This represents a potential novel therapeutic strategy for CRS relevant for further clinical evaluation.

2:08 pm

Discussion/Q&A

2:15 pm

Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions

Moderator: Brent Senior, MD

Panelists: Pete Batra, MD; Rob Kern, MD; and a surprise guest panelist

2:45 pm

Break With Industry Partners - Regency E/F

Session Topic: Topical Therapy / Mucociliary Clearance / Sinonasal Barrier

Moderators: Stella Lee, MD and Pete Manes, MD

3:15 pm

The Safety of Budesonide Delivered via Mucosal Atomization Device in Chronic Rhinosinusitis

Andrew Thamboo, MD, Jamil Manji, BSc, Andras Szeitz, PhD, Rachele Dar Santos, BSc, Cathie Garnis, PhD, Amin Javer, MD
Vancouver, BC

Objectives:

The current standard of care at the St. Paul's Sinus Centre is to prescribe budesonide via the Mucosal Atomization Device (MAD) for Chronic Rhinosinusitis (CRS) because its fine mist enhances absorption and improves bioavailability. However, no studies have shown whether enhanced absorption and improved bioavailability of budesonide via MAD causes adrenal suppression. The objective of this study is to determine whether budesonide via MAD affects the hypothalamic-pituitary-adrenal (HPA) axis.

Methods:

Twenty CRS patients were recruited from a tertiary rhinology clinic and randomized to take budesonide (1mg) via MAD or via impregnated nasal saline irrigation (INSI) twice a day for sixty days. Patients underwent ACTH stimulation tests and completed the SNOT-22 quality of life questionnaire on Day 1, 30, and 60 of the study. Plasma budesonide and cortisol levels were quantified using a high performance liquid chromatography tandem mass spectrometry technique.

Results:

There was no indication of HPA suppression in either group (n=20) based on ACTH stimulation test results nor detectable plasma budesonide levels for both groups. Repeated anova measures showed no signifi-

cant difference in stimulated cortisol levels for all 20 patients between days 1, 30 and 60. Quality of life, as indicated by SNOT-22, did not differ between groups at sixty days (p=0.404, 95% CI: -37.2, 15.9).

Conclusions:

Based on our results, the MAD is a safe method of delivering budesonide to the sinuses.

3:22 pm

Effects of Mucosal Healing after FESS on Sinonasal Airflow and Drug-Deposition Patterns: A Pilot Computational Fluid Dynamics Study

Gitanjali Fleischman, MD, Matthew Wofford, BS, Julia Kimbell, PhD, Brent Senior, MD, Charles Ebert, MD, MPH, Adam Zanation, MD
Chapel Hill, NC

Introduction:

Pre-operative surgical planning of FESS in a virtual environment may aid in prognosis and treatment decision-making by providing important outcome predictions. This study investigates ways in which computational models based on pre-FESS computed tomography (CT) scans must be modified to accurately predict post-operative airflow dynamics and particle deposition.

Methods:

Sinonasal cavities were reconstructed from pre- and post-FESS CT scans in a chronic rhinosinusitis patient. Two virtual models were created from the pre-FESS reconstruction: one representing post-surgical changes to the ostiomeatal complex (OMC) only, and another with the addition of middle and inferior turbinate decongestion, reflecting healing. Airflow and nebulized particle transport were simulated using computational fluid dynamics.

Results:

Nasal cavity resistance was higher pre-operatively (0.047Pa.sec/ml) than post-operatively (0.018Pa.sec/ml). Modification of OMC alone had no effect on resistance (0.046Pa.sec/ml) but subsequent decongestion reduced resistance to near post-FESS levels (0.023Pa.sec/ml). FESS dramatically increased aeration of the maxillary sinus (MS) from 3.8×10^{-4} L/min pre-operatively to 2.9L/min post-operatively. MS aeration with OMC-modification alone (1.8L/min) was substantially lower than both post-FESS and decongested models (3.4L/min). Decongestion was required for deposition of 10- and 20- μ m nebulized particles to approximate that of the post-FESS model, in which there was greater penetration of particles past the anterior nasal cavity as well as greater MS delivery of 20- μ m particles than pre-operatively or with OMC modification alone.

Conclusion:

Our findings suggest that the use of virtual pre-operative systems for FESS must take into account post-

operative mucosal healing to predict accurate sinonasal ventilation and topical drug deposition outcomes.

3:29 pm

Chronic Rhinosinusitis without Nasal Polyps is Associated with Increased Expression of Trefoil Factor Family (TFF) Peptides

Justin Turner, MD PhD, Ping Li, MD
Nashville, TN

Introduction:

Trefoil factor family (TFF) peptides are mucin-associated secretory products that are produced in the airways and gastrointestinal tract. These peptides appear to play an important role in mucosal healing and epithelial protection and are overexpressed in chronically inflamed gastrointestinal tissues. We hypothesize that TFF peptides may also be differentially expressed in the sinonasal tissue of patients with and without chronic rhinosinusitis.

Methods:

Ethmoid sinus tissue was obtained from patients with CRSsNP (n=12), CRSwNP (n=12), and non-diseased controls (n=8). mRNA was extracted from samples and quantitative real-time PCR was performed for all trefoil factor family members (TFF1, TFF2, and TFF3). Expression was confirmed using immunohistochemistry.

Results:

TFF1 and TFF3 were both highly expressed in sinonasal tissue, while TFF2 was expressed at near-undetectable levels. CRSsNP tissue had a statistically significant increase in the expression of both TFF1 and TFF3 when compared to control tissue. No difference in TFF expression was found between control and CRSwNP patients.

Conclusions:

TFF1 and TFF3 are overexpressed in CRSsNP. The role of TFF peptides in mucosal protection and repair suggests a possible important physiologic role in maintaining the sinonasal epithelial barrier and modulating innate immunity in the sinonasal tract.

3:36 pm

Effects of Fluticasone Furoate on Clinical and Immunological Outcomes (IL-17) for Mild-to-Moderate Nasal Polyposis in Naive Patients to Steroid Treatment

Philippe Lavigne, MD, Normand Dubé, MD, Qutayba Hamid, MD PHD, François Lavigne, MD
Montreal, Quebec

Introduction:

We have investigated the effect of topical steroids on clinical outcomes and related immune response of CRSwNP patients in order to assess the limited effec-

tiveness of treatment in eradicating some polyps. We want to explore a new potential mechanism linked to Th-17 cells.

Methods:

Prospective, double-blind placebo-controlled study that enrolled 24 allergic and non-allergic patients treated either with placebo or Fluticasone Furoate ID, BID for 12 weeks. Assessment of clinical response, endoscopic score with biopsies of the inferior turbinate and polyps before and at the end of treatment. Tissue from biopsies processed to identify T cells, eosinophils, neutrophils and IL-17 A and F .

Results:

The use of topical steroids improved the mean symptoms scores from 7.12 to 4.02 and the polyp score from 5,13 to 3.31(p=0,05).The use of topical steroids was also associated with decrease eosinophil counts on allergic individuals but not neutrophils or t cells. The expression of IL-17 A and F at the base line was identified on all patients however the highest expression was associated with tissue taken from non-allergic with high neutrophil counts and was inclined by steroids. In allergic individuals the number of IL-17 cells was significantly less compared to base lines. This expression was not observed on patients without allergy and with high neutrophil counts.

Conclusions:

In conclusion the use of topical steroids was more effective on certain phenotypes of nasal polyps. Identification of polyp phenotype might be of essential to ensure a better response to topical steroids

3:43 pm

Discussion/Q&A

Session Topic: Etiology and Inflammation in Sinonasal Disease

Moderators: Jamie Litvack, MD and Abtin Tabaei, MD

3:50 pm

Markers of Disease Severity and Socioeconomic Factors in Allergic Fungal Rhinosinusitis

Justin Miller, BSPH, Allison Deal, MS, Kibwei McKinney, MD, Brent Senior, MD, Adam Zanation, MD, Charles Ebert, MD, MPH
Chapel Hill, NC

Introduction:

Allergic fungal rhinosinusitis (AFRS) has been found to have a higher incidence in lower socioeconomic groups. However, there is a paucity of data investigating the association of epidemiologic markers of disease severity. The primary objective of this study is to evaluate individual components of disease severity with socioeconomic status and health care access.

Methods:

A retrospective analysis was performed on patients diagnosed with AFRS by Bent and Kuhn criteria from 2000-2013. Severity of disease was measured by number of surgeries, orbito-cranial involvement, serum IgE, mold hypersensitivity, and bone erosion on CT. The North Carolina State Data Center provided county-specific socioeconomic and demographic data. Fisher's Exact, Wilcoxon Rank-Sum, and Spearman correlations explored associations between variables.

Results:

Of 104 patients, 54.9% were African American and 41.2% Caucasian with a male:female ratio of 1.3:1 and average age at diagnosis of 30.2 years. The most common payment method was private insurance (58.7%) followed by self-pay/charity care (28.8%). Race, age, insurance status and gender were not associated with severity of disease. Bone erosion was correlated with residence in counties with lower income per capita ($p=0.0028$). Patients with orbito-cranial involvement resided in more rural counties ($p=0.0118$) with lower income ($p=0.0243$) and less primary care providers per capita ($p=0.008$). Residence in counties with older or poorer quality housing was associated with both orbito-cranial involvement ($p=0.0192$) and bone erosion ($p=0.0487$).

Conclusion:

Markers of disease severity (bone erosion and orbito-cranial involvement) in AFRS are associated with lower income, rural counties, poor housing quality, and less health care access.

3:57 pm**An In Vitro Organoid Model of Sinus Development**

Tanner Wallen, BS, Eugene Chang, MD
Iowa City, IA

Rationale:

Epithelial-mesenchymal interactions are critical in craniofacial sinus development. Yet the mechanism of how epithelia and cartilage interact in utero to form the paranasal sinus is not known.

Objective:

Our primary objective was to develop an in vitro model to replicate paranasal sinus development with epithelial and chondrocyte cultures.

Methods:

Epithelia and chondrocytes were harvested from newborn piglet ethmoturbinates and cultured in a commercially available gel suspension to facilitate 3-d tissue architecture. Light microscopy was utilized to track cell differentiation up to 3 weeks, at which point cells were fixed in 10% formalin, paraffin processed, and sectioned for histochemical staining. We also performed 3-dimensional confocal microscopy to assess luminal size,

shape, and the presence of ciliated cells.

Results:

After 5 days in culture, epithelial cysts filled with luminal fluid formed. By day 14, there were on average 26.2 cysts in culture with an average lumen diameter of .12mm. Utilizing confocal microscopy, we visualized 3-dimensional spheres composed of polarized epithelia with synchronized ciliary beating on the luminal surface. Histochemical staining exhibited an acidic polysaccharide-rich extracellular matrix consistent with cartilage surrounding epithelial cysts.

Conclusion:

3-dimensional cultures of epithelia and chondrocytes develop into epithelial-lined fluid-filled cysts with cartilage formation, similar to that of paranasal sinus development in utero. The lumen of these cysts are filled with fluid, and synchronized ciliary movement was observed. This in vitro model presents an opportunity to investigate the pathogenesis of epithelial-mesenchymal interactions in paranasal sinus development.

4:04 pm**MicroRNA Profiles in Nasal Mucosa in Allergic and Non-allergic Rhinitis and Asthma**

Elina Toskala, MD, PhD
Philadelphia, PA

Background:

Rhinitis and asthma commonly coexist and are often regarded as "unified airways disease". Evidence exists that microRNAs are important in controlling inflammatory processes, but little is known about their role in airway inflammation. The present study evaluated the inflammatory profiles of patients with allergic rhinitis (AR), with and without concomitant asthma, and of patients with non-allergic rhinitis (NAR).

Methods:

We analyzed inflammatory cells, cytokines and microRNAs from nasal biopsies and measured nasal nitric oxide (nNO) levels in 159 young adult subjects subdivided into four groups: 1) AR 2) AR+asthma 3) NAR and 4) controls.

Results:

We observed the up-regulation of Th2 cytokines and the trend of elevation of nNO levels in AR patients compared to controls. Subjects with current AR symptoms had increased levels of miR-155, miR-205 and miR-498 but reduced levels of let-7e. In addition, patients with positive skin prick test (SPT) reactions exhibited increased miR-155 and miR-205 expression and a decreased level of let-7e, compared to subjects with negative SPT findings. Concomitant asthma had little effect on the inflammatory profile of AR. No significant changes in inflammatory markers were found in NAR patients compared to healthy controls.

Conclusions:

Our results suggest that microRNAs miR-155, miR-205, miR-498 and let-7e may be important in the allergic inflammation present in nasal mucosa. As regards NAR, our findings support the view that mechanisms other than inflammation are pivotal.

4:11 pm**Expression of Protease-activated Receptors in AFRS**

Charles Ebert, MD, MPH, Kibwei McKinney, MD, Brian Thorp, MD, Gita Fleischman, MD, Brent Senior, MD, Adam Zanation, MD
Chapel Hill, NC

Introduction:

The etiology of the intense inflammatory response demonstrated by patients with allergic fungal rhinosinusitis (AFRS) remains a mystery. Potential sources of this inflammation may include fungal proteases. Protease-activated receptors (PARs) are components of the innate immune response that are modulated by proteolytic activity and are involved in potentiating Th2 responses.

Objective:

To determine whether there is differential expression of PARs in patients with AFRS compared to controls.

Study Design:

Comparison of gene expression profiles in patients with AFRS vs non-diseased controls.

Methods:

Twenty-one patients were enrolled. Patients with AFRS (n=16) that had documented 5/5 Bent-Kuhn criteria were included and were compared to non-diseased controls (n=5) undergoing minimally invasive pituitary surgery. Ethmoid mucosa samples RNA were hybridized to 4x44K microarray chips. Four gene probes (PAR1, PAR2, PAR3, PAR4) were used to assess for differential expression. A linear-mixed model was used to account for some patients having multiple samples. A significance level was determined at p<0.05.

Results:

Of the four probes, only PAR3 showed statistically significant differential expression between AFRS and non-diseased control samples (p=0.03) as well as a 2.21 fold change. PAR2 was noted to have a 1.09 fold increase in expression but was not statistically significant (p=0.81).

Conclusions:

PARs have been shown enhance production of inflammatory cytokines and potentiate Th2 responses. In this initial report, patients with AFRS have a significantly increased expression of PAR3 compared to non-diseased controls, which may play a role in predisposing these patients to an amplified inflammatory response.

4:18 pm**Discussion/Q&A****4:25 pm****Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions**

Moderator: Rod Schlosser, MD

Panelists: Joe Han, MD; Richard Harvey, MD; and a surprise guest panelist

5:00 pm**Closing Remarks and Meeting Adjourned**

AFTERNOON BREAKOUT SESSION 2 Regency C 1:00 pm - 5:00 pm

1:00 pm**Welcome**

Ralph Metson, MD, Regency C Chairperson

Session Topic: CRS, Steroids, and Polyps

Moderators: Nithin Adappa, MD and Justin Antisdell, MD

1:05 pm**Increased P-glycoprotein Activity Promotes Th2 Associated Epithelial Cytokine Secretion in Chronic Sinusitis with Nasal Polyps**

Benjamin Bleier, MD, Angela Nocera, BS, Hufsa Iqbal, BS, John Hoang, BS, Ulises Alvarez, BS, Rachel Feldman, BA
Boston, MA

Background:

Sinonasal epithelial cells are recognized as drivers of inflammation in chronic sinusitis with nasal polyps(CRSwNP) through secretion of Th2 promoting cytokines. P-glycoprotein(P-gp) is overexpressed in nasal polyps and modulates epithelial cytokine secretion in healthy mucosa. The objective of this study is to determine whether P-gp overactivity promotes Th2 associated cytokine secretion in CRSwNP.

Methods:

Polyp explants(n=4) and primary epithelial cell cultures(n=5) were cultivated from patients with CRSwNP.

Explant P-gp activity was determined using a Calcein assay. In culture, P-gp was quantified by ELISA and sensitivity to PSC 833 inhibition was determined using a Calcein assay. Lipopolysaccharide(LPS) stimulated cytokine secretion of IL-6, IL-8, IL-25, and GM-CSF were quantified by ELISA and compared to secretion following P-gp inhibition. Differences in P-gp expression and cytokine secretion were compared using a Mann-Whitney U test. Secretion was correlated with P-gp expression using a Pearson correlation coefficient.

Results:

Calcein retention is increased in P-gp inhibited vs. uninhibited polyp explants (mean \pm -SD; 5.17 \pm -1.76 vs. 2.55 \pm -0.62; $p < 0.05$) but not controls indicating increased nasal polyp P-gp activity. P-gp is sensitive to dose dependent P-gp inhibition with PSC 833 in vitro. LPS stimulated secretion of normalized GM-CSF(45.21 \pm -41.39) and IL-6(63.16 \pm -36.37) were significantly reduced following P-gp inhibition(8.47 \pm -3.28; $p < 0.01$ and 39.94 \pm -31.07; $p < 0.05$; respectively) and secretion was highly correlated with P-gp expression($r = 0.824$, $p < 0.05$ and $r = 0.833$, $p < 0.05$; respectively).

Conclusion:

P-gp overactivity promotes Th2 associated epithelial cytokine secretion in nasal polyps suggesting a novel mechanism for maintaining chronic inflammation in CRSwNP.

1:12 pm

Dynamic Expansion of Functional Regulatory T (Treg) Cells Within Nasal Polyps Through a Novel Chemokine CCL4-mediated Mechanism in Chronic Rhinosinusitis Patients Following Glucocorticoid Therapy

Presented by: Jayakar V. Nayak, MD, Ph.D
Justin Edward, MS, Mrinmoy Sanyal, PhD,
Todd Kingdom, MD, Peter Hwang, MD,
C. Garrison Fathman, MD, Jayakar Nayak, MD, PhD
Stanford, CA

Introduction:

Chronic rhinosinusitis (CRS) with nasal polyps (NPs) is a challenging inflammatory upper airway disorder, often ameliorated by glucocorticoid (GC) treatment. How GC exposure may alter lymphocyte populations in the sinonasal tissue microenvironment is poorly understood.

Methods:

NPs, adjacent ethmoid sinus tissue, and peripheral blood mononuclear cells (PBMCs) from 41 GC-naïve and GC-treated CRSwNP patients were analyzed using high-dimensional flow cytometry for common and rare lymphocyte populations. Subsequent experiments directed by findings included lymphocyte proliferation assays, chemokine RNA microarrays, qRT-PCR quantitation, immunohistochemistry and chemotaxis migration

assays to understand the dynamic cellular activities within NPs.

Results:

A robust, selective expansion ($p < 0.001$) of CD4⁺CD25^{hi}CD127^{lo} activated subset of regulatory T (Treg) cells within NPs is detected after patient exposure to GCs that is absent from blood and adjacent ethmoid tissues. Treg cells exert profound immunosuppressive functional effects on local CD4 and CD8 T cell pools, and Treg cell expansion is secondary to cellular recruitment, rather than proliferation, into the NP microenvironment. Gene expression profiling reveals selected induction of 4 chemokines, mostly notably C-C chemokine ligand 4 (CCL4, $p < 0.01$), within NPs of CRS patients upon GC treatment. Moreover, neutralization of CCL4 ligand/receptor interactions using small molecule antagonists significantly ablates Treg cell migration into NP tissues ($p < 0.05$).

Conclusions:

GC therapy culminates in the recruitment of functional immunomodulatory Treg cells from circulating blood into inflammatory NPs, through novel chemokine CCL4/CCR4 ligand/receptor interactions. The ensuing dynamic microenvironmental changes are critical to, and provide translational relevance for, the beneficial effects seen in CRS patients following GC therapy.

1:19 pm

Elevated serum IgE is a Feature of CRSwNP Irrespective of Atopy Status

Kåre Håkansson, MD, Lars Konge, PhD, Simon Thomsen, PhD, Claus Bachert, PhD, Vibeke Backer, DMSci, Christian von Buchwald, DMSci
Copenhagen, Denmark

Background:

Chronic Rhinosinusitis with nasal polyps (CRSwNP) affects approximately 2-4 % of the European population and it frequently co-exists with asthma. A multiclonal local immunoglobulin-E (IgE) production in the airways driven by a response to staphylococcus aureus (SA) enterotoxins has been hypothesized. Furthermore, anti-IgE therapy has shown promising efficacy in the treatment of CRSwNP. Thus, local IgE production may play a pivotal role in CRSwNP.

Methods:

Forty CRSwNP patients (30 with asthma, 3 with COPD and 7 without lung disease) and 21 controls (5 with asthma, 2 with COPD and 14 with no lung disease) were consecutively included. Nasal secretions, BAL and serum was collected and analyzed for total IgE; furthermore, anti-SA IgE and eosinophil cationic protein (ECP) was measured in serum and nasal secretions, respectively.

Results:

Atopy was equally distributed between patients and

controls ($p=0.38$) as well as between participants with or without asthma ($p=0.66$). As expected, total IgE in nasal secretions, BAL and serum was associated with atopy ($p=0.001$, $p=0.014$ and $p=0.003$ respectively). However, total IgE in nasal secretions and serum was also associated with CRSwNP; the association between anti-SA IgE and asthma did not reach significance ($p=0.066$). Linear regression analysis of log-transformed IgE showed that CRSwNP was significantly associated with elevated total IgE in serum ($p=0.018$) independent of atopy status.

Conclusion:

Serum IgE was elevated in CRSwNP irrespective of atopy; however, local IgE was not. Furthermore, we found a trend towards more anti-SA IgE in asthma patients but this association was insignificant.

1:26 pm

Aquaporins: A Channel to Understanding Chronic Rhinosinusitis?

Claire Frauenfelder, MBBS, Charmaine Woods, PhD, Damian Hussey, PhD, Professor A. Simon Carney, FRCS, FRACS, MD
Bedford Park, South Australia

Introduction:

Altered composition of secretions, mucosal oedema, tissue remodelling and polyp formation are features suggestive that water flow through sinonasal mucosa may be aberrant in chronic rhinosinusitis (CRS). Aquaporins (AQPs) are cell membrane water transport channels; their discovery clarified variation in water permeability between tissue types. We hypothesize altered AQP expression or localization contributes to CRS etiology.

Methods:

This preliminary examination of AQPs in sinonasal tissue compares controls ($n=9$) and CRS patients (CRSwNP, $n=13$; CRSsNP, $n=10$) utilizing quantitative real-time PCR to establish mRNA expression of all known human AQPs (AQP0 - AQP12b).

Results:

Comparison of control and CRSwNP tissue showed a statistically significant difference in mRNA expression for 5 aquaporins. AQP3 mRNA expression increased 3.3-fold in polyp patients ($p<0.05$). Decreased mRNA expression was seen in AQP4 (1.7-fold), AQP7 (1.6-fold), AQP10 (2.4-fold) and AQP11 (1.2-fold) ($p<0.05$ for each). No statistically significant difference in mRNA expression was identified in any AQP when comparing controls to CRS patients without polyps.

Conclusion:

This is the most comprehensive study of aquaporin mRNA expression in the upper airway and will be complimented with immunohistochemical studies for in-situ localisation of AQPs 3, 4, 7, 10 and 11. AQP3 and AQP4 have been shown to regulate matrix metallopro-

teinases (MMPs). Unregulated MMP activity causes tissue destruction and pseudocyst formation - an early histological step in polyp formation. Increased AQP-mediated MMP activity may play a role in polyp formation. There are promising future applications for this research: MMPs are sensitive to tetracycline medications and knowledge of AQP regulation is expanding.

1:33 pm

Discussion/ Q&A

Session Topic: CRS and the Microbiome

Moderators: Naveen Bhandarkar, MD and Eugene Chang, MD

1:40 pm

Differences in Healing at Five Weeks Following ESS are characterized by Differences in Composition of the Sinus Microbiome

Martin Desrosiers, MD, Leandra Mfuna Endam, MSc, Stephen B. Cox, PhD, Abdelali Filali-Mouhim, PhD, Michael Surette, PhD
Montreal, Quebec

Introduction:

While endoscopic sinus surgery (ESS) enjoys a high success rate, a subpopulation of subjects evolves poorly after surgery. We wished to verify whether the composition of the microbiome of the healing sinus cavity varies according to disease status of the sinus mucosa.

Methods:

Twenty patients (40 sinus cavities) were monitored for evolution of healing in a prospective trial comparing perioperative irrigation strategies at time of primary ESS for CRS. Evolution was characterized according to mucosal edema. Ethmoid cavities with severe mucosal edema (score = 2 on a scale 0-2) were defined as 'Poor evolution'. 'Good' and 'Poor' evolution cavities were compared using microbiome profiling by 16s sequencing and gene expression profiling to identify factors associated with poor evolution.

Results:

At five weeks, 12 cavities in 8 patients were "poor evolution". Microbiomes differed between 'good' and 'poor' evolutions, with a predominance of Gram-negative species in the 'poor-evolution' cavities. Indicator species analysis in 'poor-evolution' showed a predominance of Gram-negative species, with the exception of one *Corynebacterium* species. Limited differential gene expression was seen. Maximal change was downregulation of the keratin 6C gene in 'poor-evolution' (Fold-change: 2.51, unadjusted p-value = 0.0094)

Conclusions:

Severe edema of the ethmoid cavity 5 weeks after ESS is characterized by increased presence of mainly Gram-

negative bacterial species and expression changes suggesting deficient re-epithelialisation of the mucosa. Possible interpretations are that gram-negative bacteria colonizing the sinus cavity after ESS delay healing or alternately, that the unique ecological niche of injured sinus cavity preferentially selects for Gram-negative species.

1:47 pm

The Fungal Microbiome in Chronic Rhinosinusitis: Richness, Diversity, Post-operative Changes and Patient Outcomes

Presented by: Sarah Vreugde, MD, PH.D
Edward Cleland, MBBS, Ahmed Bassiouni, MBCh, Samuel Boase, MBBS (Hons), PhD, Scot Dowd, PhD, Sarah Vreugde, MD, PhD, Peter-John Wormald, MD
Woodville South, South Australia

Introduction:

Our understanding of fungi in chronic rhinosinusitis (CRS) has been limited by previously employed detection techniques. This study examines the fungal component of the microbiome in CRS patients and controls using a highly sensitive culture-independent molecular technique. The aims of this study include the characterization of fungal richness, prevalence, abundance, temporal changes and their relationship with patient outcomes.

Methods:

Swabs were harvested from the sinuses of 23 CRS patients and 11 controls. Collection occurred intra-operatively, and again at 6 and 12 weeks post-operatively. DNA was extracted from the swabs and fungal outcomes were determined through 18S rDNA fungal tag-encoded FLX amplicon pyrosequencing.

Results:

Fungi were ubiquitous to all patients. A total of 207 fungal genera were detected with a mean sample richness of 8.18 and 12.14 in the control and CRS groups respectively. *Malassezia* was detected in all patients at surgery and was also the most abundant. Post-operatively, fungal richness decreased ($P < 0.05$) and was associated with declines in the prevalence of *Fusarium* and *Neocosmospora* ($P < 0.05$). *Neocosmospora* was also less abundant post-operatively ($P < 0.05$). No correlations were found for quality of life.

Conclusions:

This is the first study to use a highly sensitive pyrosequencing technique to reveal the true diversity of fungi in CRS patients and post-operative changes in richness. The presence of *Malassezia*, a genus not previously described in the sinuses is of great interest, and its potential as a disease modifier should see further interest given its association with atopic disease.

1:54 pm

Characterization of the Sinus Microbiome in Poor Evolution Patients with Previous Endoscopic Sinus Surgery

Mohammad Al Felasi, MD, Leandra Mfuna Endam, MSc, Michael Surette, MD, Martin Y. Desrosiers, MD
Montreal, QC

Introduction:

We have previously demonstrated that the bacterial composition of the sinus microbiome differs between patients with chronic rhinosinusitis (CRS) and healthy controls (Stephenson, 2009), suggesting bacteria are implicated in disease. Our objective is to identify whether differences in the composition of the microbiome are present in patients with CRS persisting despite technically adequate endoscopic sinus surgery (ESS).

Method:

Twenty patients having previously undergone ESS for CRS >6 months previously were recruited: 11 "bad evolution" and 9 "good evolution". Quality of life (QoL) was assessed using the SNOT-22 questionnaire. Endoscopic swab cultures were obtained for conventional culture and assessment of microbiome by sequencing of the 16s RNA subunit. The microbiome was assessed according to Gram status and for different taxonomical levels.

Results:

Demographic characteristics were similar in both groups. QoL was lower in patients with poor outcome ($p = 0.0384$). There was no difference in conventional bacteriology, however, 16s sequencing demonstrated differences in the microbiome according to state of the disease. "Bad-evolution" cavities were characterized by i) a reduction in bacterial diversity of species ii) an increase in *Pseudomonas* and *Streptococcus* iii) an increase in the proportion of Gram-negative bacteria.

Conclusion:

The microbiome of post-ESS sinus cavities differs according to disease state, with poor evolution characterised by reduction in bacterial diversity and Gram-positive depletion. Sequencing-based techniques to bacterial identification thus offer a new dimension to the appreciation CRS, suggesting potential diagnostic Methods: and a potential basis for targeted manipulation of the microbiome.

2:01 pm

Effectiveness of the Medtronic Hydrodebrider? Endoscopic Sinus Irrigation System used at the Time of ESS on the Sinus Microbiome

Martin Desrosiers, MD, Leandra Mfuna Endam, MSc, Stephen B. Cox, PhD, Abdelali Filali-Mouhim, PhD, Michael Surette, PhD
Montreal, Quebec

Introduction:

The impact of pressurized irrigation on evolution of the disease following endoscopic sinus surgery (ESS) for chronic rhinosinusitis (CRS) have not been studied. We wished to evaluate whether pressurized therapy administered to the sinus cavities at the completion of ESS using the Medtronic Hydrodebrider was more effective than simple irrigation with 0.9% saline in reducing bacterial presence on the sinus mucosa and improving post-operative evolution.

Methods:

Twenty patients undergoing primary ESS for CRS were randomized to receive either simple irrigation with 0.9% saline or pressurised irrigation with the Hydrodebrider at end of surgery. Symptoms and endoscopic aspect of the sinus mucosa were assessed at 2.5, 5 and 12 weeks after ESS. Biopsies for bacterial sequencing, swabs for conventional microbiology and brushing for gene expression profiling were obtained before and after treatment and 5 and 12 weeks after ESS.

Results:

The effect of Hydrodebrider was limited to better clearance of *S. Aureus* intraoperatively, but not at 5 or 12 weeks. Regardless of the treatment used, following successful ESS, we observed 1) an increased recovery of *S. Aureus* by both molecular and conventional cultures and 2) a decrease in the percentage of Gram-negative bacteria composing sinus microbiome.

Conclusions:

This first study assessing shifts in the sinus microbiome after ESS suggests that resolution after ESS is associated with a shift in the microbiome towards staphylococcal species and certain other gram-positive bacteria. The concept that Gram-positive bacteria may exert an immunoregulatory role suggests a need to reconsider the role of bacteria in CRS.

2:08 pm**Discussion/Q&A****2:15 pm****Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions**

Moderator: Mickey Stewart, MD

Panelists: Andrew Goldberg, MD; Ash Kacker, MD; and a surprise guest panelist

2:45 pm**Break With Industry Partners - Regency E/F****Session Topic: Surgical Field and Approach**

Moderators: Charles Ebert, MD and Karen Fong, MD

3:15 pm**5-,10- and 20-degrees Reverse Trendelenburg Position during Functional Endoscopic Sinus Surgery: A Double-blind Randomized Controlled Trial**

Eng Gan, MBBS, MRCS, MMED, Al-Rahim Habib, Alykhan Rajwani, Amin Javer, MD
Vancouver, BC

Background:

Utilizing the Reverse Trendelenburg Position (RTP) during functional endoscopic sinus surgery (FESS) is a safe, simple and cost-free method that has been found to reduce intraoperative blood loss. However, the critical angle of RTP that produces the least amount of bleeding without compromising surgical technique and safety remains unanswered.

Objective:

To assess the effects of 5, 10 and 20 degrees RTP on intraoperative bleeding during FESS

Methods:

This double blind randomized controlled trial involved 75 patients with CRS with and without nasal polyposis undergoing FESS. Twenty-five patients were enrolled into each group; 5-, 10- and 20-RTP. Boezaart endoscopic field-of-view score (BS), total blood loss (TBL), mean arterial blood pressure (MABP), operating time and blood loss per minute were recorded. An intention-to-treat analysis was utilized with a Bonferroni adjustment for multiple comparisons.

Results:

Intervention groups were comparable in age, sex, nasal polyposis and disease severity. Mean values of BS and TBL were as follows: 5-RTP (2.0, 231ml), 10-RTP (1.8, 230ml) and 20-RTP (1.4, 135ml). The differences in means were significant for BS ($p < 0.01$) and TBL ($p = 0.03$). There was no significant difference in MABP ($p = 0.85$), operating time ($p = 0.10$) or blood loss per minute ($p = 0.11$) between the three groups. Pairwise comparison between 5- vs. 20-RTP found significant difference in BS ($p < 0.01$) but not TBL ($p = 0.04$). Significance was not found in similar comparisons between 10- vs. 20-RTP and 5- vs. 10-RTP ($p > 0.03$).

Conclusion:

FESS in 20-RTP produced the best BS and lowest blood loss without compromising surgical technique.

3:22 pm**Topical Cocaine versus Adrenaline in Endoscopic Sinus Surgery: A Prospective Randomized Controlled Comparison**

Constanza Valdes, MD, Mariana Bogado, MD, MSc, Almoaidbellah Rammal, MD, Mark Samaha, MD, MSc, FRCSC, Marc Tewfik, MD, MSc, FRCSC
Montreal, Quebec

Background:

Adequate surgical field visualization is among the most important factors in preventing complications in Endoscopic Sinus Surgery. The aim of this study was to assess the effect of topical cocaine versus adrenaline on surgical field visualization and intra-operative bleeding during ESS.

Methods:

A prospective blinded (to surgeon, statistician and patient) randomized controlled trial was conducted. A total of 45 patients were randomized to the side of the nose that received adrenaline or cocaine-soaked patties, and the side that was operated first. The surgeon evaluating the bleeding was blinded to the vasoconstrictor allocation. At the commencement of surgery and at regular 15-minute intervals, the operating surgeon evaluated the extent of bleeding in the operative field according to a validated scale. At each assessment, mean arterial pressure, heart rate, and end tidal CO₂ were also recorded. At the end of each side, total blood loss was measured.

Results:

There was no difference in the mean surgical field scores between the adrenaline and cocaine sides (2.12 ± 0.81 versus 2.23 ± 0.66 , $p=0.487$), nor the total blood loss ($p=0.794$). On the cocaine side, there was a correlation between surgical field grade and duration of surgery ($p=0.003$) as well as blood loss ($p=0.017$).

Conclusion:

There is no difference in the quality of the surgical field achieved through the use of topical cocaine or adrenaline during endoscopic sinus surgery. Either one of these agents can be effectively used for topical decongestion at the onset of surgery.

3:29 pm**Management of Far Lateral Frontal Sinus Pathology in the Endoscopic Era**

Elisa Illing, MD, Bryant Conger, MD, Benjamin Bush, MD, Bradford Woodworth, MD
Birmingham, AL

Objective:

Considerable advances in endoscopic technique and experience have allowed an increasing number of

patients with complex frontal sinus disease to be treated with endoscopic surgery. The objective of the current study was to evaluate management strategies and outcomes regarding treatment of far-lateral frontal sinus disease.

Methods:

Prospectively collected data concerning frontal sinus pathology located lateral to the plane of the lamina papyracea (far-lateral disease) was reviewed. Data were collected regarding demographics, etiology, surgical technique, revision rate, anatomic considerations, and clinical follow up. Only patients with at least 24 weeks of clinical follow up and pathology that required removal and dissection in this region were included in the study.

Results:

Over 5 years, 156 patients (mean age 47.9, range 14-84) with 183 far-lateral frontal sinus pathologies and an average clinical follow up of 76 weeks (range 24-237) were evaluated. Endoscopic or open surgery was attempted in 84 patients (54%) prior to intervention at our institution. Primary pathologies included inflammatory/obstructive diseases ($n=119$), skull base defects ($n=33$), and tumors ($n=31$). Initial interventions included endoscopic - Draf IIA ($n=76$), Draf IIB ($n=52$), Draf III ($n=23$); extended - IIA+trephine ($n=1$), III+trephine ($n=2$), III+osteoplastic flap ($n=2$); and open - osteoplastic flap ($n=3$), Reidel ($n=1$), cranialization ($n=1$) procedures. Seven patients (4%) required a subsequent revision procedure.

Conclusion:

The vast majority of far-lateral frontal sinus pathology was managed utilizing endoscopic techniques with excellent outcomes and a low revision rate in the current study.

3:36 pm**Early Versus Delayed Treatment of Primary Epistaxis in the United States**

Jennifer Villwock, MD, Parul Goyal, MD
Syracuse, NY

Introduction:

Epistaxis treatment is variable. This study sought to determine demographic, management, and outcome differences in patients treated with early (<24 hours) versus late ligation or embolization.

Methods:

Retrospective review of the 2008-2010 Nationwide Inpatient Sample for patients admitted with epistaxis. Descriptive statistics were obtained for hospital and patient demographics. Multivariate models analyzed the effect of early versus late treatment with ligation or embolization. Primary outcomes were morbidity, length of stay (LOS), and total charges.

Results:

Of 11,394 cases of primary epistaxis identified in the NIS database, 935 (8.2%) received ligation or embolization. Predictors of early treatment with either intervention were weekday admission ($p < .001$, OR:1.856), income greater than \$39,000 ($p = .003$, OR:1.674), and non-Midwest hospital admission ($p < .001$, OR:3.276). Separate analysis of either intervention revealed black race ($p = 0.023$, OR:2.4) and admission to a teaching hospital ($p = 0.024$, OR:2.4) impacted early ligation; the number of chronic conditions decreased odds of early embolization ($p = 0.017$, OR:0.912). Late treatment with ligation or embolization occurred on hospital day 3.34 and 3.41, respectively. There was no effect on mortality, stroke, blindness, or rate of blood transfusions. Late intervention significantly increased LOS from 3.27 to 5.09 days for ligation and from 2.97 to 6.27 days for embolization. Average total charges significantly increased by \$11,837 and \$20,705, respectively.

Conclusion:

Efficient and effective healthcare delivery is paramount given the potentially life threatening nature of epistaxis and the current economic environment. Delayed intervention significantly increased hospital charges and LOS. Rapid identification and treatment may decrease costs and hospital LOS for epistaxis.

3:43 pm**Discussion/Q&A****Session Topic: Disease Severity and Treatment Outcomes**

Moderators: Amin Javer, MD and Ayesha Khalid, MD

3:50 pm**A New Model for Collecting Clinical Outcomes in Patients with Chronic Rhinosinusitis**

Josh Meier, MD, Aaron Remenschneider, MD, Laura D'Amico, BA, Eric Holbrook, MD, Stacey Gray, MD, Ralph Metson, MD
Boston, MA

Introduction:

The need for objective assessment of patient outcomes is becoming an essential component of clinical practice for both private and academic otolaryngologists. The purpose of this study is to describe the implementation of a successful online model for collection of clinical outcomes data in patients with chronic rhinosinusitis.

Methods:

Patients completed the rhinosinusitis-specific SNOT-22 and Chronic Sinusitis Survey as well as the EQ-5D, a general health related QOL instrument before and after sinus surgery. One year after patient enrollment began, an online tool was developed to facilitate collection of

postoperative data. Response rates before and after implementation of online data collection were compared.

Results:

Seven private practice and four academic surgeons participated in the study. A total of 557 sinus-surgery patients provided outcomes data (327 private, 230 academic). With implementation of the online follow-up instrument, the response rate at 3 months increased from 64.2% to 78.4% ($p < 0.001$) and at twelve months from 61.1% to 70.3% ($p = 0.001$).

Conclusions:

Quality of life data can be effectively collected in a mixed setting of private practice and academic otolaryngologists. The addition of an online data collection tool can significantly increase response rates, and allow a comprehensive capture of meaningful clinical outcomes. Such a model is not difficult to implement and may become more relevant as payers begin to request outcome data from providers.

3:57 pm**Increase of Inflammatory Serum Biomarkers and Protective Effect Against Asthma in Active Smokers with Chronic Rhinosinusitis (CRS)**

Ilyes Berania, MS, Mfuna Leandra, MSc, Pierre Boisvert, MD, Yohan Bossé, PhD, Louis-Philippe Boulet, MD, Martin Desrosiers, MD
Montreal, Quebec

Objectives:

Smoking negatively affects postoperative evolution in patients with chronic rhinosinusitis (CRS), however the mechanism remains undescribed. In the lung, smoking acts as a biologic modifier that increases expression of pro-inflammatory genes and is associated with an elevation of inflammatory serum markers. The objective of this study is to determine the effect of smoking on these biomarkers in CRS

Methods:

Two existing populations of patients phenotyped for genetic association were studied; 206 patients with refractory CRS (GCRS1) and 408 patients with CRS and nasal polyposis (GCRS2). The groups were stratified according to self-reported smoking status and available serum biomarkers (CBC, total IgE). Asthma and bacterial cultures were also evaluated.

Results:

Active smoking was low in both groups (GCRS1: 11.2%, GCRS2: 12.3%) Total white blood cell (WBC) count was significantly higher in smokers than never and ex-smokers. Serum eosinophilia and prevalence of self-reported asthma was lower in smokers than never smokers. In the GCRS2, endoscopically-collected cultures trend towards a lower recovery rate of *Staphylococcus aureus* in smokers. ($p = 0.07$). Levels of WBC and eosinophils

were similar for never and ex-smokers, when compared to active smokers.

Conclusion:

Active smokers with CRS have increased systemic markers of inflammation. Association between lower circulating levels of eosinophils and lower prevalence of asthma suggest that smoking-induced inflammation may somehow influence development of asthma. Comparable levels of inflammation in non- and ex-smokers suggest a partial reversibility, encouraging smoking cessation in patients with CRS.

4:04 pm

Conductive Olfactory Losses in Chronic Rhinosinusitis? - A Computational Fluid Dynamics Study of 29 Patients

Kai Zhao, PhD, Jianbo Jjiang, PhD, Edmund Pribitkin, MD, Pamela Dalton, PhD, Beverly Cowart, PhD, Nancy Rawson, PhD
Philadelphia, PA

Objective:

Conductive impediments is often thought to contribute significantly to olfactory losses in chronic rhinosinusitis (CRS) patients, in addition to sensorineural factors, yet with no conclusive evidences. We aim to examine the possible conductive factors underlying such losses through the use of individualized computational fluid dynamics (CFD) models.

Methods:

29 CRS patients were assessed via odorant detection thresholds (ODT), rhinomanometry, acoustic rhinometry and CT staging. CFD simulation of nasal airflow and odorant absorption specific to the olfactory region were carried out based on CT. Biopsies of olfactory epithelium (OM) were collected, cryo-sectioned, stained and scored for epithelial erosion.

Results:

Among all the variables, significant correlations to ODT were found for three: odor absorption in the olfactory region ($r=-0.53$, $p<0.01$), epithelial erosion in biopsies ($r=-0.31$, $p<0.05$) and CT staging ($r=0.41$, $p<0.05$). However, the significant correlations were limited to ODT of high soluble odorant: l-carvone. Multiple regression revealed that four variables can in combination account for 50% of total variance in ODT. They surprisingly include nasal resistance and minimum cross-sectional area, suggesting that they are important only if the fraction of odorant flow to the olfactory region and the integrity of the OM are taken into consideration. CT staging scores correlated significantly with OM erosion ($r=0.71$, $p < 0.01$) and only one need to be entered into regression with comparable outcome.

Conclusion:

Both conductive and sensorineural mechanisms contribute to olfactory losses in CRS patients. CFD modeling provides critical guidance in understanding the role

of conductive impediments in olfactory dysfunction in CRS patients.

4:11 pm

Comprehensive Quality of Life Outcomes for Pediatric Patients with Chronic Rhinosinusitis Undergoing Endoscopic Sinus Surgery

Robert Taylor, BS, Justin Miller, BSPH, Austin Rose, MD, Amelia Drake, MD, Charles Ebert, Jr., MD, MPH, Adam Zanation, MD
Chapel Hill, NC

Introduction:

Previous studies of pediatric chronic rhinosinusitis (CRS) patients undergoing endoscopic sinus surgery (ESS) have investigated limited quality of life data, lacking child report and objective outcome measures. To obtain a more comprehensive understanding, support clinical decision-making, and generate hypotheses for future high-level studies the following concepts were explored: baseline and postoperative general and disease-specific quality of life, parent vs. child report, and correlation of nasal endoscopy to sinus CT scores.

Methods:

A prospective cohort study evaluated CRS patients age 5-18 undergoing ESS at an academic medical center. Preoperatively and 30-90 days postoperatively, general (PedsQLTM) and disease-specific (SNOT-16 and SN-5) surveys were completed separately by children and a parent. Preoperative Lund-Kennedy nasal endoscopy and Lund-Mackay sinus CT scores were calculated.

Results:

Impaired preoperative general quality of life was evidenced by parent proxy-report of PedsQLTM scores in 9 cystic fibrosis (79.0) and 10 non-CF patients (69.9). For the 5 CF and 5 non-CF patients completing the postoperative visit, ESS was associated with decreased sinus symptoms with SN-5 change scores of -1.5 ($p=.02$) and -2.0 ($p=.0008$), respectively. Parents proxy-reported more sinus symptoms than their children self-reported, with higher SNOT-16 scores ($p=.04$). Nasal endoscopy correlated with sinus CT with a Spearman correlation coefficient of 0.55 ($p=.04$).

Conclusions:

In pediatric patients with CRS electing ESS, general quality of life is impaired preoperatively and sinus symptoms improve 1-3 months after sinus surgery. Parents proxy-report statistically higher CRS symptoms than their children self-report. Nasal endoscopy scores in these patients correlate with their sinus CT scores.

4:18 pm

Discussion/Q&A

4:25 pm**Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions****Moderator:** Jim Palmer, MD**Panelists:** Zara Patel, MD; and surprise guest panelists

5:00 pm**Closing Remarks and Meeting Adjourned****AFTERNOON
BREAKOUT SESSION 3****Regency D****1:00 pm - 5:00 pm**

1:00 pm**Welcome**

Don Leopold, MD, Regency D - Chairperson

Session Topic: Comorbidity and Treatment Outcomes**Moderators:** Steve Pletcher, MD and Luke Rudmik, MD

1:05 pm**Inadequate Antibiotic Therapy Decreases Quality of Life Improvement after Sinus Surgery**Zi Zhang, MD, MSCE, James Palmer, MD, Nithin Adappa, MD, Alexander Chiu, MD, Noam Cohen, MD, PhD, Ebbing Lautenbach, MD, MPH, MSCE
*Philadelphia, PA***Introduction:**

Despite their widespread use, antibiotics have not been shown to improve chronic rhinosinusitis (CRS) outcomes. To determine whether inadequate postoperative antibiotic therapy was associated with less improvement in quality of life (QOL) following functional endoscopic sinus surgery (FESS) for CRS.

Methods:

This retrospective cohort study consecutive recruited 376 adult CRS patients undergoing FESS between 10/1/2007 to 12/31/2011. Patient demographics, comorbidities and medication use were collected at baseline before FESS. Trimethoprim-sulfamethoxazole and clindamycin were administered for 2 weeks postoperatively. The adequacy of postoperative antibiotic therapy was determined based on the bacterial resistance profile of

organisms identified during intraoperative culture. The QOL outcome was defined as the change of 22 item Sinonasal Outcome Test scores from preoperative visit to 1-, 3- and 6-month post-FESS. Mixed-effects regression models were used for analysis.

Results:

Seven percent of patients (n=27) had inadequate postoperative antibiotic therapy for 2 weeks, and 5% had inadequate initial therapy adjusted to adequate at 1-week follow-up. Compared to patients with adequate initial therapy, patients with inadequate therapy for 2 weeks had significantly less improvement of QOL from baseline to postoperative 1-month (coefficient=0.83, 95%CI 0.18-1.49, p=0.013) and 3-month (coefficient=1.06, 95%CI 0.38-1.74, p=0.002) follow-up; patients with antibiotic adjustment showed no significant QOL difference at 1-month follow-up (coefficient=-0.01, 95%CI -0.57-0.55, p=0.964), but significantly less QOL improvement at 3 month follow-up (coefficient=0.87, 95%CI 0.28-1.47, p=0.004).

Conclusions:

Inadequate postoperative antibiotic therapy decreased short-term QOL improvement after FESS. Our findings suggest that culture guided selection of antibiotics may improve FESS outcome in CRS.

1:12 pm**Incidence of Middle Turbinate Lateralization after Axillary Flap Approach to the Frontal Recess**Philip Chen, MD, Ahmed Bassiouni, MBBCh, Peter-John Wormald, MD
*Woodville South, SA***Objectives/Hypothesis:**

The axillary flap approach to the frontal recess improves visualization and clearance while minimizing use of angled endoscopes. However, some argue that it may destabilize the middle turbinate (MT) and increase risk of turbinate lateralization. The aim of this study was to establish rates of MT lateralization after frontal recess clearance, as well as determine whether surgical or disease factors affect lateralization.

Study Design:

Retrospective chart review.

Methods:

Endoscopic post-operative videos between 3-9 months (short-term) and greater than 9 months (long-term) were reviewed in a blinded fashion. Presence of MT lateralization, ability to pass an endoscope into the middle meatus, and ability to evaluate the frontal recess were recorded. Surgical characteristics included primary vs. revision surgery, MT conchopexy, concha bullosa partial resection, and septoplasty. Patient characteristics included age, sex, polyposis, asthma, and smoking. Cases with absent MT were excluded.

Results:

124 patients (248 operated sides) were included in the short-term cohort. Revision cases constituted 47.6%, 42.3% had polyposis, 38% asthmatics, and 2.3% smokers. Overall rate of MT lateralization was 14.5%, with an inability to examine the frontal recess in 12.1%. Suture conchopexy did not affect lateralization. Results: were statistically similar in the long-term cohort.

Conclusions:

The axillary flap technique yielded 14.5% and 17.4% MT lateralization in the short- and long-term cohorts, respectively. This rate is comparable to reports in the literature of cases with frontal recess clearance that did not use the axillary flap. No patient or surgical factor affected rates of lateralization.

1:19 pm**Does Foregut Surgery for Laryngopharyngeal Reflux Impact Chronic Sinusitis?**

Presented by: Edward Hepworth, MD
Anne Cosgriff, MD, Edward Hepworth, MD, Jessica Olson, BA, Reginald Bell, MD, Kate Freeman, RN
Denver, CO

Introduction:

Between 2004 and 2013, 59 patients from a rhinology practice were identified to 1) have co-existing diagnoses of chronic sinusitis and laryngopharyngeal reflux (LPR), and 2) underwent foregut surgical intervention, most commonly fundoplication, to address reflux. 53 (90.0%) of these patients had undergone previous sinus surgery. The purpose of this study was to assess the postoperative impact of foregut surgery on the chronic sinusitis patient.

Methods:

The clinical diagnosis of sinusitis and LPR was made by a rhinologist. The patients were referred to a foregut surgeon and underwent foregut intervention. This study retrospectively addresses five indices pre- and post-foregut surgery: 1) frequency of rhinology office visits, 2) sinus culture requirements, 3) antibiotic requirements for sinusitis, 4) Lund-McKay scores, and 5) SinoNasal Outcome Test (SNOT-22) scores.

Results:

53 patients (89.8%) returned to the rhinology practice after foregut surgery. The average duration of otolaryngology care was 2.1 and 1.9 years pre- and post-foregut surgery. After foregut surgery, the number of sinus cultures performed in the rhinology clinical was reduced by 44.5%. After foregut surgery, 23 patients (43.4%) had no further need for antibiotics for sinusitis. Overall, after foregut surgery there was a reduction in the number of prescriptions written for sinusitis by 71.7%.

Conclusion:

It is imperative that the otolaryngologist be well versed in the diagnosis of LPR and its association with chronic

sinusitis. We recommend close collaboration between the otolaryngologist and foregut surgeon. Surgery for reflux can dramatically reduce the need for cultures and antibiotics due to sinusitis.

1:26 pm**The Effects of Diabetes Mellitus on Sinus Infection and Sinus Surgery Outcome**

Presented by: James Palmer, MD
Zi Zhang, MD, MSCE, Nithin Adappa, MD, Alexander Chiu, MD, Ebbing Lautenbach, MD, MPH, MSCE, Noam Cohen, MD, PhD, James Palmer, MD
Philadelphia, PA

Introduction:

Patients with diabetes mellitus (DM) are known to be liable to infections and postoperative infection. However, the association between diabetes and chronic rhinosinusitis (CRS) has not been well studied. We sought to determine the effects of DM on CRS culture results, severity and quality of life (QOL) after functional endoscopic sinus surgery (FESS).

Methods:

We conducted a retrospective cohort study. Consecutive adult CRS patients undergoing FESS were recruited from the Department of Otorhinolaryngology-Head and Neck Surgery between 10/1/2007 to 12/31/2011. Patient demographics, comorbidities, medication use, the Lund-Mackay CT scores were collected at baseline before FESS. Intraoperative culture was obtained. Preoperative and 1- and 6-month postoperative QOL was measured by the 22 item Sinonasal Outcome Test (SNOT-22) scores.

Results:

Among the 376 CRS patients included in the analysis, 26 patients (6.9%) had DM. Pseudomonas spp. and other gram negative rods were significantly more likely to be obtained from DM patients than non-DM patients (34.6% versus 16.0%, $p=0.015$), but there were no significant difference in the prevalence of Staphylococcus aureus and anaerobes. Although there were no significant difference in preoperative Lund-Mackay CT scores and SNOT-22 scores, DM patients had significantly worse postoperative SNOT-22 scores at 1-month (29 versus 19, $p=0.009$) and 6-month (31 versus 20, $p=0.041$) follow-up than non-DM patients.

Conclusions:

DM patients may be prone to gram negative bacterial sinus infection, and had less QOL improvement after FESS. Special postoperative care may be needed in CRS patients with DM.

1:33 pm**Discussion/ Q&A**

Session Topic: Bacteria and Host Response

Moderators: Vijay Ramakrishnan, MD and Ameet Singh, MD

1:40 pm**Bacterial Immune Evasion via an IL-10 Mediated Host Response - A Novel Pathophysiologic Mechanism for CRS**

Joseph Schwartz, MD, Sawsan Al-Mot, MSc, Leandra Endam, MSc, Saud Al-Romaih, MD, Joaquin Madrenas, MD, PhD, Martin Desrosiers, MD, FRCSC
Montreal, Quebec

S. aureus is a frequently implicated pathogen in chronic rhinosinusitis (CRS). *S. aureus* may promote commensalism by triggering a TLR-2 dependent, PI3K/AKT mediated IL-10 response that downregulates pro-inflammatory T cell host responses. (Chau, 2009) This finding, coupled with the observation that *S. aureus* and CD8+ T cell numbers are inversely correlated in CRS mucosa, suggests that *S. aureus* may be locally modulating host immunity to elude destruction by inducing an IL-10-mediated host response. To support this hypothesis, we evaluated i) whether IL-10 levels differ in CRS compared to controls and ii) whether IL-10 levels correlate with *S. aureus* and CD8+ T cell levels. Surgical biopsy samples from 20 CRS patients and 10 controls underwent immunohistochemistry staining for IL-10, CD8+ T cells and *S. aureus*. Intensity of coloring was evaluated on a 5-point scale at 5 randomly selected mucosal fields and the mean calculated. Statistical analysis involved Student t-test and Pearson's correlation coefficient. Levels of IL-10 were significantly higher in CRS samples compared to controls (Epithelium: CTL=1.0, CRS=2.09, $p<0.05$; Glands: CTL=2.4, CRS=3.62, $p<0.05$). A strong inverse correlation was observed between subepithelial CD8+ T cell levels and IL-10 (intraepithelial: $r = -0.61$, intraglandular: $r = -0.52$). Intraepithelial *S. aureus* correlated moderately to intraglandular IL-10 levels ($r = 0.33$). Elevated IL-10 levels is a feature of CRS mucosa associated with a significant downregulation of host CD8+ T cell levels. The lack of a strong relationship between *S. aureus* and IL-10 levels suggests other bacterial species may induce IL-10 production as a common survival strategy in CRS.

1:47 pm**Clinical Features OF Cytotoxic CD8+ T-Lymphocytic Deficiency in CRS**

Nathalie Gabra, MS, Saud Alromaih, MD, MSc, Leandra Mfuna Endam, MSc, Martin Desrosiers, MD, FRCSC
Montréal, Québec

Background:

Identification of *Staphylococcus aureus* intracellularly in chronic rhinosinusitis (CRS) suggests an underlying cellular immunodeficiency. Supporting this, we have previously reported low CD8+ ('cytotoxic') T-lymphocyte lev-

els in a sub-population of CRS patients (Alromaih, 2011) and identified polymorphisms in the CD8A gene associated with CRS (Alromaih, 2013). In order to better understand the role of low CD8+ in CRS, we wished to determine the phenotype for CRS/low CD8+ in comparison to that of conventional CRS.

Methods:

Sixty-seven low CD8+ CRS patients identified during investigation of CRS and 480 CRS with nasal polyposis patients previously recruited for genetic studies were compared for demographics, disease evolution and bacteriology on endoscopic culture.

Results:

Mean level of CD8+ in the CRS/low CD8+ population was $0.15 \times 10^9/L$ ($N=0.20-1.5 \times 10^9/L$). There was no difference between both groups in terms of history of allergy, asthma, eczema, ASA intolerance or smoking. The bacteriology was similar between both groups (*S. aureus* : CRS/low CD8+ : 35 %; CRS 32 %, $p=0.643$). Evolution of disease was somewhat milder in CRS/low CD8+, with less patients requiring surgery, and first surgery performed at a more advanced age. However, antibiotic use was higher in CRS/low CD8+.

Conclusion:

Low CD8+ levels are often identified in CRS patients, however, these patients have disease remarkably similar to those with conventional CRS. This suggests that immune deficiency, whether systemic or locally mediated, is well tolerated and may be present in other forms in CRS. However, CRS patients with low CD8+ levels may occasionally benefit from antibacterial therapies.

1:54 pm**Contribution of Polymorphisms to Susceptibility to *Staphylococcus aureus* Colonization in Chronic Rhinosinusitis**

Leandra Mfuna Endam, MSc, Chantal Cormier, MD, Abdelali Filali-Mouhim, PhD, Pierre Boisvert, MD, Louis-Philippe Boulet, MD, Martin Desrosiers, MD
Montreal, Quebec

Introduction:

Staphylococcus aureus (*S. aureus*) has been implicated in the pathogenesis of chronic rhinosinusitis (CRS). Host factors contributing to susceptibility to *S. aureus* colonisation in CRS remain unknown. We wished to identify candidate genes possibly implicated with *S. aureus* colonization by using a pooled genome-wide association study (pGWAS) to identify single nucleotide polymorphisms (SNPs) associated with *S. aureus* colonisation in CRS.

Methods:

408 French-Canadian CRS patients with nasal polyposis (CRS_{NP}) were prospectively recruited in two tertiary rhinology clinics. Sinus culture was performed under endoscopic guidance. DNA was obtained from peripher-

al blood. A pGWAS compared DNA pools according to presence or absence of *S. Aureus* using the Illumina HumanHap 1M chip interrogating 1 million SNPs. High priority SNPs were selected according to bi-allelic differences and silhouette rank, and confirmed via individual genotyping using the Sequenom platform. PLINK software was used to test association. Ingenuity pathway analysis was used to identify disease-associated SNPs and signaling pathways, as well as identification of the underlying biological mechanisms.

Results:

39 top priority SNPs were selected for individual genotyping. 23 of 39 SNPs were associated ($p < 0.05$) with increased or decreased risk of *S. Aureus* colonization. These SNPs are located in 21 genes implicated in several diseases and involve canonical pathways including cell to cell signalling, cell growth and proliferation, macropinocytosis signalling, LPS-stimulated MAPK signalling, virus entry via endocytic pathways, and IL8 signalling.

Conclusion:

Our results suggest novel genetic factors influencing *S. Aureus* colonisation in CRSwNP. Identifying implicated mechanisms may offer new insights into pathogenesis of CRS.

2:01 pm

Osteitis is a Misnomer: A Histopathology Study in Primary Chronic Rhinosinusitis

Kornkiat Snidvongs, MD, Peter Earls, MD, Eleanor Pratt, Ms, Dustin Dalgorf, MD, Raymond Sacks, MD, Richard Harvey, MD
Sydney, NSW

Introduction:

The histological features of osteitis in chronic rhinosinusitis (CRS) in human studies differ from animal studies. Osteitis in animal studies induced by bacterial inoculation into maxillary sinuses revealed inflammatory involvement of the underlying bone matrix and/or the Haversian system, however none of human studies mentioned these findings. The objective of this study was to investigate the inflammatory characterization of osteitis in CRS.

Methods:

A cross-sectional study of consecutive primary CRS patients undergoing sinus surgery was conducted. Bony samples shown maximal thickness from computed tomography were collected. Histopathological examinations were bony inflammation, periosteal reaction, osteoblastic activity, osteoclastic activity, fibrosis and the percentage of woven bone.

Results:

Twenty-two primary CRS patients (age 45.8 ± 15.6 , 59.1% female) and 5 controls were recruited. Nine (40.9%), 11 (50%) and 2 (9.1%) were CRS without

polyps, CRS with polyps and allergic fungal rhinosinusitis respectively. None of bone samples of CRS (0%) have evidence of bony inflammation. All bone samples of CRS (100%) have osteoblastic activity together with woven bone formation. The correlations between the percentage of woven bone and periosteal reaction ($r=0.55$, $p=0.04$), osteoclastic activity ($r=0.55$, $p=0.04$) and fibrosis ($r=0.55$, $p=0.04$) were revealed. The mean percentage of woven bone was greater when the presence of osteoclast (83.75 ± 7.50 v 62.00 ± 27.61 , $p=0.04$) and fibrosis (75.42 ± 19.01 v 25.00 ± 7.07 , $p=0.002$).

Conclusion:

Osteitis or neo-osteogenesis was observed in all primary CRS and correlates with the formation of new woven bone, without inflammation of the bone. Osteitis is shown by this study a process of neo-osteogenesis and bone remodeling, rather than bony inflammation.

2:08 pm

Discussion/Q&A

2:15 pm

Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions

Moderator: Andy Lane, MD

Panelists: Rick Chandra, MD; PJ Wormald, MD; and a surprise guest panelist

2:45 pm

Break With Industry Partners - Regency E/F

Session Topic: Why should I care about Bitter Taste Receptors and Inflammation?

Moderators: Jeff Suh, MD and Troy Woodward, MD

3:15 pm

The Bitter Taste Receptor T2R38 is an Independent Risk Factor for Chronic Rhinosinusitis Requiring Sinus Surgery

Nithin Adappa, MD, Zi Zhang, MD, Robert Lee, PhD, David Kennedy, MD, James Palmer, MD, Noam Cohen, MD, PhD
Philadelphia, PA

Background:

The bitter taste receptor T2R38 was recently described to play a role in upper airway innate mucosal defense. When activated by bacterial quorum sensing molecules, T2R38 stimulates the ciliated epithelial cells to produce nitric oxide (NO) resulting in bactericidal activity and an increase in mucociliary clearance (MCC). Polymorphisms within the T2R38 gene (TAS2R38) confer variability in activation of the receptor yielding dramatically blunted upper airway defensive responses (NO and accelerated MCC) to microbial stimulation.

Objective:

Determine whether T2R38 polymorphisms, which render the receptor inactive, correlate with medically recalcitrant chronic rhinosinusitis necessitating surgical intervention in the context of known risk factors, and thus identify whether T2R38 genotype is an independent risk factor for patients undergoing Endoscopic Sinus Surgery (ESS).

Methods:

Patients undergoing primary ESS were genotyped for TAS2R38. Chi squared analysis was performed on the genotype distribution with respect to other risk factors including allergies, asthma, nasal polyposis, aspirin sensitivity, diabetes, and smoking exposure.

Results:

Seventy primary ESS patients were genotyped demonstrating a statistically significant skewing from the expected distribution of the general population ($p < 0.02$). T2R38 genotype did not correlate with any other risk factors associated with CRS.

Conclusion:

Our findings suggest that T2R38 genotype is an independent risk factor for patients failing medical therapy necessitating surgical intervention.

3:22 pm**Genetic Variations in Taste Receptors are Associated with CRS: A Replication Study**

Leandra Mfuna Endam, MSc, Abdelali Filali-Mouhim, PhD, Pierre Boisvert, MD, Louis-Philippe Boulet, MD, Yohan Bossé, PhD, Martin Desrosiers, MD
Montreal, Quebec

Introduction:

Recently, Lee et al. (J Clin Invest, 2012) has suggested that the T2R38 genotype represents a defining characteristic in respiratory innate defense that may contribute to the complex genetic and environmental interactions predisposing to chronic rhinosinusitis (CRS). The purpose of our study is i) to verify whether identified polymorphisms in taste receptors replicate within our existing population of patients with CRS ii) to identify other taste receptors potentially associated with CRS.

Methods:

Existing pooling-based genome-wide association studies (pGWAS) previously performed on two populations of Canadian CRS patients (GCRS1; refractory CRS and GCRS2; CRS with nasal polyposis) using the Illumina HumanHap 1M chip were screened for polymorphisms in taste receptor genes. SNPs were considered replicated when allelic frequency differences were $\geq 10\%$ in both case-control populations.

Results:

The previously identified T2R38 coding SNP

rs10246939 (I296V) was associated with CRS in both populations. Allele frequency difference compared to control subjects was 11.1% in GCRS1 and 15.1% in GCRS2. In addition, we also identified a previously undescribed coding SNP in the T2R13 gene (rs1015443) associated with CRS in both populations. Allele frequency difference compared to control subjects was 13.8% in GCRS1 and 14.1% in GCRS2.

Conclusions:

We replicate that the coding SNP rs10246939 of the T2R38 gene is associated with CRS. In addition, we suggest that the T2R13 taste receptor may also be implicated in CRS. Further studies using individual genotyping and sequencing will provide more information about the implication of this genetic variant in CRS.

3:29 pm**Molecular Characterization of a Mouse Model of Sinonasal Inflammation**

Murugappan Ramanathan, MD, Michelle Mendiola, BS, Tomefa Asempe, BS, Andrew Lane, MD
Baltimore, MD

Background:

Currently, few efficacious topical therapies exist for chronic rhinosinusitis. The lack of a reproducible mouse model of CRS limits the pilot testing of potential novel anti-inflammatory topical therapies. Although the ovalbumin induced mouse model of sinonasal inflammation is the most commonly used model, it is often difficult to reproduce and can generate variable histologic results. In this study, we explore a variation of this model in different strains of mice and explore various inflammatory cytokines as reproducible molecular markers of inflammation.

Methods:

The mouse model of allergic sinonasal inflammation was generated in BALB/c (n=12) and C56BL/6 (n=13) mice using 2 intraperitoneal high dose injections of Ova followed by 10 days of high dose intranasal sensitization. Control mice received saline. Real-Time PCR for eotaxin, IL4, and IL13 were measured from sinonasal mucosa. Histological sections were also cut and epithelial thickening was measured at the levels of the septum, inferior, and middle turbinates.

Results:

Both BALB/c and C56BL/6 mice consistently showed statistically significant increases in eotaxin, IL-4 and IL-13 after sensitization with high dose Ova ($p < 0.001$) when compared to controls. There were also statistically significant increases in epithelial thickening in Ova sensitized mice.

Conclusion:

Our variation of the ovalbumin induced mouse model of sinonasal inflammation in both BALB/c and C56BL/6 mice provides an excellent model for testing potential

topical anti-inflammatory therapies for CRS. The utilization of sinonasal mucosal eotaxin, IL4, and IL13 levels provides a consistent and quantifiable marker of inflammation in assessing the efficacy of candidate drugs.

3:36 pm

Causes of Failure in Endoscopic Frontal Sinus Surgery in Chronic Rhinosinusitis Patients

Constanza Valdes, MD, Mariana Bogado, MD, Mark Samaha, MD, MSc, FRCSC
Montreal, Quebec

Introduction:

The frontal sinus is the most challenging area to address in endoscopic sinus surgery (ESS). Incomplete surgery or iatrogenic injury in the small space of the frontal recess with synechia formation, can lead to persistence of disease. The goal of this study was to identify the causes of failure of endoscopic frontal sinus surgery and to determine complication rates.

Study design:

Cross-sectional retrospective study.

Methods:

Charts and preoperative sinus computed tomography (CT) scans of patients who underwent revision frontal ESS for chronic frontal rhinosinusitis, operated by the senior author (MS), in the McGill University Health Center between 2006 and 2012 were reviewed.

Results:

Of patients who underwent ESS during the study period, 740 had the frontal recess dissected and frontal sinus opened. Of these, 67 patients had revision surgery of the frontal sinus. Forty were male (59.7%) with a mean age of 52 years (SD 12.9). A total of 114 frontal sinuses were included in the analysis as 20 patients had unilateral frontal sinus surgery. The most common findings were: edematous or hypertrophic mucosa (72.8%); retained Ager Nassi cell (64%); neosteogenesis within the frontal recess (37.7%); lateral scarring of the middle turbinate (37.7%); residual anterior ethmoid air cell (26.3%) and residual frontal cells (23.3%).

Conclusions:

With the exception of mucosal disease, all identified causes of failure of frontal sinus surgery are a result of surgical technique. Careful preoperative planning and meticulous and complete surgical execution are therefore critical for a successful surgical outcome in primary frontal sinus surgery.

3:43 pm

Discussion/Q&A

Session Topic: Disease Etiology and Progression

Moderators: Zach Soler, MD and Erin Wright, MD

3:50 pm

The Fate of Chronic Rhinosinusitis Sufferers after Maximal Medical Therapy

Campbell Baguley, MD, Amanda Brownlow, MD, Kaye Yeung, MD, Ellie Pratt, MD, Raymond Sacks, MD, Richard Harvey, MD
Wellington

Background:

Many chronic rhinosinusitis (CRS) treatment regimes revolve around 'one off' maximal medical therapy (MMT) protocols and although many patients initially respond, long-term control is unpredictable. The value of imaging, endoscopy and patient progress after MMT for CRS is assessed.

Methods:

Patients with computed tomography (CT)-confirmed CRS were recruited at a tertiary rhinology clinic. All patients received a 3-week oral prednisone course as part of their MMT. Pre and post-treatment nasal symptoms scores (NSS), quality of life (SNOT-22), and CT (Lund-Mackay (LM)) scores were recorded along with post MMT endoscopy status.

Results:

86 patients (38% female, age 46±13yrs) met inclusion criteria. Pre and post MMT LM scores were 10.9±5.3 and 8.3±5.5. Follow-up post MMT was 10 (IQR 17) months. At initial post MMT review, 50% were symptomatic with persistent radiologic disease ('symptomatic CRS'), 14% were asymptomatic with no radiologic disease ('resolved CRS'), 24% were asymptomatic with persistent radiologic disease ('asymptomatic CRS') and 12% were symptomatic with no radiologic disease ('alternate diagnosis'). Pre-MMT NSS and SNOT-22 were similar among groups. The 'asymptomatic CRS' group had the highest age (52 ± 11 yrs, p=0.07). The 'alternate diagnosis' group had the lowest initial LM scores (5.2±2.9, p=0.001). Of the 'asymptomatic CRS' patients, 43% relapsed between 3 and 23 months post MMT and 29% eventually underwent surgery.

Conclusion:

Although MMT for CRS achieved symptomatic relief in 38% patients, objective evidence of disease was associated with clinical relapse. The concept of 'control' of long term inflammatory burden needs to be considered.

3:57 pm

The Role of Second Hand Smoke in Sinusitis: A Systematic Review

Jonathan Liang, MD, Sandra Lin, MD, Kevin Hur, MD
Baltimore, MD

Objective:

To systematically review existing literature on the asso-

ciation between sinusitis and secondhand smoke (SHS) exposure.

Methods:

We performed a literature search encompassing the last 25 years in PubMed, Embase, and Cochrane CENTRAL. Inclusion criteria included English language papers containing original human data and the number of subjects = 7. Data was systematically collected on study design, patient demographics, clinical characteristics/outcomes, and level-of-evidence (Oxford Center of Evidence Based Medicine). Quality assessment of the studies was performed using the Newcastle-Ottawa scale. Two investigators independently reviewed all manuscripts.

Findings:

The initial search yielded 116 abstracts, and 19 articles met inclusion criteria. Twelve (63.2%) of the 19 articles showed a statistically significant association between sinusitis and SHS. Twelve studies did not differentiate between acute or chronic sinusitis. Seven (36.8%) studies specifically evaluated chronic sinusitis, and 5 (71.4%) of these demonstrated a significant association with SHS. All articles were case-control studies (Level 3b). For characterizing sinusitis, 6 (31.6%) studies included either CT or endoscopy in the diagnostic criteria, with 4 of those studies following Rhinosinusitis Taskforce Guidelines. All studies used questionnaires to assess SHS, with 2 (10.5%) articles also reporting cotinine levels.

Conclusions:

The majority of studies (63.2%) in this systematic review showed a significant association between sinusitis and SHS, with an even higher percentage (71.4%) of chronic sinusitis studies demonstrating a significant link. Further higher quality studies following recognized definitions of sinusitis, and better quantification of SHS exposure would be useful to further evaluate the relationship between sinusitis and SHS.

4:04 pm

Osteoblast Cultures from Patients with Chronic Rhinosinusitis Differ in Cellular Properties from Normal Bone

Patrick Stevens, MD, Belachew Tessema, MD, Seth Brown, MD, MBA, Kourosh Parham, MD, PhD, Gloria Gronowicz, PhD
Hartford, CT

Introduction:

Osteitis, characterized by bony thickening and remodeling, is often thought to be a hallmark of recalcitrant sinusitis. However, there is a limited amount of literature examining the bone in chronic rhinosinusitis pathology. In this study we grew osteoblast cultures from bone harvested during surgery for chronic sinusitis as well as from non-diseased controls to compare their cellular properties.

Methods:

Sinus bone was collected during sinus and skull base surgery and placed in proliferation media. Outgrowth of cells occurred at 2 weeks and primary osteoblast culture was confirmed by alkaline phosphatase staining. Cellular adhesion was determined by replating 10,000 cells/cm² and counting adhered cells at 4 hours. Proliferation of cells plated for 24 hours was assayed by measuring [3H]-thymidine. Calcium content was measured by changing cells to differentiation media with ascorbic acid.

Results:

Alkaline phosphatase staining showed a majority of osteoblasts in all samples. Osteoblasts from patients with chronic rhinosinusitis had significant decreases of 44% in adhesion ($p < 0.05$) and 11% (> 0.05) in proliferation compared to osteoblasts from skull base patients. Chronic rhinosinusitis patients without polyps showed a more profound decrease in proliferation of 34% ($p < 0.05$) of controls. No significant difference was found in mineralization between any of the samples.

Conclusions:

This is the first study to date that shows a direct comparison of osteoblast properties between patients with and without chronic rhinosinusitis. Our results indicate that there are fundamental phenotypic differences between osteoblasts in patients with chronic rhinosinusitis compared to controls.

4:11 pm

Porcine Nasal Epithelial Cultures for Studies of Cystic Fibrosis Sinusitis

Presented by: Nichole Dean, DO

James Phillips, MD, Elisa Illing, MD, Shaoyan Zhang, PhD, Dan Skinner, BS, Neel Ranganath, BS, Bradford Woodworth, MD
Birmingham, AL

Background:

Transgenic cystic fibrosis (CF) murine models do not develop spontaneous lung and sinus disease, two major causes of morbidity in human CF patients. Because of these limitations, pig transgenic CFTR^{-/-} animals have been developed and are currently being characterized. These CF animal models have phenotypes more closely resembling that of human CF subjects. The objectives of the current experiments were to develop primary porcine nasal epithelial (PNE) cultures and evaluate their usefulness as a model of sinonasal transepithelial transport and CFTR function.

Methods:

PNE derived from the septum or turbinates of WT and CFTR^{-/-} pigs were cultured at an air-liquid interface to confluence and full differentiation. Epithelial monolayers were mounted in Ussing chambers to investigate pharmacologic manipulation of ion transport. Ciliary

beat frequency (CBF) and scanning electron microscopy of monolayers were used to indicate degree of ciliation and cell differentiation.

Results:

Stimulation of CFTR-mediated anion transport (I_{sc} in $\mu A/cm^2$) was significantly greater in epithelia derived from the septum when compared to turbinates (33.04 ± 1.17 vs. 18.9 ± 0.73 , respectively; $p < 0.001$). CFTR-mediated Cl^- secretion was absent in CFTR $^{-/-}$ epithelia. Calcium-activated Cl^- (CaCC) secretion was also increased (2.3 ± 0.08 vs. 0.76 ± 0.16 , respectively; $p < 0.001$), however, overall Cl^- transport through CaCCs was very low. Degree of ciliation (90%) and CBF were similar among groups.

Discussion:

Septal PNE exhibit a robust ion transport phenotype and indicate CFTR $^{-/-}$ sinus disease could be attributable to diminished alternative pathways for Cl^- transport. Overall, PNE have similarities to human respiratory epithelia not demonstrated in murine cells and represent useful in vitro models for studying CF sinus disease.

4:18 pm**Discussion/Q&A**

4:25 pm**Panel: On the Cutting Edge: Translation to Clinical Problems and Solutions**

Moderator: David Poetker, MD

Panelists: Eric Holbrook, MD, Douglas Reh, MD

5:00 pm**Closing Remarks and Meeting Adjourned**

POSTERS

#1

Ability Of Endoscope Sheaths To Decrease Risk Of Thermal Injury From Nasal Endoscopes

John Craig, MD, Parul Goyal, MD
Syracuse, NY

Introduction:

Elevated temperatures at the tips of rigid nasal endoscopes can cause thermal injury if tissue temperatures exceed 40 °C. Scope irrigation sheaths are generally used to improve intraoperative visualization, but may also decrease risk of thermal injury. This study assessed the ability of sheaths to insulate against dangerous scope tip temperatures.

Methods:

A 4-mm 0° rigid nasal endoscope was used with LED and Xenon light sources (400W LED, 300W and 175W Xenon) to assess the scope tip temperature before and after endoscope sheath placement. Peak scope temperatures were measured using a noncontact infrared thermometer. Temperatures were assessed again after placement of plastic and metal sheaths, before and after active saline irrigation.

Results:

The unsheathed rigid scope tip reached a maximal temperature after 10 minutes at 100% light source intensity. 400W LED and 300W Xenon sources generated potentially dangerous scope tip temperatures exceeding 42°C, while the 175W Xenon source never generated a maximal temperature over 32.6°C. After placement of plastic and metal sheaths, mean scope tip temperatures were decreased by 2°C (4.8%) and 2.2°C (5.5%), respectively. After active saline irrigation, mean scope tip temperatures were decreased by 5.1°C (12.6%) and 5.2°C, (12.8%) respectively.

Conclusions:

With modern light sources, nasal endoscopes have the potential to reach temperatures that may cause thermal tissue injury. Endoscope sheaths lead to modest decreases in scope temperatures, and the effect is greater with active irrigation. In addition to improving visualization, use of endoscope sheaths may decrease the risk of thermal tissue injury.

#2

Achromobacter in an Immunocompetent Patient with Chronic Rhinosinusitis and Frontal Mucocele Formation

Zara Patel, MD, Timothy Ryan, MD, Atlanta, GA

Introduction:

The bacteriology of chronic rhinosinusitis (CRS) is a

well-studied topic, yet it is constantly evolving.

Achromobacter species have thus far been encountered in the context of Cystic Fibrosis (CF) and nosocomial infections concerning neonates, burn victims, and other immunocompromised patients. We report a case of an immunocompetent patient with CRS and frontal mucocele, demonstrating two separate Achromobacter strains on culture. .

Methods:

Single case report with literature review

Results:

Two different strains of Achromobacter were seen on subsequent surgical frontal sinus cultures, both with antibiotic resistance. The first culture showed 1+ growth of Achromobacter xylosoxidans and antibiotic resistance to Aztreonam, Cefepime, Gentamicin, and Tobramycin. The second culture showed 1+ growth of Achromobacter denitrificans with antibiotic resistance to Aztreonam, Cefepime, Gentamicin, Tobramycin, and Trimethoprim-Sulfamethoxazole.

Conclusion:

To our knowledge, there have been no reports in the existing literature of Achromobacter species causing CRS in an immunocompetent individual. The culture growth and sensitivities showed similar patterns that until now have only been seen in chronic infection of CF patients or immunocompromised patients. The bacteriology of immunocompetent patients with CRS has shifted gradually over the last two decades, first to include Pseudomonas species, now a commonly encountered pathogen, and more recently to include newer gram negative bacteria, such as Stenotrophomonas. Now we present Achromobacter as another possible suspect. It is paramount that otolaryngologists be aware of this constant evolution in bacteriology, take cultures in their CRS patients, and have proper speciation and sensitivities for appropriately directed antimicrobial treatment.

#3

Allergic Fungal Rhinosinusitis and Fungus Sinus Ball: Characteristics, Intermediate and Long Term Outcomes of Surgery and Adjunctive Treatments

Umang Khetarpal, MD
Brownsville, TX

Objectives:

To compare and contrast clinical and radiological presentations of AFRS and Fungus sinus ball (FSB) and their treatment responses as well as recurrence rates. To use this data for comparative analysis with CRSwNP and EMRS.

Study design:

Literature review and retrospective analysis of 40 surgically treated patients with FSB and AFRS treated over the past 10 years in a private community practice setting.

Methods:

Analysis of clinical, radiological and operative findings, as well as responsiveness to surgery as well as steroids, immunotherapy, oral and intranasal antifungals.

Results:

FSB can occur in more than one sinus simultaneously and responds very well to surgery. Maxillary and sphenoid sinuses are the most common locations. AFRS can be unilateral or bilateral, generally with higher IgE levels and significantly more discolored mucin than in EMRS or CRSwNP. *Bipolaris* and *Curvularia* were the most common fungi isolated. Recurrence rates for early AFRS are low whereas those for more diffuse AFRS are significantly higher despite immunotherapy, oral and intranasal steroids, intranasal or oral antifungals.

Conclusions:

AFRS appears to be a different from CRSwNP. The exact role of fungus in CRS remains unclear and in some cases even in recurrent AFRS. Clinical features may be distinguishable between EMRS, AFRS and CRSwNP but disease recurrence (especially polyposis) is high especially in diffuse disease despite surgery and adjunctive treatment options. Fungal, allergy and super antigen hypotheses will be analyzed in the context of this data.

#4**Ambulatory Interstitial Endoscopic Diode Laser Turbinoplasty**

Hazem Saleh, MD
Dokki, Guiza

Surgery is indicated for chronic nasal obstruction due to inferior turbinate hypertrophy once medical therapy fails. Laser induces comparable results to conventional techniques. Laser induced submucosal scarring obliterates the venous sinusoids. To assess the feasibility and subjective outcome of interstitial Diode Laser Turbinoplasty, under local anaesthesia and video-endoscopic guidance, a prospective non controlled pilot study included 8 patients (4 males, 4 females, mean age 27 years, range 19-43 years), suffering from nasal obstruction due to inferior turbinates hypertrophy. Patients with infection, polyps, severe septal deviation or previous nasal surgery were excluded. Turbinoplasty was performed using Diode laser (980 nm wavelength, continuous-wave mode, output power 5-7 W). Laser was applied interstitially after introducing the 600 µm fiber via a small mucosal incision on the head of the turbinate. Retrograde photocoagulation was performed while withdrawing the fiber. Patients were followed-up for at least 1 year. Subjective rating was done after 1, 6 and 12 months. The questionnaire investigated complications (postoperative pain, bleeding, and infections) and changes in nasal obstruction by choosing between: deterioration, no change, temporary improvement, or constant improvement. 80% of patients described a

constant improvement of the nasal airflow, with early worsening during the first month. No acute complications occurred. During follow up, there was no synechia, dryness or crusting. Ambulatory Interstitial Endoscopic Diode Laser Turbinoplasty can be a cost effective, time saving outpatient procedure for the treatment of inferior turbinates hypertrophy. However, it would be necessary to perform a prospective, randomly assigned trial for this method.

#5**An Adjunctive Method for Repair of Oronasal Fistula - the Inferior Turbinate Flap**

Toby Steele, MD, Quang Luu, MD, Christopher Le, MD
Sacramento, CA

Introduction:

Oronasal fistulas in conjunction with persistent alveolar clefts are common sequelae following cleft lip and palate surgery. Furthermore, repair of the secondary oronasal fistula or alveolar cleft represents a surgical challenge, as the tissue needed to re-close the defect may be friable, scarred, and less amenable to repositioning. We describe the harvest and inset of both anterior and posteriorly pedicled inferior turbinate flaps for the reconstruction of an oronasal fistula.

Methods:/Materials:

At the UC Davis Anatomic Dissection Lab, endoscopic dissections were performed on 6 cadaveric turbinates. Three anteriorly pedicled turbinate flaps were raised along with three posteriorly pedicled inferior turbinate flaps.

Results:

Similar to previous studies on inferior turbinate flaps, the average length of the turbinate flap was 5cm with an average width of 2cm. The flap was found to be malleable and easily reoriented into either the nasal floor to provide additional layer of tissue closure or rotated inferiorly to provide additional tissue coverage over the alveolus. The posteriorly based inferior turbinate flap is capable of reaching an anterior limit of the incisive foramen and is suitable for defects posterior to this.

Conclusion:

Scarring secondary to previous operations may lead to poor tissue movement and hinder repair of the oronasal fistula. Alternative methods of repair have been reported in the literature, including temporoparietal fascial flap, and even microvascular free tissue transfer. Though adequate in tissue, the alternative flaps do not closely resemble the original nasal mucosa. The inferior turbinate flap represents an alternative method for closure.

#6**Analysis of the Medial Rectus in Patients with and without Graves' Disease: an Endonasal Endoscopic Perspective.**

Jeffrey Suh, MD, Christopher Thompson, MD,
Henry Barham, MD, Aaron Feinstein, MD,
Vijay Ramakrishnan, MD
Los Angeles, CA

Introduction:

Injury to the medial rectus (MR) is a potentially devastating complication of endoscopic orbital and sinus surgery. Precise knowledge of the MR location relative to the lamina papyracea (LP) is important during surgery for Graves' ophthalmopathy and ESS. The objective of this study is to determine the location of the MR in relation to multiple easily identified and frequently encountered intranasal landmarks in patients with and without Graves' disease.

Methods:

High resolution CT scans were analyzed in 100 controls and 63 patients with Graves' disease. The position of the MR was recorded relative to the location of the 1) maxillary sinus ostium (MSO) 2) anterior ethmoid artery (AEA) 3) posterior ethmoid artery (PEA)/horizontal segment of the basal lamella. Clinically relevant variables recorded for analysis included: Keros stage, AEE location, MR length, and distance of the MR to orbital floor (OF), skull base (SB), and LP.

Results:

The mean distances between the MR and LP for controls at the MSO, AEA, and PEA were 2.78mm, 1.52mm, and 0.91mm. Mean distances for Graves' patients were 2.50mm, 1.51mm, and 0.68mm. There was no significant differences in ethmoid cavity width ($P < 0.05$) between controls (9.83mm) and Graves' patients (9.71mm). Distances between MR and SB/OF were greater in controls all at locations ($P < 0.05$).

Conclusions:

This study demonstrates the anatomy of the MR from the perspective of an endoscopic surgeon. Knowledge of the position of MR is critical to safely perform decompression surgery, and when operating adjacent to the LP during endoscopic sinus and skull base surgery.

#7**Anterior Clinoid Mucocoeles and Visual Field Defects: Role of Endoscopic Surgery**

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Naveen Bhandarkar, MD
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Objective:

Mucocoele formation in a pneumatized anterior clinoid process (ACP) is a rare but serious event that may present with loss of vision due to optic nerve compression. We present two cases of ACP mucocoeles resulting in visual field defects (VFD) treated successfully with endoscopic sinus surgery (ESS).

Methods:

Case series with retrospective chart review.

Results:

Patient 1: A 51 year old man with a history of traumatic left optic neuropathy was diagnosed with a right superior nasal VFD on routine ophthalmic examination. Imaging studies demonstrated a mucocoele of the right ACP with compression of the medial right optic nerve. The patient underwent right ESS with marsupialization of the mucocoele. Postoperatively, there has been near complete resolution of VFD with four year follow-up. Patient 2: A 57 year old man presented after developing intermittent blurry vision and a sense of pressure behind his left eye. He was found to have a cystic lesion involving the left ACP on a magnetic resonance imaging. Ophthalmic examination noted a superior nasal VFD. The patient underwent left ESS with marsupialization of the ACP mucocoele. Postoperatively, he noted subjective resolution of the pressure and visual impairment with six month follow-up.

Conclusions:

Mucocoeles of the ACP may result in loss of vision. Early recognition and treatment may prevent permanent vision loss and can result in resolution of VFD. Endoscopic marsupialization of these lesions is a viable and effective treatment option.

#8**Balloon Catheter Dilation in Office: Analysis of 513 Patients from a US Administrative Claims Database.**

Michael Sillers, MD, Kristopher Lay, MD,
Chantal Holy, PhD
Birmingham, AL

Introduction:

Evidence exists describing the safety, efficacy and long-term clinical benefits of balloon catheter dilation (BCD) for chronic rhinosinusitis (CRS). However, fewer publications have described BCD as a standalone procedure in the office. Using one of the largest US-based administrative claims databases, we evaluated comorbidities, postoperative complications, reoperations and health-care resource use of patients following in-office BCD.

Methods:

The MarketScan claims database was queried for patients undergoing BCD (CPT31295-31297) since 2011 in the office care setting. Exclusion criteria included <2 years preoperative enrollment, <6 months post-

operative history, or concurrent (+/- 30 days) endoscopic sinus surgery with traditional instrumentation. Analyses included preoperative comorbidities, index procedures, postoperative complications and revisions, pre- and postoperative CRS-related outpatient and inpatient history and drug utilization.

Results:

513 patients with CRS were included. Key comorbidities included asthma (29% of all patients), polyps (11%) and aspirin sensitivity (9%). On average, patients underwent 2.03 procedures per surgery. Maxillary, frontal and sphenoid dilations were performed in 90%, 76% and 39% of all surgery, respectively. Thirty-one additional sinus surgeries (28 of which being revisions of treated sinuses) were conducted at an average 7.6 months post-index. Three orbital complications and 8 cases of hemorrhage were reported (no CSF leaks). Outpatient and drug use declined significantly postoperatively vs. preoperatively.

Conclusions:

BCD in office is currently performed in patients with comorbidities such as polyps, asthma and aspirin sensitivity and is associated with low rates of adverse events and revisions. Decline in drug and procedural use post-operatively suggests that BCD effectively reduces patient's healthcare needs.

#9

Carotid Pseudoaneurysm from a Nasal Foreign Body Presenting as Epistaxis

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Maywood, IL

Introduction:

Epistaxis is commonly seen by the otolaryngologist and is often easily treated, but can also be life-threatening. Massive epistaxis may ensue following injury to nearby critical vasculature. Pseudoaneurysms of the carotid artery may present with sentinel bleeds, an ominous sign, prior to massive hemorrhage.

Methods:

Case report and literature review.

Results:

A 58 year old male presented to an outside hospital with spontaneous epistaxis. He denied trauma and prior episodes and was not anticoagulated. Hemoglobin upon admission was 7.0. Packing was attempted but the patient continued to ooze and required 4 units of blood. A CT scan was obtained and an 8 cm tapered foreign body was seen traversing the nasal septum into the parapharyngeal space adjacent to the internal carotid artery. The patient was subsequently transferred and was emergently taken to the operating room for intubation prior to planned angiography. Upon attempted intu-

bation the patient began to massively hemorrhage from his nose and oral cavity. An emergent tracheotomy was performed and the oropharynx, nasopharynx and nasal cavity were packed off. The patient was taken to the angiography suite where a carotid pseudoaneurysm was seen and successfully stented. The object was subsequently retrieved in the operating room with no further bleeding.

Conclusion:

The nose and sinuses are surrounded by critical vascular and neural structures. Pseudoaneurysms of the carotid artery may cause life threatening hemorrhage but may be preceded simply by epistaxis. Airway protection and angiography are prudent in the setting of suspected carotid injury.

#10

Cavernous Carotid Artery Pseudoaneurysm Formation Secondary to Invasive Fungal Sinusitis

Jeffrey Hotaling, MD, Kevin Welch, MD
Maywood, IL

Objectives:

To present a rare case of cavernous carotid artery pseudoaneurysm formation secondary to invasive fungal sinusitis and to briefly review the literature regarding this rare complication.

Methods:

Case report and review of literature

Results:

A 74 year-old male with a history of AML s/p induction chemotherapy developed refractory sinusitis with MRI findings suspicious for invasive fungal sinusitis. ESS revealed non-invasive Aspergillus. Outpatient follow-up weeks later revealed a fixed right globe, and MRI/MRA demonstrated a pseudoaneurysm of the right cavernous carotid artery which was treated with endovascular stenting. Follow-up CT demonstrated significant bony erosion in the sphenoid bone and bedside endoscopic examination demonstrated purulence in bilateral sphenoid sinuses. The patient was then taken back to the operating room for debridement where endoscopy demonstrated purulence and necrosis of the sphenoid bone. Multiple dehiscences were identified. The area was debrided and pathology revealed invasive Aspergillus in the sphenoid, ethmoid, and pterygopalatine fossa regions.

Conclusions:

Infectious pseudoaneurysm of the right cavernous carotid artery is an extremely rare and often fatal complication of invasive fungal sinusitis with less than 15 cases reported in the literature. This case emphasizes both the destructive nature of Aspergillus sinusitis as well as suggests the necessity for early diagnosis and intervention in suspected intracranial carotid artery pseudoaneurysms.

#11**Cetuximab-Induced Hypersensitivity Reaction May Be Reduced by Pre-Medication with Albuterol, Famotidine and Hydrocortisone and Predicted from Pre-Treatment Patient Variables Including Drug Allergy, Peripheral Eosinophils, and Race**

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Saint Louis, MO

Background:

Cetuximab is the only targeted therapy approved for SCCHN. Hypersensitivity reaction (HSR) is the most serious adverse effect and is common in our geographical area. Little is known about what factors associate with risk for HSR and what pre-medications may reduce the risk.

Methods:

We conducted a single institution retrospective review of 115 patients with SCCHN given cetuximab. All patients were pre-medicated with diphenhydramine and some with additional agents. Dichotomous variables were compared using the chi-square or Fisher's exact tests, and continuous variables were compared using the Student's t-test.

Results:

HSR occurred in 28 patients (24.3%) and was distributed equally between low (1,2) and high grades (3,4) (Hi-HSR). Pre-medications associated with a lower risk of HSR (all Grades) included: albuterol inhaled (18.2% vs. 45.8%, $P=0.005$), famotidine (16.1% vs. 32.1%, $P=0.047$), and hydrocortisone (20.2% vs. 44.4%, $P=0.037$). These pre-medications also associated with a lower risk of Hi-HSR. Dexamethasone did not affect the risk of HSR. Pre-treatment patient variables associated with a higher risk of HSR were drug allergy history ($P=0.04$) and peripheral blood eosinophils $>3\%$ ($P=0.03$). African-American race was associated with a lower risk of HSR ($P=0.02$). 21 patients who developed HSR that rapidly resolved with therapy were re-challenged and 17 of these patients safely tolerated the drug without recurrent HSR.

Conclusion:

Pre-medication with albuterol, famotidine, and hydrocortisone associate with a lower risk of HSR due to cetuximab. Pre-treatment variables (drug allergy, peripheral eosinophils, and race) may be useful to select patients at different risks for HSR.

#12**Clinical and Radiologic Findings in a Case Series of Maxillary Sinusitis of Dental Origin (MSDO)**

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Background:

Maxillary sinusitis of dental origin (MSDO) has been described for decades, but tends to be overlooked as a possible cause of chronic sinusitis by both clinicians and radiologists. The incidence of MSDO in published series is reported to be from 10-40% in bacterial sinusitis. We present this series to highlight clinical and radiologic indicators of MSDO.

Methods:

Databases from the authors' Otolaryngology and Endodontic practices were reviewed to identify patients who had been seen mutually. Sixty-seven (67) patients were identified. Both authors then reviewed the clinical records and associated radiographs and determined that 33 (49%) had MSDO. The clinical and radiologic features related to these patients were then tabulated.

Results:

The clinical characteristics of the 33 patients with MSDO were as follows: Sinus pain (88%), post-nasal drainage (64%), congestion (45%), maxillary toothache (39%), and foul drainage (15%). Radiographic findings of MSDO showed periapical abscess in 48%, with other radiographic findings showing prior root canal therapy, loss of bone, fistula and periodontal disease. Two cases had no radiologically apparent dental disease. The extent of associated sinusitis was variable from mucoperiosteal thickening to florid unilateral sinusitis involving multiple sinuses. Thirteen (13) patients were found to have either a patent maxillary infundibula or a prior surgical antrostomy.

Conclusions:

MSDO should be considered likely when obvious dental pathology is associated with maxillary sinus disease. Unilateral maxillary (or more extensive) sinus disease associated with a patent infundibula should raise the suspicion of MSDO.

#13**Combined Endoscopic Endonasal and Bifrontal Craniotomy Approach for Treatment of Pediatric Intranasal Meningoencephalocele**

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Introduction:

Congenital meningoencephaloceles of the anterior skull base are rare entities. Traditionally, these defects were repaired with an open craniotomy approach, though advances in endoscopic endonasal techniques have allowed for successful endoscopic repair. We report the resection of an anterior skull base meningoencephalocele with a combined open bifrontal craniotomy and endonasal endoscopic approach in a pediatric patient.

Methods:

Case report

Results:

A 12 month-old healthy boy was referred for a 5 month history of an enlarging external right nasal mass. The patient's mother reported lifelong clear right-sided nasal drainage, previously diagnosed as sinusitis without improvement with intranasal steroid sprays and antibiotics. The patient had no history of meningitis or fever requiring hospitalization. An MRI demonstrated a right-sided 3.1 x 2.4 x 1.2 centimeter nasoethmoidal encephalocele extending through the foramen cecum into the anterior nasal cavity, causing mass effect on the nasal septum and right nasal bone. The patient underwent a combined endonasal endoscopic approach and bifrontal craniotomy to remove the meningoencephalocele and repair the 6mm x 6mm anterior skull base defect. A pericranial flap was placed from above and a temporalis fascia graft was placed from below. The patient did well following surgery with no evidence of CSF leak at his 6 month follow-up visit.

Conclusion:

Combined superior and inferior treatment of the skull base defect may reduce the risk of a persistent skull base defect and the need for a subsequent repair compared to either an open or an endoscopic approach alone, an important consideration in young pediatric patients.

#14**Comparison of L-strut Preservation in Endonasal and Endoscopic Septoplasty: a Cadaveric Study**

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Introduction:

Preservation of an adequate cartilaginous L-strut to prevent complications of septoplasty has been long recognized as critical. However, no previous study has examined the dimensions of the L-strut that remain after septoplasty. We hypothesized that differences in exposure and visualization between endoscopic and endonasal techniques would result in differences in preserved L-strut dimensions. We designed this study to determine L-strut dimensions after performance of septoplasty with endonasal and endoscopic technique.

Methods:

We performed a cadaveric study with 24 heads randomly assigned to undergo endonasal vs. endoscopic septoplasty. Removal of the skin-soft tissue envelope and mucoperichondrium was performed after septoplasty to permit direct measurement of the L-strut. Minimum and maximum widths were recorded for the caudal and dorsal segments; a single measurement was recorded for the width at the anterior septal angle. Statistical analysis was performed with a two-tailed student's t-test.

Results:

There was no significant difference in caudal or anterior septal width between endonasal and endoscopic techniques. There was a statistically significant difference in dorsal segment width for both minimum and maximum values, with endoscopic technique resulting in a narrower dorsal segment than endonasal technique (mean minimum value of 10.8 mm vs. 13.2mm, respectively [$p=0.03$], and mean maximum value of 12.6mm vs. 16mm, respectively [$p=0.01$]).

Conclusion:

Differences in exposure and visualization between endoscopic and endonasal septoplasty techniques may result in differences in preserved L-strut dimensions. Care should be taken with endoscopic technique to prevent overly aggressive resection of septal cartilage.

#15**Comparison of Outcomes by Reconstructive Method of the Endoscopic Approach to Lateral Sphenoid Encephaloceles in Sternberg's Canal**

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Brent Senior, MD, Adam Zanation, MD
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Objectives:

Cerebrospinal fluid leaks (CSF) originating from the lateral sphenoid sinus can be challenging to treat endoscopically, and method of repair ranges from indirect fat obliteration to direct repair with mucosal grafts, inlays, or nasoseptal flaps (NSF). Success rates of these methods vary throughout the literature in small case series. Here we present our experience with a specific comparison of direct vs. indirect repair.

Methods:

Retrospective chart review for all patients who underwent endoscopic encephalocele repair from 2000-2012. Rate of recurrence between direct (resection of encephalocele with approximation of graft or flap to denuded bone defect) and indirect (obliterative) methods of repair were compared using Student's T-Test.

Results:

Twenty out of 126 patients who underwent encephalocele repair from 2000-2012 were found to have lateral sphenoid encephaloceles (1 male, 19 female; ages 40-74). These patients underwent a total of 26 operations (5 recurrences and 1 new leak). Etiologies of these encephaloceles were spontaneous in 17 patients and non-spontaneous/traumatic in 3(15%). Methods: of direct repair included NSF (n=7), duragen (n=1), alloderm and fat (n=2), bone and fat (n=1), mucosa (n=3) or mucosa and fat (n=4) grafts. The remaining patients underwent indirect repair with fat obliteration (n=8). Lumbar drains were placed intra-operatively in 16 of 26 cases. Four CSF recurrences occurred following indirect repair versus one recurrence after direct repair ($p=0.05$). Complication rates were the same between groups, and no patients

suffered from meningitis post-operatively.

Conclusions:

Lateral sphenoid encephaloceles can be successfully repaired endoscopically. Direct methods of repair provide superior reconstructive outcomes.

#16

Complex Anatomy of the Sphenoid Sinus: A Radiographic Study

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Objectives:

Nasal endoscopic approaches to the sphenoid sinus are challenging. Variations in septation, shape, and dimensions critically impact surgical planning of the skull base. Previous anatomical studies have small numbers and limited description of this complex structure. The present study is a radiographic analysis of the contents and dimensions of the sphenoid sinus.

Study Design:

Anatomic study utilizing computed tomography.

Methods:

High-resolution surgical-guidance CT images of the sinuses from 90 patients at a tertiary care medical center between 2002 and 2007 were studied. Axial and sagittal images were analyzed to determine the septation and dimensions of the sphenoid sinus. Multiple anatomical measurements were obtained and analyzed with imaging and statistical software.

Results:

Of the 90 patients studied, 9% had a presellar sinus, 37% were sellar, and 54% were postsellar. 4% of patients lacked a septum, 3% of patients had two complete septa, 8% had a septum that diverged posteriorly, and 83% had a single septum. Of the septa, 34% involved the bony covering of the carotid artery. The average presellar width of the sinus was 1.3 cm (0.4-2.5). The average presellar depth of the sinus at the midline was 1.4 cm (0.4-2.6). The average infrasellar depth of the sinus at the midline was 2.6 cm (0.6-4 cm).

Conclusions:

Approaching the skull base through the sphenoid sinus requires a tailored process based on anatomy. Septal involvement of the carotid artery occurs frequently. Pneumatization patterns are potentially disorienting, and awareness of its posterior and lateral extensions is critical.

#17

Complications from Office-Sclerotherapy for Epistaxis Due to Hereditary Hemorrhagic Telangiectasia (HHT or Osler-Weber-Rendu)

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Minneapolis, MN

Background:

The aim of this study is to identify and evaluate adverse clinical outcomes following office-based sclerotherapy using sodium tetradecyl sulfate (STS) for epistaxis due to hereditary hemorrhagic telangiectasias (HHT or Osler-Weber-Rendu).

Methods:

A retrospective chart review of 36 adult patients treated with STS sclerotherapy for severe and/or recurrent epistaxis due to HHT was performed.

Results:

A total of 153 separate treatment sessions were analyzed. Each patient underwent an average of 4.3 sessions with an average of 7 intranasal injections per session. Bleeding during the procedure was experienced by 8 patients with a maximum reported blood loss of 200 cc in one patient, but less than 50 cc in all others. Seven patients reported some post-injection pain, which included nasal, cheek, and eye pain. Nasal congestion, sneezing and vasovagal responses were each noted to occur two times. No complications of post-procedural visual loss, deep venous thrombosis/pulmonary embolus, TIA/stroke, or anaphylaxis were encountered.

Conclusions:

Conventional therapies used in the management of HHT-related epistaxis, such as laser coagulation, septodermoplasty, selective arterial embolization, and Young's occlusion each have specific associated complications, including worsened epistaxis, septal perforation, foul odor, nasal crusting, and compromised nasal breathing. Sodium tetradecyl sulfate (STS) is a safe office-based treatment option for HHT-mediated epistaxis that is associated with exceedingly few of the aforementioned serious sequelae.

#18

Conservative Endoscopic Excision of Schneiderian Papilloma in Critical Sinonasal Sites

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Introduction:

Endoscopic excision of sinonasal Schneiderian papillomas is a well described technique. It has been suggested that the underlying bone be removed with the papilloma for adequate tumor control. However, there are several sinonasal sites whose proximity to critical structures precludes resection of underlying bone. The objective of this study was to determine the outcomes of surgery in areas where underlying bone cannot safely be removed.

Methods:

A retrospective analysis was performed on all patients referred to a tertiary rhinology center for Schneiderian papilloma (inverting or cylindrical cell) treated without underlying bone removal between 1996 and 2013.

Results:

25 patients had >6 months follow up (6-121 months). Two patients had no papilloma on evaluation. Average tumor free follow up was 35 months (2-121 months). 7 patients (30%) had no recurrence after 1 surgery, while 8 patients (35%) required a second operation. 6 additional patients (26%) required a third surgery, and 2 patients (9%) required a fourth surgery. Areas more prone to recurrence were the frontal sinus, frontal recess, supraorbital ethmoid cell, ethmoid cavity and lamina papyracea. Five patients with recurrent tumor required an endoscopic approach combined with either Caldwell-Luc or osteoplastic flap for complete exposure and extirpation.

Conclusion:

In areas where resection of underlying bone or tissue is difficult, dangerous, or implausible, a subperiosteal dissection with soft tissue excision is a viable surgical option. Revision surgery may be necessary. Nevertheless, long term tumor-free outcomes can be achieved with concomitant preservation of normal sinonasal architecture and their underlying structures.

#19

COX-2 Expression in Oncocytic Papilloma

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Background/Aims:

Oncocytic papilloma (OP) is a rare, locally aggressive benign tumor of the sinonasal cavity with malignant potential. Despite improvements in surgical resection techniques, there remains a high rate of local recurrence. Cyclo-oxygenase-2 (COX-2) is overexpressed in papillomas throughout the upper aerodigestive tract, and inhibition of this enzyme serves as a potential for adjuvant therapy. This study seeks to characterize COX-2 expression of OP.

Methods:

Immunohistochemistry for COX-2 was performed on OP samples obtained during surgical resection between October 2000 and October 2012. The intensity of staining was evaluated by pathologists blinded to the clinical features and outcomes. COX-2 expression was compared to previously published inverted papilloma (IP) tumor specimens and non-tumored specimens from CSF leak repairs.

Results:

There were 8 tumor samples from 4 females and 4 males. Mean age was 55 years (range 36-92). Tumor locations included: nasal cavity (3), sphenoid (1), eth-

moids (2), maxillary (1) and frontal (1) sinuses. No cases demonstrated malignancy or dysplasia. 8/8 (100%) of the OP samples stained positive for COX-2 in contrast to IP specimens that were positive for COX-2 in only 7/12 (58.3%) of tumor samples.

Conclusion:

COX-2 overexpression was identified in all cases of OP in this study. Larger studies are necessary to identify the true incidence of COX-2 expression for this tumor. Pharmaceuticals targeting COX-2 may eventually provide an additional therapeutic option for select cases of recurrent or unresectable OP.

#20

Culture Results: after Antibiotic Failure in Acute Rhinosinusitis after Endoscopic Sinus Surgery

Jennifer Decker, MD, Neal Lofchy, MD, Jay Dutton, MD
Chicago, IL

Introduction:

The microbiology of recurrent sinusitis in patients who have previously required sinus surgery is known to contain resistant organisms that are difficult to treat. Acute infection in these patients typically requires broader-spectrum antibiotics than in the general population. Cultures and a second course of antibiotics are widely used should initial antibiotic treatment fail. However, other factors than bacterial antibiotic resistance may play a role in treatment failure. We examined the bacterial types and resistance patterns in patients with acute rhinosinusitis who failed a first course of antibiotic therapy to determine if bacterial resistance or other factors influenced treatment outcome.

Methods:

A retrospective chart review was performed of sinus cultures over the previous 2 years in a private rhinology practice. Patient who had undergone ESS, developed acute rhinosinusitis, but failed initial antibiotic therapy with available sinus cultures taken were included. Culture results were reviewed for bacterial and fungal growth and antibiotic resistance patterns.

Results:

31% of patients failed initial antibiotics despite documented susceptibility of cultured bacteria to their antibiotics. 14% of patients had resistant bacteria, 18% had fungal growth but no bacterial growth. 26% of patient showed no organism growth, and 10% of patients recovered without a second course of oral antibiotics.

Conclusions:

Failure to respond in acute infection to oral antibiotics in patients with chronic rhinosinusitis is multi-factorial in origin. Disease modifiers such as staphylococcal superantigens, biofilms, and fungal antigens play a large role treatment should include both appropriate antibiotic coverage and focus on underlying inflammatory mediators.

#21**Current Concepts in the Surgical Treatment of Pediatric Acute Complicated Rhinosinusitis**

Stefania Gallo, MD, Fabio Ferreli, MD, Mario Turri-Zanoni, MD, Apostolos Karligkiotis, MD, Maurizio Bignami, MD, Paolo Castelnuovo, MD
Varese

Introduction:

Complications of acute rhinosinusitis in pediatric population are rare but must be suitably treated because they still represent life-threatening events. The aim of this study is to demonstrate that an early radiological diagnose associated to combined medical and surgical treatment can improve their management, decreasing morbidity.

Methods:

We retrospectively reviewed all patient under 18 year-old treated for acute complicated rhinosinusitis between 2002-2012 at a single ENT Clinic. Patients were urgently admitted when symptoms and signs of acute rhinosinusitis suddenly worsened without benefit from empirical oral antibiotics. Patients underwent at least one radiological investigation. Treatment required the combination of intravenous antibiotics and endoscopic endonasal surgery eventually associated to external approaches.

Results:

24 patients were included: 18 cases of orbital complication (10 orbital cellulitis, 8 orbital abscesses), 3 cases of intracranial complication (subdural abscesses) and 3 cases of multiple orbital and intracranial complications. All patients were treated with endoscopic endonasal surgery combined to medical therapy. In 9 cases an external approach was associated in order to effectively control the disease. No intra or perioperative complications were observed. Patients were followed with endoscopic evaluations and at least one radiological examination (mean follow up 57,3 months).

Conclusions:

Complications of acute rhinosinusitis are rare but potentially serious. Early clinical recognition and institution of appropriate antibiotic therapy may lead to their improvement. Worsening should require prompt imaging to determine the indication for a surgical drainage through an endoscopic endonasal approach eventually associated to external approaches in order to prevent its progression and evolution.

#22**Diagnostic Algorithm for Unilateral Sinus Disease: A 15 year Retrospective Review.**

Marianella Paz Silva, MD, Robert Naclerio, MD
Chicago, IL

Background:

Unilateral sinus disease represents a relatively common

medical problem for Otolaryngologists. Patients presenting with unilateral sinus or nasal disease or a nasal polyp raise concerns about sinister pathology. Despite the relatively common occurrence, a broad diagnostic approach to unilateral sinus disease has never been defined. Purpose: To propose an effective diagnostic algorithm for managing patients with unilateral sinus disease.

Materials and Methods:

We performed a retrospective review of the medical records of all patients with unilateral sinus disease who underwent surgical intervention and had pathological specimens during a 15-year period at a single, urban academic center. Nasal endoscopy and CT scan findings, demographic characteristics, presenting symptoms, medical histories and previous treatments were reviewed

Results:

A total of 191 patients met the inclusion criteria, of which 153 were initially diagnosed at our center. Among this group, 51 (33%) presented with a nasal mass or polyp observed by endoscopy. Inverted papilloma represented 16% of those, and malignant tumors were 14%. In contrast, for patients without an obvious nasal polyp, 2% were inverted papilloma and 3% were malignant. Overall, chronic rhinosinusitis was the most common diagnosis in patients with (67%), and without (69%) nasal polyps. However 47% of patients referred in had malignant tumors.

Conclusions:

Whereas unilateral sinus disease is most likely to represent chronic inflammation, there is a fair likelihood of finding malignant pathology, particularly in patients presenting with unilateral polyps. Based on this review, we propose a strategy for the management of unilateral sinus disease, not previously diagnosed.

#23**Disseminated Cryptococcosis Initially Presenting as a Basal Cell Carcinoma**

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Introduction:

Cryptococcus neoformans is an opportunistic pathogen that is usually acquired via invasion of the respiratory tract. The infection can then spread hematogenously to other viscera, mainly the central nervous system. Although there are some reports of primary cutaneous cryptococcosis, skin involvement is a feature present in only 10-20% of cases of disseminated cryptococcosis. We describe the rare presentation and management of disseminated cryptococcosis that presented as a nasal lesion mimicking basal cell carcinoma.

Study Design:

Case Report

Methods:

Patient chart analysis and review of the literature

Results:

A 65-year-old Jamaican male undergoing treatment for Multiple Myeloma presented with an external nasal lesion for 1 month. The results of this biopsy eventually led to the diagnosis of disseminated cryptococcosis after the antigen was detected in the CSF and a suspicious lung mass was noted on imaging. An overview of cryptococcosis along with treatment strategies is viewed.

Conclusions:

Though exceedingly rare, cutaneous cryptococcosis may present as a facial lesion mimicking basal cell carcinoma. This entity must remain on the differential diagnosis especially in immunocompromised patients, for whom disseminated cryptococcosis has a poor outcome if unrecognized and untreated.

#24

Effect of Potassium and Sodium Ionic Compositions in Nasal Irrigation Solutions on Human Olfactory Thresholds

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Chicago, IL

Background:

Nasal irrigations are used for nasal hygiene and to treat various sinonasal conditions. Previous studies suggest that the ionic composition of irrigation solutions can affect olfactory performance.

Objective:

Determine the dose response of potassium and sodium compositions of irrigation solutions on human olfactory threshold.

Methods:

Trials of nasal rinses with different ionic compositions were tested in 16 healthy human participants. For potassium-variable solutions, potassium concentrations consisted of 2.0mM, 5.7mM, 6.5mM, 7.2mM, and 10.0mM, while the sodium concentration was constant at 93.7mM. For sodium-variable solutions, sodium concentrations consisted of 75.0mM, 84.8mM, 89.5mM, 93.7mM, and 105.0mM, while potassium concentration was 5.7mM. Calcium concentration, solution temperature, and pH were standardized for all trials. Prior to and following each rinse, olfactory thresholds were determined with the standardized Sniffin' Sticks test. Differences in the olfactory threshold scores before and after the rinses were compared.

Results:

Variations in potassium concentration demonstrated dose-dependent shifts in olfactory threshold: 5.7mM by 0.19±0.48 ($p>0.05$), 6.5mM by 1.16±0.98 ($p<0.05$), and

7.2mM by 1.94±1.44 ($p<0.05$), respectively. Solutions with potassium concentration of 2.0mM and 10.0mM elevated olfactory threshold by 1.25 and 3.75, respectively, and were only tested in one participant because of significant discomfort with their use. Ongoing experiments study the effect of different sodium concentrations on olfactory thresholds and also show dose-dependent threshold elevations.

Conclusions:

Different potassium and sodium concentrations in nasal irrigation solutions provide various shifts in the olfactory thresholds of human participants. The results suggest that an optimal ionic concentration in nasal irrigation solutions exists to preserve olfactory function.

#25

Efficacy of Budesonide Nasal Irrigation on Management of Allergic Fungal Rhinosinusitis

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Riyadh

Introduction:

Allergic fungal rhinosinusitis (AFRS) is a noninvasive form of fungal sinusitis that represents an allergic and immunological response to the presence of fungal hyphae in the sinus cavities. The management of this disease is a great challenge and despite aggressive treatment, this disease often recurs. We present our preliminary experience in testing the clinical efficacy of budesonide (Pulmicort©) nasal saline irrigation as a novel treatment for the post surgical management of AFRS.

Methods:

A prospective open-label therapeutic trial was conducted between February 2009 to August 2009. Budesonide saline standard solution as nasal irrigation was used as a standard twice-daily protocol for three weeks. 17 patients were enrolled and all of them were assessed pre- and post treatment endoscopically; using the Kuperberg staging system and by a questionnaire; using Modified Arabic Sinonasal Outcome Test (MA-SNOT) designed for symptoms evaluation.

Results:

17 patients were enrolled in this pilot study. Results: for the endoscopic staging system and (MA-SNOT) all proved significant improvement.

Conclusion:

Although the numbers of cases were small, the preliminary results of using budesonide nasal saline irrigation for the treatment of AFRS can significantly improve the endoscopic staging and symptomatology of patients with AFRS.

#26**Endonasal Endoscopic Resection of Skull Base and Paranasal Sinus Schwannomas: A Report of Four Cases**

Q Husain, MD, Danielle Blake, BA, Vivek Kanumuri, BS, Alejandro Vazquez, MD, James Liu, MD, Jean Anderson Eloy, MD, FACS
Newark, NJ

Background:

Schwannomas of the paranasal sinus and anterior skull base are rare entities. The majority of these lesions are found within the sinonasal tract, although some have intracranial extension. We present a series of four cases and a comprehensive literature review of this rare entity.

Methods:

A retrospective chart review was performed to identify individuals with sinonasal or anterior skull base schwannomas. Demographic data, presenting symptoms, imaging, treatment, and follow up were recorded. In addition a comprehensive literature search was performed using the PubMed/MEDLINE database to identify other cases of this rare tumor.

Results:

There were 2 males and 2 females included in this study. The average age was 53.5 years (range: 21 to 71). The most common presenting symptoms were facial pain and hyposmia. Radiological imaging utilized were CT and MRI. There was only 1 case that was intradural with intracranial involvement. All tumors were treated with endoscopic surgical resection with one case requiring an extended endoscopic approach with craniofacial resection. Adjuvant chemotherapy and/or radiation was not utilized in any case. All patients exhibited gross total resection.

Conclusion:

Sinonasal and anterior skull base schwannomas are rare entities, with often non-descript symptoms. We present the second largest case series to date of sinonasal and anterior skull base schwannomas treated using endoscopic surgical resection. Based on our experience, this tumor can be effectively resected using an endoscopic endonasal approach.

#27**Endoscopic Approaches to the Frontal Sinus: Modifications of the Existing Techniques and Classification**

Jean Anderson Eloy, MD, FACS, Mohemmed Khan, MD, Alejandro Vazquez, MD, Vivek Kanumuri, BS, Soly Baredes, MD, FACS
Newark, NJ

Background:

Endoscopic frontal sinus surgery is anatomically challenging. Decades of experience and advances in technology have led to the widespread use of varying endoscopic approaches to the frontal sinus. Modifications to the established techniques have been introduced recently to minimize invasiveness, yet still provide adequate treatment. We review the literature on endoscopic frontal sinus approaches and provide an updated classification.

Methods:

A PubMed literature review was performed for endoscopic techniques to the frontal sinuses; including our previously described cadaveric studies and intra-institutional case series regarding modifications to the endoscopic modified Lothrop procedure. Brief explanations and indications for each procedure, as well as a new format of nomenclature with inclusion of these modifications are included.

Results:

The modified hemi-Lothrop approach involves an ipsilateral Draf IIB as well as an antero-superior septectomy window for access to the ipsilateral lateral recess of the frontal sinus via the contralateral nasal cavity. The modified mini-Lothrop involves a contralateral Draf IIB and a frontal intersinus septectomy. A modified subtotal Lothrop involves an ipsilateral Draf IIB with a superior septectomy and frontal intersinus septectomy. These alterations represent expansion on the current Draf (or nasofrontal) classification system and approaches. The lack of nomenclature flexibility to incorporate the described modifications prompted the formulation of a new naming system incorporating all previously described approaches as well as the three newly described procedures.

Conclusion:

The use of a new system of nomenclature consolidates two previously described classification systems regarding endoscopic frontal sinusotomies and incorporates three recently described modifications.

#28**Endoscopic Culture-Directed Antibiotic Therapy: Impact on Patient Outcomes in Chronic Rhinosinusitis**

Zi Yang Jiang, MD, Yann-Fuu Kou, MD, Pete Batra, MD
Dallas, TX

Background:

Endoscopically-guided cultures are frequently employed to guide antimicrobial therapy in refractory chronic rhinosinusitis (CRS) patients. The objective of this study was to determine the impact of culture-directed antibiotics on patient outcomes.

Methods:

Retrospective cohort study was conducted of 176 adult

CRS patients. Demographics, microbiology, treatment variables, pre- and post-SNOT-20 scores, and presence of purulence on follow-up endoscopy were recorded.

Results:

A total of 105 CRS patients met the predetermined criteria for inclusion. The mean age was 46.3 years with 43.8% male. Concurrent polyposis and asthma was noted in 21.2% and 37.1%, respectively. The most common microbes were *Staphylococcus aureus* (29.5%), *Pseudomonas aeruginosa* (23.8%) and methicillin-resistant *S. aureus* (11.4%). Overall change in SNOT-20 score was -0.56 (+/-0.74), while repeat purulence was noted in 5 cases (4.8%). Univariate analysis demonstrated statistically lower SNOT-20 scores in the rhinologic domain in patients with polyposis ($p=0.0035$) or receiving oral steroids ($p=0.0049$). Multivariate regression analysis demonstrated that presence of polyps was independently associated with improvement in overall SNOT-20 score ($p=0.0283$), while presence of *S. aureus* predicted presence of purulence of repeat endoscopy ($p=0.0368$, odds ratio=10.8). Length of follow-up (14-30, 31-60, 61-90 days) did not statistically impact SNOT-20 scores.

Conclusion:

Endoscopic-derived sinus cultures did not appear to have a clinically meaningful change in SNOT-20 scores, though repeat purulence was infrequently noted at follow-up. The presence of *S. aureus* at the initial culture may predict purulence on repeat endoscopy despite treatment. Further prospective studies are needed to better delineate the role of cultures in CRS management.

#29

Endoscopic Endonasal Approach to Resection of a Cranionasal Schwannoma

Shannon Poti, MD, E. Bradley Strong, MD
Sacramento, CA

Schwannomas are benign, slow growing neoplasms that originate from the sheath of myelinated peripheral nerves. Although schwannomas are common in the head and neck, only 4% of head and neck schwannomas occur in the sinonasal cavity, most commonly occurring in the ethmoid, maxillary sinus, nasal fossa and sphenoid sinus. These neural sheath tumors arise primarily from the ophthalmic and maxillary divisions of the trigeminal nerve and less commonly from the sympathetic fibers of the carotid plexus and parasympathetic fibers of the sphenopalatine ganglion. They have a non-specific presentation, both clinically and radiographically, and the diagnosis can be confirmed only via histopathology. Schwannomas are radioresistant and thus complete surgical excision is recommended, classically through a Caldwell-Luc incision. We report a case of a 81 y/o female with a massive cranionasal schwannoma who underwent surgical resection via endoscopic endonasal approach. She initially presented with numbness of the cheek and was found to have a

mass in the infratemporal fossa. She underwent a biopsy of this mass via a transmaxillary approach that returned schwannoma. The decision was made to observe the lesion. She then represented 8 years later with double vision in the ipsilateral eye. CT scan revealed a large mass extending from her left pterygopalatine fossa, extending through the skull base up to the cavernous sinus. In this case, we report a successful endoscopic endonasal approach with resection of the skull base schwannoma and decompression of the temporal lobe and orbit.

#30

Endoscopic Nasal Septal Perforation Repair in Prepubescent Children Using Acellular Tissue Matrix Grafts Alone

Thomas Higgins, MD, MSPH
Louisville, KY

Introduction:

The timing and technical details of performing a septal perforation repair in prepubescent children is not well defined. The procedure is often delayed until the nasal architecture has developed and matured. This presentation describes a conservative endoscopic technique using acellular tissue matrix to repair nasal septal perforations in this age group.

Methods:

A 9-year-old boy presented for evaluation of a 1.5 cm anterior nasal septal perforation present for 2 years after septal cauterization. The patient had severe crusting, drainage, nasal congestion, and recurrent epistaxis that were resistant to several types of topical moisturization therapies and antibiotics. A prior attempt to close to perforation performed using nasal septal rotational and advancement flaps was unsuccessful. A septal perforation repair was then performed under endoscopic guidance using a three-layered closure technique, including elevation of a mucoperichondrial flap, insertion of an interpolated acellular dermal matrix implant, and application of bilateral thin acellular dermal matrix grafts.

Results:

The nasal septal perforation was found at 3 months to be closed entirely with exception of a tiny 1-mm pinhole superiorly. The patient had complete resolution of nasal crusting and recurrent epistaxis.

Conclusion:

Endoscopic nasal septal repair using acellular tissue matrix appears to be a feasible and effective technique for prepubescent children that can avoid the need for open rhinoplasty techniques and significant tissue manipulation. The procedure may also be considered an alternative to waiting until after puberty in highly symptomatic patients.

#31**Epistaxis: The Factors Involved in Determining Medicolegal Liability**

Mohammed Khan, MD, Danielle Blake, BA, Alejandro Vazquez, MD, Michael Setzen, MD, FACS, Soly Baredes, MD, FACS, Jean Anderson Eloy, MD, FACS
Newark, NJ

Background:

To examine litigation involving epistaxis and analyze factors which determine liability.

Methods:

Jury verdicts and settlements regarding cases involving epistaxis were gathered utilizing the Westlaw database. Factors involved in litigation gathered included demographics, defendant specialty, procedure, alleged cause of malpractice, outcome, monetary award, and other variables.

Results:

A total of 26 cases were analyzed. The majority of cases (57.7%) were decided in favor of the plaintiff or settled out of court. Total awards amounted to \$24,501,252. Average awards for cases decided in favor of the plaintiff were \$2,260,893 and ranged from \$499,845 to \$9,022,643. Settlements averaged \$1,084,375 and ranged from \$300,000 to \$3,800,000. Common causes of malpractice encountered included delay in diagnosis, complications from medical procedures, and failure to recognize complications in a timely manner.

Conclusion:

Contrary to previous reports analyzing malpractice for varying medical procedures and complications, litigation in epistaxis is more commonly resolved in favor of the plaintiff or resolved through out-of-court settlements. Substantial financial awards and therapeutic complications from blindness to death make epistaxis a candidate for litigation. Of importance from a medicolegal stand is the fact that 30.8% (8) of the patients involved in epistaxis litigation died, either from complications of therapy or from experiencing epistaxis as a complication of another procedure/pathology. Utilizing necessary diagnostic imaging, ensuring proper management techniques, and recognizing complications in a timely manner can serve to limit legal liability and enhance patient safety. Technical proficiency is key when performing both bedside procedures and operative interventions.

#32**Evidence Based Long Term Outcomes in Endoscopic Sinus Surgery**

Presented by: Shawn Nasser, MD and Nareen Vardanyan, MHA
Martin Hopp, MD, PhD, Shawn Nasser, MD, Narine Vardanyan, MHA
Los Angeles, CA

Objective:

To determine whether patients who undergo Endoscopic Sinus Surgery, including balloon sinuplasty, experience clinically significant short term and long term improvement in their Rhinosinusitis disease process in a prospective, consecutive patient, multi-surgeon, single hospital.

Design:

Prospective, consecutive patient study, in a multi-surgeon, single hospital group.

Methods:

Patient selection included consecutive patients undergoing sinus surgery in the Cedars Sinai Medical Center who were able to complete the SNOT 22 patient questionnaire prior to surgery. A total of 474 surgical patients between the ages of 21-65 were included from 18 physicians who gave consent for all consecutive patients to participate in the study. Patients were required to be fluent in English, and met criteria for FESS, as outlined in the Rhinosinusitis Task Force criteria. Patients were multi-cultural and diverse natured, ranging from tertiary care academic referrals to community otolaryngology patients. Patients were studied prospectively between April 2009 and May 2013, and demographic data was recorded for tracking purposes only. All patients underwent Standard FESS (no balloon) or Hybrid Standard Balloon procedure.

Results:

41 of the forms were not yet due at the time of this analysis, and were excluded from the study due to not having all forms completed. The study is currently still ongoing.

Conclusions:

In this prospective, consecutive patient, multi-surgeon, single hospital study, patients who underwent endoscopic sinus surgery, with or without Balloon Sinuplasty, experienced statistically significant short term and long-term improvement in their Rhinosinusitis disease process.

#33**First Reported Case of Invasive Fungal Sinusitis due to Anabolic Steroid use in a Healthy Athlete**

Irene Kim, MD, Christopher Thompson, MD,
Paul Kedeshian, MD, Fernando Palma Diaz, MD,
Jeffrey Suh, MD
Los Angeles, CA

Introduction:

Invasive fungal rhinosinusitis is a potentially fatal infection that affects immunocompromised patients. Prognosis is generally poor despite aggressive medical and surgical treatments. We present the first reported case of invasive fungal sinusitis in a healthy 18 year-old male athlete who was taking anabolic steroids.

Methods:

Case report and literature review.

Results:

An 18-year-old healthy male with history of bilateral allergic fungal sinusitis presented with rapidly progressive headaches, facial numbness, and diplopia. Physical examination was significant for left-sided proptosis, abducens nerve palsy, and facial numbness. CT and MR imaging revealed a destructive mass centered in the left maxillary sinus, involving the ethmoid and sphenoid sinuses, pterygopalatine fossa, cavernous sinus, and orbital apex concerning for an aggressive tumor. There was also enhancement of the maxillary nerve in foramen rotundum with perineural invasion. He was taken to the OR for tissue biopsy. Intraoperative findings demonstrated large areas of necrosis. Pathology revealed invasive *Aspergillus fumigatus*. After surgery, he admitted to long-term anabolic steroid use when no other cause of immune dysfunction was found. The steroids were stopped. He was started on amphotericin B, subsequently IV caspofungin and PO voriconazole, and then underwent a second debridement. Four months after diagnosis, he has had remarkable clinical and radiographic improvement with resolution of diplopia and slow return of V2 sensation.

Conclusion:

This is the first reported case of invasive fungal sinusitis due to anabolic steroid abuse. This case demonstrates the potential immunomodulatory effects of anabolic steroids and highlights a previously unknown cause of invasive fungal sinusitis.

#34**Frontal Sinus Angiosarcoma: Report of a Rare Entity and Review of the Literature**

Senja Tomovic, MD, Evelyne Kalyoussef, MD, Soly Baredes, MD, Jean Eloy, MD
Newark, NJ

Introduction:

Primary sinonasal angiosarcomas are very rare tumors. They typically occur in the nasal cavity of middle-aged patients. They are highly aggressive; primary treatment is surgical excision with postoperative radiation. We describe a unique case of angiosarcoma in a young woman arising from the frontal sinus with distant metastasis. We review the literature and discuss newer treatment options for advanced disease.

Methods:

Case report and review of the literature.

Results:

A 21-year-old female presented with a two-month history of left forehead pain and left sided vision changes. Work-up revealed a 3 x 2.5 x 3.5cm mass arising from

the left frontal sinus with posterior table dehiscence with invasion into the frontal lobe and superior orbit extending to the ipsilateral ethmoid, nasal cavity, anterior sphenoid sinus, Meckel's cave, and pterygopalatine fossa. There was distant disease in the right lung apex and C2 vertebral body. Biopsy confirmed angiosarcoma. Consideration was given to surgical resection, however, given the local and distant extent of disease, the patient was referred for chemoradiotherapy prior to surgical resection.

Conclusions:

Angiosarcoma is a rare tumor of the paranasal sinuses. This case represents the first report of angiosarcoma arising from the frontal sinus in the English literature. Angiosarcoma is a very aggressive disease with poor prognosis. Survival rates of less than 15% at two years have been reported. It is important to weigh the risks and benefits of morbid surgery with patients' overall prognosis. Newer chemotherapeutic regimens on the horizon show promise in helping to control this disease.

#35**Genetic Variation in Genes Encoding Airway Epithelial Potassium Channels are Associated with Chronic Rhinosinusitis in a Pediatric Population**

Michael Purkey, MD, Jin Li, PhD, Frank Mentch, PhD, Struan Grant, PhD, Hakon Hakonarson, MD, PhD, Elina Toskala, MD, PhD
Philadelphia, PA

Background:

Apical potassium channels regulate ion transport in airway epithelial cells and influence air surface liquid hydration and mucociliary clearance (MCC).

Objectives:

We sought to identify whether genetic variation within genes encoding airway potassium channels was associated with chronic rhinosinusitis (CRS).

Methods:

Single nucleotide polymorphism (SNP) genotypes for selected potassium channels were derived from data generated on the Illumina HumanHap550 BeadChip or Illumina Human610-Quad BeadChip for 828 unrelated individuals diagnosed with CRS and 5,083 unrelated healthy controls from the Children's Hospital of Philadelphia. Statistical analysis was performed with set based tests using PLINK, and corrected for multiple testing.

Results:

Set-based case control analysis revealed that two SNPs strong linkage disequilibrium within KCNMA1 were associated with CRS in our Caucasian component of the cohort (598 CRS cases and 3,489 controls; rs2917454 and rs790026, $P=0.022$, confirmed with 10,000 permutations). In addition there was borderline evidence that two SNPs in strong linkage disequilibrium

at the KCNQ5 locus (rs6907229 and rs9343015, $P=0.0704$) were associated with the trait in our African American component of the cohort (230 CRS cases and 1,594 controls).

Conclusions:

We have implicated two airway epithelial potassium channels as novel susceptibility loci in contributing to the pathogenesis of CRS.

#36

Global Lipid Profiling of Sinus Mucosa from Chronic Rhinosinusitis Patients

Farbod Fazlollahi, BS, Kessiri Kongmanas, BS, Nongnuj Tanphaichitr, PhD, Kym Faull, PhD, Jeffrey Suh, MD
Los Angeles, CA

Introduction:

Sinusitis causes significant morbidity. Distinguishing between those who are likely to improve with empirical medical therapy from those who require specialty care is problematic. Lipidomics globally profiles the lipids of tissues and fluids. We used this approach to investigate a new method for categorization of sinusitis patients.

Methods:

Sinus mucosa from 11 patients chronic rhinosinusitis (CRS) patients, 12 controls, and 9 with CRS and nasal polyp growth, and polyp samples from 10 other patients were used. Samples were subjected to Bligh/Dyer extraction, then high performance thin layer chromatography (HPTLC) followed. Plates were divided into 4 zones and the components were eluted, then analyzed by flow-injection onto a PE Sciex ABI III triple quadrupole MS system with electrospray ionization. Data were analyzed for mass spectral peak disparities between groups. A 50 μ L aliquot of each of the redissolved HPTLC fractions was also analyzed by GC/MS.

Results:

By visual inspection, after background subtraction, samples containing FA run in the positive ion mode, and samples containing TEA run in the negative ion mode showed the greatest number peaks and disparities between sample groups. GC/MS analysis revealed the presence of cholesterol and several fatty acids, namely palmitic, stearic, and oleic acid.

Conclusions:

These results suggest there are lipidomic differences between sample groups. In on-going work these differences will be further interrogated by targeted MS/MS analysis to identify the major lipid tissue constituents and the major known contributors to group disparity. The ultimate goal is to relate those molecules to disease state and progression.

#37

Histopathological and Clinical Analysis of Chronic Rhinosinusitis by Subtype

Mary Scaduto, MD, Arya Namin, BA, Michael Anne Gratton, PhD, Justin L. Antisdell, MD

Background:

Chronic rhinosinusitis (CRS) encompasses diverse phenotypic expression. Clinical and histological differences suggest four CRS subtypes: eosinophilic CRS with and without nasal polyps (eCRSwNP, eCRSsNP) and non-eosinophilic CRS with and without nasal polyps (neCRSwNP, neCRSsNP). The mucosal basement membrane (BM) and cilia are believed to play roles in CRS pathogenesis by impacting mucociliary clearance and immune barriers. This study aimed to identify clinical, surgical, and histopathological subtype differences to further elucidate disease mechanisms.

Methods:

Ethmoid tissue from 33 adult CRS patients and 7 controls was obtained during endoscopic sinus or other sinonasal surgery (controls) and analyzed by light and transmission electron microscopy for BM thickness and presence of cilia. CRS patients were categorized into the four subtypes, and Sinonasal Outcome Test (SNOT)-22, endoscopy, computed tomography (CT), and surgical data were compared and correlated with histopathology measures.

Results:

CRS subtypes could be distinguished by CT score and surgical data, with eCRSwNP patients exhibiting greatest disease severity. While nasal polyposis correlated to surgical measures, mucosal eosinophilia correlated to neither clinical nor surgical data. No significant difference in BM thickness was found between controls and CRS subtypes but distinctions were found regarding cilia, which were less common in eosinophilic subgroups compared to controls and neCRSsNP patients.

Conclusions:

CRS subtypes exhibit histopathological changes that correlate with some measures of clinical status and surgical treatment scope. The absence of cilia appears to hold an important role in the eosinophilic subgroups. Further histologic evaluation is warranted to evaluate for possible subtype-specific treatment targets or prognostic markers.

#38

How Do CT Facilities Perceive the Accreditation Process: Results of an Intersocietal Accreditation Commission (IAC) Survey

Alice Zhao, MD, Adam Weisstuch, MD, Gavin Setzen, MD, Gary Heller, MD, PhD, Mary Beth Farrell, MS
Albany, NY

Accreditation for imaging modalities, such as computed tomography (CT) studies, has become an accepted standard of quality and several are now required by Centers for Medicare and Medicaid Services (CMS) for reimbursement. It is unclear how CT imaging facilities view the accreditation process. Therefore, a survey of all CT facilities accredited by the Intersocietal Accreditation Commission (IAC) was sanctioned. An online survey was sent to all IAC accredited CT facilities. The survey asked respondents to rate statements on how the accreditation process impacted their facility. Of the 1147 facility requests, 146 facilities (13%) responded, of which 49% had been accredited for greater than 3 years. The majority of responses were from technologists (71.2%), followed by physicians (13.7%), administrators (12.3%), or others (2.7%). Most respondents described their facility as private practice (44.5%), followed by hospital based (28.8%), multi-specialty clinic (15.1%), and freestanding imaging center (11.6%). There was a positive response to the accreditation process with 64.3% agreeing that image quality was improved. A majority of respondents also agreed that the accreditation process helped identify facility deficiencies (72%), improved report standardization (87%), improved guideline adherence (80.7%) and improved facility efficiency (53.4%). Survey respondents had a positive response (43.7%) when inquired about patient satisfaction. All remaining questions resulted in a higher percentage of positive responses. The response to an IAC survey revealed that most facilities have a positive view of the accreditation process. There was a consensus that multiple indicators of quality were improved, especially those indicators related to laboratory functioning and reporting.

#39

How to Preserve Nasal Mucosa: the Balloon Sinusoplasty Technique

Luca Volpi, MD, Maurizio Bignami, MD, Fabio Ferrelli, MD, Ignazio Ermoli, MD, Giovanni Padoan, MD, Paolo Castelnuovo, MD
Varese

Introduction:

The main target in functional endoscopic sinus surgery is the natural ostia's patency. The purpose of the study is to evaluate the effectiveness in reaching the same goal through a Balloon Sinusoplasty, a mini-invasive technique with preservation of the mucosal covering.

Methods:

We retrospectively reviewed the clinical records of 67 patients affected by chronic rhinosinusitis enrolled in the present study. We used balloon catheter as stand alone procedure or in association with true cutting instruments in order to achieve patency of the involved sinus ostia. The correct placement of the catheter, during surgery, was helped by the combination of the endoscopic view with a sinusal transillumination device (Luma).

Results:

163 sinuses were processed by balloon catheter ostial enlargement, with a follow up of 3 to 52 months. No intra and postoperative complications were observed. 4/67 patients complained persisting symptoms of chronic rhinosinusitis after the surgical procedure, but reintervention was not performed yet.

Conclusions:

This new technology provides encouraging results, proving to be safe and effective. Long-term results seem to be in favour with the introduction of this minimally invasive surgical tool. This kind of surgery has anyway to be performed by expert surgeons with good knowledge of the paranasal sinuses' anatomy.

#40

Image Guidance and Function Endoscopic Sinus Surgery: Is It More Cost-Effective?

Benjamin Walton, MD, Patricia Maeso, MD
Galveston, TX

Image-guidance surgery of the sinuses has increased dramatically in popularity and availability. The need for improved imaging to allow for image-guidance surgery has lead many surgeons to request specific image-guidance protocols for CT imaging. While initial costs to the set-up of image-guidance have been established, there is no study that measures the cost-effect of having the specific imaging required for surgery or how much of an impact repeating imaging has on the healthcare system. A retrospective chart review was performed on 871 CT images of the sinuses dating from November of 2009 to November of 2012 in both a public academic and private medical center. Only 8% of all CT images ordered by a non-Otolaryngologist resulted in functional endoscopic surgery. For CT imaging ordered by an Otolaryngologist, 41.8% of all scans resulted in a functional endoscopic sinus surgery. Of this, 64.7% of the cases utilized image-guidance CT imaging. Cost was found to be equal between CT sinus imaging and image-guidance protocols in both the private and public institution. Total cost for CT imaging was approximately \$3,729,540. 7.26% of this cost or \$270,840 was spent on repeat imaging. Ordering image-guidance for all CT sinus imaging is far more cost-effective than repeating imaging. Practitioners and radiology departments should consider a fundamental change in acquisition of imaging protocol scans to save money, time, and radiation for the patients. Secondarily, many non-Otolaryngology providers are needlessly ordered CT imaging of the sinuses further increasing the burden on healthcare.

#41**Image-Guidance in Endoscopic Sinus Surgery: Is It Associated with Decreased Medicolegal Liability?**

Jean Anderson Eloy, MD, FACS, Peter Svider, MD, Christine D'Aguillo, BA, Soly Baredes, MD, FACS, Michael Setzen, MD, FACS, Adam Folbe, MD
Newark, NJ

Background:

The use of image-guidance (IG) in endoscopic sinus surgery (ESS) has escalated over the last decade despite a lack of consensus that its use improves outcomes or decreases complications. One reason frequently stated by otolaryngologists for using IG in ESS is its potential to minimize legal liability should an adverse outcome occur. In this study, we aimed to characterize the role of IG in ESS litigation, and further detail other factors in pertinent cases.

Methods:

Relevant cases from the Westlaw database were examined to determine whether the use of IG played a role in plaintiff's initiation of litigation in ESS malpractice suits. Factors such as patient demographics and alleged cause(s) of malpractice litigation were examined.

Results:

Out of 30 malpractice cases from 2004 to April 2013, 4 (13.3%) mentioned the use of IG during ESS, although this did not appear to be a factor affecting the plaintiff's decision to initiate litigation, nor the outcome of suits. In the 26 cases (86.7%) in which IG was not used, its non-use was not specified as an alleged cause of negligence. Eleven (36.7%) cases were resolved in the defendant's favor. Recurrent factors included iatrogenic injury (83.3%), permanent deficits (66.7%), needing additional surgery (63.3%), orbital and intracranial injury, and perceived deficits in informed consent (40.0%).

Conclusions:

The use of IG was not found to be a factor in ESS litigation. This suggests that not using IG does not necessarily make one more vulnerable to malpractice litigation.

#42**Infectious Optic Neuritis Secondary to Dental Related Maxillary Sinusitis: A Case Report**

Christopher Larsen, MD, FACS, Valerie Wood, MD
Kansas City, KS

Acute optic neuritis is defined as sudden and often reversible condition consisting of inflammation of the optic nerve that may cause partial or complete loss of vision. The causes of optic neuritis are varied, and is of

interest to the Otolaryngologist as infectious optic neuritis secondary to sphenoid and pansinusitis have been described in several case reports in medical literature. Rarely, though, has this condition been linked to isolated maxillary sinusitis secondary to a dental infection. We present one such case of vision loss secondary to maxillary sinusitis, in a middle age male with recent history of treatment for a dental abscess. Our case highlights the need for early clinical recognition, aggressive work up and medical management by a multispecialty treatment approach

#43**Inferior Turbinate Reduction: on Which Portion Should Surgery Focus? A CFD Study**

Thomas Lee, MD, Parul Goyal, MD, Yuehao Luo, BS, Kai Zhao, PhD
Syracuse, NY

Abstract:

Background: Inferior turbinate reduction (ITR) is a commonly performed procedure for the treatment of nasal obstruction. The objective of this study was to use computational fluid dynamics analysis to evaluate the airflow changes after reduction along different portions of the inferior turbinate.

Study Design:

Case Series (n=2).

Methods:

CT scans of two patients were selected. Seven computational fluid dynamics (CFD) models were created for each patient: 1 un-altered and 6 various ITR reductions, including: 3 one-third ITR reduction (Anterior, middle, and posterior one-third); 2 two-thirds ITR (anterior and posterior two thirds); and 1 full-length ITR models. Total airflow rate and nasal resistance was obtained through CFD analysis, and regression analysis was performed on the increased nasal volume, locations and nasal resistance for both patients.

Results:

Full ITR over the whole length were consistently most effective to improve nasal airflow and resistance for both patients, adjusted for the volume. Regression analysis shows a strong linear (Rsquare = 0.93) relationship between nasal volume changes and nasal airflow. However, the most effective location of turbinate reduction was not consistent between the two patients. Surprisingly, for Patient A, posterior ITRs were more effective than anterior ones.

Conclusion:

The effectiveness of partial ITR and target location likely depends on individual patient anatomy. The fact that full ITR were consistently most effective and the linear regression between flow and nasal volume changes may indicate that the entire length of the IT has a functional impact on nasal airflow and resistance.

#44**Inflammatory Cells within Sinonasal Inverted Papillomas**

David Stoddard, MD, Michael Keeney, MD, Nicole Tombers, BS, Joaquin Garcia, MD, Erin O'Brien, MD
Rochester, MN

Introduction:

Inverted Papilloma (IP) is a benign tumor of the nasal cavity and paranasal sinuses. Despite what is known regarding the cells of origin for IP, the etiological progression from Schneiderian epithelium to IP remains to be definitively elucidated. Prior research has implicated human papilloma virus and environmental pollution; other studies have identified inflammation as a possible causative factor. The presence of intraepithelial neutrophils-so-called "transmigrating neutrophils"-is a classic histopathologic feature of IP, and researchers have noted radiographic evidence of inflammation even within sinuses unaffected by IP. Interestingly, fewer inflammatory cells are noted when severe dysplasia or carcinoma accompany IP. At our institution, preoperative steroids are often prescribed to decrease inflammation surrounding IP, but the histologic impact this may have has not been demonstrated. The data presented explore the relationship between inflammation and the development of IP, and describe the impact of steroid administration on IP.

Methods:

Surgical specimens from twenty IP patients (ten with and ten without preoperative systemic steroids) were examined histologically. The degree of acute inflammation for each was classified as mild, moderate or severe based on extent of neutrophilic infiltration.

Results:

Of the ten patients not receiving preoperative steroids, eight (80%) demonstrated severe neutrophilic infiltration; the remaining two (20%) exhibited mild inflammation and malignant transformation. Of ten patients receiving steroids, five (50%) had severe inflammation, four moderate (40%), and one (10%) mild; none had carcinoma.

Conclusion:

Inflammatory cells were appreciably concentrated in tissues involved with IP. Steroid administration was associated with less severe inflammation.

#45**Intracranial Mucocele Formation in the Context of Longstanding Chronic Rhinosinusitis: Case series and Literature Review**

Joseph Brunworth, MD, Rohit Garg, MD, MBA, Lester Thompson, MD, David Keschner, MD, JD, Jivianne Lee, MD
Anaheim, CA

Objectives:

Chronic rhinosinusitis (CRS) may have serious adverse sequelae, particularly if left untreated. The aim of this study is to describe a series of intracranial mucoceles (ICMs) that arose in the context of longstanding CRS combined with a review of the pertinent literature. Study Design: Case series and literature review

Methods:

A retrospective chart review was performed on all patients who developed ICMs in association with CRS between 2003-2012. The clinical presentation, radiographic features, surgical approach, intraoperative findings, and patient outcome were examined in the context of a literature review.

Results:

Sixty-five cases of mucoceles were identified in patients with a history of CRS, 7 (10.8%) of which were intracranial. 5 were men and 2 women with a mean age of 42.1 years. Headache, facial pressure, retro-orbital pain, and visual disturbances were the most common presenting symptoms. Five of the 7 had previously undergone sinonasal surgery. Imaging studies demonstrated ICMs involving the anterior cranial fossa, two of which were bilateral. Latency between onset of CRS and ICM detection ranged from 3-19 years (mean, 9.4). All patients underwent endoscopic transnasal drainage with three also requiring a concurrent, open neurosurgical procedure to access the intracranial component. There were no postoperative complications, and no recurrences were observed after a mean follow-up of 2.73 years.

Conclusion:

ICMs presenting as delayed complications of CRS are uncommon and constitute a surgical challenge. Open, external skull base approaches used in conjunction with transnasal endoscopic drainage procedures may be necessary to achieve successful management of this rare condition.

#46**Invasive Fungal Sinusitis in Children: Prognosticators for Survival**

Henry Barham, MD, Katherine Green, MD, Gregory Allen, MD, Kenny Chan, MD
Aurora, CO

Background:

Invasive fungal sinusitis (IFS) in children is rare and its prognosticators for survival are poorly understood. This study aims to determine important factors affecting outcome.

Methods:

A 10-year retrospective review at a tertiary academic children's hospital was performed using a combined ICD-9 and procedure-based search following institution-

al review board approval. All relevant demographic and clinical information was collected. Confirmation of IFS was based on endoscopic, histologic and microbiologic findings. Survival was defined as clearing IFS.

Results:

Twelve immune-compromised patients (M:F = 5:7; mean/range = 11/2-16 years) were identified including hematologic malignancies (10), diabetes mellitus (1) and unknown (1). Fungal species included: aspergillus (5), mucor (3), alternaria (2), rhizopus (1) and scopulariopsis (1). The cohort underwent an average of 6.3 (median= 5.5) endoscopic sinus surgeries (ESS) and was treated with aggressive anti-fungal therapy. Four (2 related and 2 unrelated to IFS) deaths occurred in the study population, with 10 survivors and 2 deaths by study definition. There was a significant difference in the absolute neutrophil count (ANC) at follow-up after treatment of IFS between the survival and mortality subgroups, with mean ANC being 3934/mm² and 169/mm², respectively (p=0.016).

Conclusions:

Despite the small sample size, this study represents one of the largest case series on pediatric IFS. Age, gender, immunodeficiency etiology and causative fungal agent were not important prognosticators. ANC appears to be the only factor responsible for survival as supported by the adult literature. While surgical debridement is deemed essential in IFS management, its role for disease survival is indeterminate.

#47

Is a Persistent Septal Deviation a Risk Factor for Disease Recurrence Following Endoscopic Sinus Surgery?

John Lee, MD FRCSC MSc, Alisha Jamal, HBSc MSc, Mazin Merdad, MD MPH
Toronto, Ontario

Background:

Inadequate treatment of a septal deviation (SD) during endoscopic sinus surgery (ESS) for chronic rhinosinusitis (CRS) may be a risk factor for disease recurrence because of limitations of endoscopic access and post-operative care.

Methods:

This was a case-control study accrued from a database of patients undergoing revision ESS for CRS at a tertiary rhinology center. Cases were identified as patients who required a septoplasty at the time of their revision ESS. An age and sex matched control group (revision ESS without septoplasty) was also identified. A blinded reviewer scored the pre-operative CT scans using the Lund-Mackay (LM) scoring system, treating each side independently.

Results:

In total, 11 cases and 11 controls were included giving a

total of 22 sides for comparison. The total LM score was 16.09 +/- 1.19 in the cases and 11.64 +/- 1.26 in the controls (p < 0.05). For the individual sinuses, there was no statistically significant difference in the maxillary (1.04 vs. 0.95) or in the frontal sinus (1.50 vs. 1.36) opacification scores. However, in the cases that had an untreated SD, there were statistically higher scores of the anterior ethmoid (1.50 vs. 1.18), posterior ethmoid (1.50 vs. 1.14), and sphenoid sinuses respectively (1.32 vs. 1.00) (p<0.05). Furthermore, radiographic OMC obstruction was highly associated with the presence of a SD (p<0.05).

Conclusion:

Inadequate treatment of a SD during ESS may be a risk factor for persistent or recurrent disease in the OMC, anterior and posterior ethmoid and sphenoid sinuses.

#48

Matthew Whinery, MD
Julie Goddard, MD, Michael Lepore, MD,
Aurora, Colorado

Introduction:

The purpose of this case report and literature review is to describe a disfiguring and increasing prevalent disease processes that is medically treatable. Mucocutaneous leishmaniasis (MCL) is an important entity to include in the differential diagnosis of destructive nasal, soft palatal, and pharyngeal lesions.

Methods:

Case report and literature review

Results:

Leishmaniasis is a protozoal disease caused by different species of the genus *Leishmania*. Leishmaniasis is increasing in incidence worldwide, especially in non-endemic areas, like the U.S. Leishmaniasis has two basic forms: 1. Visceral and 2. Tegumentary. The later includes both cutaneous and mucocutaneous forms and accounts for 1.5 million cases a year, predominately in N. Africa, the Middle East, and Latin America. MCL is characterized by localized destruction of the oral, nasal, and pharyngeal cavities. Diagnosis is often made with PCR, ELISA, or indirect immunofluorescence assay for Leishmanial DNA. Pentavalent antimonials (ie. sodium stibogluconate) are the first line of treatment, though; increasing resistance is being seen in certain endemic areas. Alternate/complementary treatment includes Amphotericin B and Pentamidine. Our patient, MN, underwent a nasal mucosal biopsy as well as serologic testing revealing active leishmaniasis. He was initially treated with itraconazole and was then transitioned to IV amphotericin, which halted his disease progression.

Conclusion:

Mucocutaneous leishmaniasis is a disfiguring and treat-

able disease process that is being seen in the United States with increasing frequency. The clinician needs to have a high degree of clinical suspicion for, as well as knowledge of, this curable disease.

#49

Modified Facial Artery Musculomucosal Flap for Reconstruction of Nasopharyngeal Defect after Extirpation of Chordoma Invading The Clivus

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Montreal, Quebec

Introduction:

The superiorly pedicled facial artery musculomucosal (FAMM) flap has been successfully used for reconstruction of head and neck defects since 1992. Common sites of defects include the oral cavity and oropharynx. Recently, the FAMM flap has been described in skull base reconstruction in cadaveric studies.

Objectives:

- 1) To present the harvesting technique of a newly developed modification of the FAMM flap using fascia of the masseter muscle.
- 2) To present a clinical case in whom we have successfully used this flap for nasopharyngeal and skull base reconstruction.

Methods:

- 1) Describe the anatomy and the harvesting technique of the FAMM flap with an extension to the masseteric fascia.
- 2) Present a case report of a patient recently operated at our institution using a modified FAMM flap for reconstruction of a nasopharyngeal and skull base defect after extirpation of a chordoma invading the clivus.

Results:

After tumor removal, the internal carotid artery in the nasopharyngeal portion was exposed. A modified superiorly based FAMM flap measuring up to 10 cm in length and 2.5 cm in width was successfully harvested and completely covered the defect. The flap survived at clinical follow up even after radiation therapy at the operating site.

Conclusion:

We have developed a new modification of the FAMM flap using the fascia of the masseter muscle. This is the first reported case in the literature using a modified FAMM flap for the reconstruction of nasopharyngeal and skull base defect.

#50

Modified Subtotal-Lothrop Procedure for Extended Frontal Sinus and Anterior Skull-Base Access: A Case Series

Jean Anderson Eloy, MD, FACS, Leila Mady, PhD, James Liu, MD
Newark, NJ

Background:

The endoscopic modified Lothrop procedure (EMLP) is well established for recalcitrant frontal sinus disease and anterior skull base (ASB) exposure. However, this technique may be unnecessarily aggressive by removing avoidable sinonasal structures in select cases. We previously proposed a modification of the EMLP, termed the modified subtotal-Lothrop procedure (MSLP) to access the ASB and complex frontal sinus disease for which access to the bilateral frontal sinus posterior table is required in a cadaveric study. In this study, we provide a step-by-step description of this technique, and present our experience in a series of 8 patients who underwent this approach.

Methods:

A retrospective analysis was performed at a tertiary referral center on all patients undergoing endoscopic ASB resection and complex frontal sinus surgeries between May 2011 and May 2013. Eight patients were identified who underwent a MSLP.

Results:

All patients underwent successful ASB exposure via the MSLP without complications and preservation of one frontal sinus recess. Adequate access to the bilateral posterior frontal sinus table was achieved in all cases. A patent frontal sinus drainage pathway could be assessed endoscopically after a mean follow-up of 9.4 months (range, 1-21 months).

Conclusions:

The MSLP is a feasible approach for exposure of the ASB and accessing complex frontal sinus pathology. This modification provides adequate ASB exposure and surgical maneuverability as the EMLP, while preserving one frontal sinus recess. This modification was successful in providing adequate exposure and maneuverability as well as maintaining frontal sinus patency in this small cohort.

#51

Monostotic Paget's Disease of the Frontal Sinus: Case Report and Review of Osseous Frontal Sinus Pathology

Varant Labajian, MD, Evie Landry, MS3, Fahad Alfawwaz, MD, Shaun Kilty, MD
Ottawa, Ontario

Introduction:

Osseous lesions of the frontal sinus are common. It is important to be aware of the various osseous pathologies that can present in this location as the management strategies may be similarly varied. Paget's disease of the bone (PDB) is one such osseous pathology that can present in the frontal sinus. Most of the time,

patients are asymptomatic which makes distinction from other pathologies difficult preoperatively.

Methods:

We present a rare case of monostotic PDB involving the frontal sinus. We provide a literature review of this presentation while reviewing the relevant clinical, diagnostic and histological findings. We also review the clinical distinctions seen with other paranasal sinus fibro-osseous lesions.

Results:

The presented case was treated using an osteoplastic flap given its extensive posterior wall involvement of the frontal sinus. This resulted in complete resolution of the patient's primary symptom, headache and for extenteration of the disease. Rheumatologic evaluation revealed that the disease was monostotic as whole body bone scan was otherwise normal, and the serologic alkaline phosphatase level was normal. Only one other case of frontal sinus PDB exists in the literature emphasizing its uncommon presentation as an isolated frontal sinus osseous lesion.

Conclusions:

Paget's disease of the bone is a disorder characterized by abnormal breakdown and formation of bone tissue. Although monostotic Paget's disease of the bone affecting frontal sinus is not common, the presented case illustrates the important clinical, radiologic and pathologic findings and how to clinically differentiate amongst frontal sinus osseous pathologies.

#52

Mucociliary Clearance Time in Patients with GERD using a Novel Technique

Luis Macias-Valle, MD, Mauricio Morales-Cadena, MD
Mexico City, Mexico

Introduction:

Currently there is conflicting data regarding the etiological relationship between chronic rhinosinusitis and gastroesophageal reflux. The effect of acid reflux in sinonasal mucociliary clearance has been the object of current lines of research obtaining both positive and negative correlations between them. The objective of the study was to evaluate the effect of GERD in sinonasal mucociliary clearance time using a novel technique.

Material/Methods:

Mucociliary clearance time was measured using a technique previously validated by the same authors, applying topical intranasal fluorescein and direct visualization in the oropharynx. Conditions such as temperature and humidity of the room where the study was realized were standardized to avoid variations between subjects. The study group was formed by patients with confirmed GERD and compared with a control group of patients without sinonasal disease and excluding patients with

factors that might affect mucociliary clearance on their own (smokers, ciliary disease, anatomic variations)

Results:

The study group included 30 patients with a mean age of 44.3 years (range 27-67) obtaining a median for muciliary clearance time of 22.15 minutes (range 17.09-26.17 SD 2.79). The control group was formed by 30 individuals with a mean age of 36 years (range 24-63) and the mucociliary clearance time of 9.45 minutes (range 7.3-14 SD 2.27). Using a student t we obtained a $p < 0.0001$ with a difference between groups of 12 minutes.

Conclusion:

On our study group we found a strong correlation of a delayed mucociliary clearance time in patients with documented GERD.

#53

Multifocal Sinonasal Inverted Papilloma with Middle Ear Involvement

Colin Fuller, MD, MS, Gerhard Hill, MD, Felix Olobatuyi, MD, David Clark, MD
Charleston, SC

Introduction:

Inverted papillomas (IP) of the paranasal sinuses are the second most common benign tumor in this anatomic region. Primary or secondary involvement of the temporal bone is extremely rare, with less than 30 total cases reported in the literature.

Methods:

Case report

Results:

The authors present a case of recurrent, multifocal IP of the paranasal sinuses with secondary spread to the Eustachian tube orifice of the right middle ear in a 44-year-old female. HPV 11 genotyping of nasal tissue was negative, while it was positive in the middle ear. Histology demonstrated high-grade dysplasia in all positive biopsies, however no malignant transformation was identified. Currently, there is no evidence of disease 8 months post-operatively. The patient is under close observation with scheduled MRI follow-up, nasal endoscopy, and in-office endoscopic middle ear examination via an anteriorly-based tympanic membrane perforation.

Conclusion:

Temporal bone involvement of inverted papilloma remains a rare disease, with little consensus concerning the best treatment options for multifocal, highly dysplastic disease. Close surveillance is recommended.

#54**Mycobacterium chelonae Dacryocystitis After Dacryocystorhinostomy**

Annika Meyer, BS, Kumar Prasad, MD,
Justin Antisdell, MD
Saint Louis, MO

Introduction:

This is the first known case report of a woman who developed unilateral dacryocystitis secondary to *Mycobacterium chelonae*. Patient had previously undergone right endoscopic sinus surgery (ESS) and dacryocystorhinostomy (DCR) with Crawford stent placement. We seek to describe our findings and effective methods to manage the infection.

Methods:

Three weeks after undergoing DCR, patient acutely developed symptoms consistent with dacryocystitis. The patient was treated with broad-spectrum antibiotics followed by incision and drainage of the dacryocystocele abscess. While patient improved somewhat, cultures were negative for bacteria and thus stents were removed. Cultures eventually grew *M. chelonae* and patient was treated with four months of intravenous antibiotic therapy. While receiving antibiotics, patient developed three abscesses along the inferior lid requiring excision.

Results:

To date, patient remains free of infection and has not experienced any other complications. Epiphora is resolved. Patient performed nasal irrigation with distilled water throughout her course. There have been five previously reported cases of *M. chelonae*-associated canalculitis, four of which occurred after intracanalicular plug placement. Because mycobacterium is a slow-growing organism, cultures may be negative for several weeks. Recommended therapy includes surgical debridement, removal of any implanted devices, and a two-drug antibiotic regimen for at least 4 months.

Conclusions:

Mycobacterium chelonae is an uncommon cause of ocular and periocular infections. This case serves as a reminder to consider *M. chelonae* as a potential cause of periocular infection, which may be more likely to occur with indwelling devices, as well as those patients with sinonasal issues requiring nasal irrigations.

#55**Nasal Obstruction - What are our Noses Sensing?**

Kai Zhao, PhD, Jianbo Jiang, PhD, Kara Blacker, PhD,
Pamela Dalton, PhD, Beverly Cowart, PhD,
Edmund Pribitkin, MD
Philadelphia, PA

Objective:

Nasal obstruction is the principal symptom that drives patients with rhinosinus disease to seek medical treatment. However, patient perception of obstruction often bears little relationship to actual measured physical obstruction of airflow. This lack of an objective clinical tool hinders effective diagnosis and treatment. Previous work has suggested that the perception of nasal patency may involve nasal trigeminal activation by cool inspiratory airflow; we attempt to derive clinically relevant variables following this phenomenon.

Study design:

Prospective healthy cohort

Methods:

Twenty-two healthy subjects rated unilateral nasal patency in controlled room air using a visual analog scale, followed by rhinomanometry, acoustic rhinometry and butanol lateralization thresholds (BLT). Each subject then immediately underwent a CT scan, enabling the construction of a "real-time" computational fluid dynamics (CFD) nasal airway model, which was used to simulate nasal mucosa heat loss during steady resting breathing.

Results:

Among all measured and computed variables, only CFD-simulated peak heat loss posterior to the nasal vestibule significantly correlated with patency ratings ($r=-0.46$, $p<0.01$). Linear discriminant analysis predicted patency categories with 89% success rate, with BLT and rhinomanometric nasal resistance being two additional significant variables. As validation, CFD simulated nasal resistance significantly correlated with rhinomanometrically measured resistance ($r=0.41$, $p<0.01$).

Conclusion:

These results reveal that our noses are sensing patency via a mechanism involving localized peak nasal cooling. The analysis provides a strong rationale for combining the individualized CFD with other objective and neurological measures to create novel clinical tool to diagnose nasal obstruction and to predict and evaluate treatment outcomes.

#56**Nasal Steroid Spray as a Causative Factor in the Development of Nasal Septal Perforation**

Andy Courson, MD, Stephen Bansberg, MD
Phoenix, AZ

Introduction:

Nasal steroid spray has been implicated as a potential cause of nasal septal perforation. We review our large series of septal perforations to examine the correlation between nasal steroid spray and the development of perforation.

Methods:

A retrospective study was conducted to determine the relationship between nasal steroid spray use and the development of a septal perforation. The medical histories from one physician's experience from November 1991 through January 2013 at a tertiary hospital were reviewed. Each patient had undergone perforation repair or silastic prosthetic obturation in the operating room. Establishing the etiology of each perforation was attempted. When steroid sprays were implicated, etiology was recorded as probable or highly probable.

Results:

Two hundred twenty-eight patients who met the study criteria were identified. Perforation etiology was determined in 198 (86.8%) patients. Steroid spray use was implicated in 6.6% of patients (40% probable, 60% highly probable) and was the fourth most common perforation etiology. Prior nasoseptal surgery (39.5%), nasal trauma (12.3%), and chemical cautery (7.0%) were more common causes of perforation. Less common causes were digital trauma (6.1%), intranasal drugs (5.3%), topical decongestants (4.8%), autoimmune disease (2.6%), and nasotracheal intubation (1.8%).

Conclusions:

Nasal steroid spray use is an important consideration when evaluating the patient with a septal perforation. Physicians prescribing nasal steroid sprays should make patients aware of the possibility of developing a septal perforation. Patients should be educated on proper administration technique and worrisome signs of septal irritation or ulceration.

#57**Nasopharyngeal Carcinoma Following Proton Beam Radiation for Recurrent Pituitary Adenoma**

Patrick Stevens, MD, Jessica Weiss, MD,
Seth Brown, MD, MBA
Hartford, CT

Introduction:

External beam radiation therapy has been shown to be effective in preventing recurrence and reducing mass effect of pituitary adenomas. The risks of post-operative radiation are well studied and include cerebrovascular accident, damage to the optic apparatus, brain necrosis, and development of brain tumors. Here we present the development of a nasopharyngeal squamous cell carcinoma in a patient only five years post radiation therapy to her pituitary gland.

Case Report:

An otherwise healthy 46-year-old female underwent transphenoidal hypophysectomy for an ACTH secreting pituitary adenoma in 2005. In 2008 she developed recurrent Cushing's disease and elected to undergo revision surgery and post-operative proton beam radiation to the sella. Five years later she noted to have significant con-

gestion and a nasal endoscopy revealed purulence around the sphenoid region bilaterally with friable tissue extending into the nasopharynx. The mass was biopsied and then subsequently resected following a tumor board dissection on treatment options. Pathology was consistent with a squamous cell carcinoma.

Discussion:

Secondary carcinoma following radiation for head and neck cancers is a known entity. External beam radiation therapy for pituitary adenomas is associated with the development of secondary neoplasms, although typically found intracranial (meningioma, schwannoma and glioblastoma multiforme). This case highlights early development of nasopharyngeal carcinoma secondary to radiation therapy occurring only 5 years post radiation therapy.

Conclusions:

Secondary radiation induced tumors can occur in the nasal cavity following pituitary radiation and should be considered in patients with nasal symptoms following this treatment.

#58**Newly Designed Double Vascularized Naso-Septal Flaps to Prevent Restenosis after Modified Endoscopic Lothrop Procedure (Draf III):**

Laboratory Investigation & Preliminary Results:
Abdulaziz Alqahtani, MD, Paolo Castelnovo, MD
Riyadh

Introduction:

Despite advances in endoscopic approaches, instrumentations and imaging guidance systems, the management of frontal sinus is still challenging. Failure of the endoscopic procedure and restenosis of the newly formed ostium have been demonstrated even with large frontal sinusotomy. We describe a newly designed double naso-septal flap to cover the bare bone after EMLP.

Material & Methods:

Five fresh, double injected cadavers were dissected through an endoscopic endonasal approach. Posterior-based nasoseptal flap in one side and lateral-based nasoseptal flap on the other side were harvested before performing wide EMLP. Feasibility of the procedure, versatility of the flap, coverage area and measurements were calculated. Clinical applications on our patients were evaluated along with follow up of 9 months.

Results:

Harvesting the mucoperichondrial /mucoperiosteal flap over the septectomy site was straightforward step. Two different designed flaps (one on each side) are more practical to avoid torsion of the flap. The flap measures 2x3 cm on average that was able to cover the bare bone of the anterior and posterior wall of frontal sinus. Clinically, our patients are a symptomatic and have stable frontal sinus opening with no re-stenosis.

Conclusion:

Osteoneogenesis and progressive osteoplastic activity after EMLP plays a major role in re-stenosis of frontal sinus. Vascularized nasoseptal flap helps in preventing closure of the new-formed ostium. Applying these flaps over the bare bone enhances the healing process and minimizes the crust formation.

#59**Novel Stenting of Frontal Sinus with an Esophageal or Bronchial Stent**

Shoji Matsune, MD, Kuwon Sekine, MD, Satoshi Yamaguchi, MD, Tadashi Kanashiro, MD, Hiroyuki Tajima, MD, Kimihiro Okubo, MD
Kawasaki, Kanagawa

Background:

Frontal sinus scarring and obstruction is a common complication of frontal sinus surgery. Though multiple stents and methods, such as balloon dilatation have been used to facilitate healing with an intact outflow tract, failures occur.

Aim:

To describe 2 cases of frontal sinus stenting using a novel application of an available esophageal and bronchial stent respectively. This may be useful in situations in which commercially available stents and techniques are not available.

Results:

Under general anesthesia, revision endoscopic frontal sinus surgery without navigation using a microdebrider, successfully opened the infected stenotic frontal sinus and purulence was irrigated from the sinus. An esophageal stent (Boston Scientific product) was adjusted to 4cm in length and placed in the nasofrontal duct endonasally and confirmed with fluoroscopy guidance. In a similar second case, a bronchial stent, which is similar to the esophageal stent but shorter in length, was used to stent the frontal recess. In the first case, at 6 months the patient remained free of frontal headaches with a patent stent, however the accumulation of a sticky mucus coat on the exposed esophageal stent required endoscopic debridement every two to three weeks. The bronchial stent case, the patient is free of headaches and at 2 month follow up the stent remains debris free.

Conclusion:

An esophageal or bronchial stent can be one of the effective devices for preventing re-obstruction of the frontal drainage route.

#60**Office Drainage of Fronto-Ethmoid Mucocoeles with Orbital Erosion**

Emily Barrow, MS, John DeGaudio, MD

Background:

Endoscopic marsupialization with drainage is the procedure of choice for the treatment of mucocoeles. In select patients this can be performed in the office. This study reviews our experience with in-office endoscopic drainage of mucocoeles with orbital bone erosion.

Methods:

A retrospective review of prospectively collected data of patients undergoing in-office endoscopic drainage of fronto-ethmoid mucocoeles with orbital erosion between 2007-2013. Patient demographics including age, gender, previous sinus surgery, previous facial trauma and presentation were reviewed. Anatomic location, bone erosion, complications, recurrence, and need for additional surgery were analyzed.

Results:

Between 2007-2013, 22 fronto-ethmoid mucocoeles were drained in the office. 12 of these patients were noted to have 13 mucocoeles (59%) with orbital erosion on CT. Mean follow up time for mucocoele drainage was 8.38 months. 58.3% of patients had undergone prior sinus surgery. Of the 13 mucocoeles with orbital erosion, 4 (33%) had further skull base erosion. No procedural complications occurred. All mucocoeles (100%) were successfully drained in the office. Two patients (15% of mucocoeles) required additional surgery, both of which were due to septated mucocoeles not completely drained in the office. One procedure was aborted due to neo-osteogenesis (not included in results).

Conclusion:

In-office drainage of advanced fronto-ethmoid mucocoeles has a high success rate, low complication rate, and high patient satisfaction with proper patient selection, even in the presence of bony erosion. The presence of septations and neo-osteogenesis reduce the chance of complete drainage and are relative contraindications. Orbital and skull base erosion are not contraindications.

#61**Omaliuzumab Therapy for Refractory allergic fungal rhinosinusitis Patients with Moderate or Severe Asthma**

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Vancouver, BC

Objectives:

1. To assess the efficacy of omalizumab therapy in improving sinonasal outcomes in refractory allergic fun-

gal rhinosinusitis (AFRS) patients with moderate or severe asthma

2. To determine if omalizumab therapy reduces the usage of corticosteroids or antifungal therapy in AFRS patients

Methods:

The clinical charts of patients with AFRS with moderate or severe asthma who received at least three subcutaneous injections of omalizumab therapy between 1st January 2012 and 1st February 2013 were retrospectively reviewed. These patients had undergone bilateral functional endoscopic sinus surgery (FESS) and failed adjunct medical treatments (oral or topical corticosteroids and/or antifungal therapy).

Results:

Seven patients met the inclusion criteria and were included in this study. The mean age of the patients was 48.14. The average number of subcutaneous omalizumab injections was 7.57 (range 6-11) with a mean dosage of 287mg (range 225-375mg). The mean pre-omalizumab treatment Sino-Nasal Outcome Test-22 (SNOT-22) score was 52.14 while the mean post-omalizumab treatment SNOT-22 score was 35.86 (31% improvement). The mean pre-omalizumab therapy Phillipott-Javer endoscopic score per sinus (over the last one year before omalizumab therapy) was 5.3/10 while the mean post-omalizumab therapy endoscopic score per sinus (from the last clinic visit) was 3.4/10 (36% improvement). Omalizumab therapy reduced the dependence of AFRS patients on corticosteroid and antifungal treatments. No significant complications were encountered from subcutaneous omalizumab therapy.

Conclusion:

Our case series showed that omalizumab therapy is a safe and effective treatment for patients with refractory AFRS with moderate or severe asthma.

#62

Out Fracture of Inferior Turbinate and Nasal Airflow

Ramin Zojaji, MD, Mehdi Bakhshaei, MD, Mojdeh Keshavarzmanesh, MD, Reza Behdani, MD, Sarvenaz Esmaealzadeh, MD, Morteza Mazloom, MD
Mashhad, Razavi Khorasan

Introduction:

Rhinoplasty is one of the most common and challenging cosmetic procedures. Surgeons should be aware of risk factors that are potentially associated with dissatisfaction especially nasal obstruction that is often related to narrowing in the region of the nasal valve. There are some procedures to prevent and correct this problem such as turbinoplasty.

Methods and Materials:

Using anterior active rhinomanometry before and 6 months after procedure, the nasal airflow was meas-

ured in 50 who underwent a cosmetic rhinoplasty as well as bilateral in and out fracture of inferior turbinate.

Results:

None of subjects complain from nasal obstruction before and after surgery, subjectively. According to rhinomanometry results improvement of nasal flow were seen in inspiration and expiration while the expiration was significant ($P=0.034$). Age and sex did not show any significant difference ($P>0.05$).

Conclusion:

We found that a rhinoplasty does not adversely affect the nasal airflow when considering simple adjuvant procedures such as turbinoplasty.

#63

Ozena Case Series: Klebsiella Infections in Immigrants of Differing Backgrounds

Mallory J. Yelenich-Huss, MS, Mallory J. Yelenich, MS, Derek J. Schmidt, MD, William Stauffer, MD, Holly Boyer, MD
Minneapolis, MN

Introduction:

Ozena, a form of atrophic rhinitis, though rare in the US, continues to be an important disease process in Africa, India, and the Middle East. Increasing physicians' awareness of the triad of fetid nasal discharge, crusting, and atrophy, particularly in immigrant populations, is key to diagnosis of this uncommon but debilitating disease.

Methods:

We present cases of nasal Klebsiella infection in three unrelated patients, including two East African children and one Saudi adult.

Results:

All three patients grew Klebsiella species in culture and required prolonged treatment with multiple methodologies, including antibiotics, saline rinses, and surgical debridement. They differed greatly in time from presentation to diagnosis, and demonstrate various stages of the disease process.

Conclusions:

Ozena is rarely seen in the US, and when it is seen it may be misdiagnosed for prolonged periods of time. Lack of prompt, adequate treatment can lead to long term sequelae such as obliteration of nasal architecture, anosmia, sinus and skull base destruction, and social ostracization due to the extreme foulness of the nasal discharge. Clinicians should maintain a high index of suspicion for primary atrophic rhinitis when presented with its classic symptoms.

#64**Pain and Functional Status Following Endoscopic Transsphenoidal Surgery**

Christopher French, MD, Walter Hall, MD, MBA, Parul Goyal, MD, MBA
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Introduction:

Over the last decade, endoscopic transsphenoidal surgery has been increasingly used for the surgical resection of sellar and parasellar lesions. Many studies have described the surgical technique and outcomes of endoscopic transsphenoidal surgery, but data regarding postoperative pain levels and functional scores in patients undergoing endoscopic transsphenoidal surgery remain limited. The goal of this study is to evaluate the postoperative pain levels and functional status in patients undergoing endoscopic transsphenoidal surgery.

Methods:

The Surgical Pain Scale (SPS) and the Activities Assessment Scale (AAS) are validated questionnaires designed to assess postoperative pain and functional status. This study used the SPS and AAS in 45 patients who underwent endoscopic transsphenoidal surgery. Average SPS and AAS scores were calculated at pre- and post-operative time points. Two-tailed T-tests were performed to compare pre- and post-operative scores.

Results:

At the first post-operative visit, average pain was 1.8/15 at rest and 1.9/15 during normal activities. The average rating of greatest pain intensity was 2.6/15. The average AAS score at the first post-operative visit was 87.7/100. When compared to pre-operative scores, there was minimal change in pain levels and functional status at the first post-operative visit ($p=.6$ for pain scores and $p=.08$ for functional status scores).

Conclusions:

Pain levels after endoscopic transsphenoidal surgery are very mild. In addition, patients have very limited impairment of their functional status based on validated questionnaires. This information may be helpful in surgical counseling and decision making.

#65**Parental Smoking and Allergic Rhinitis in Children**

Maryam Salehi, MD, Mehdi Bakhshae, MD, Samineh Sehatbakhsh, MD, Mana Hossainzadeh, MD, Sara Ashtiani, MD, Mona Najafi, MD
Mashhad, Khorasan Razavi

One of the controversial risk factors for allergic rhinitis is parental smoking. The aim of this study was to investi-

gate the relationship between parental smoking and allergic rhinitis with taking into account other possible related factors in children 2-7 years old.

Methods:

A cross sectional study was conducted on 671 children 2-7 year old in Mashhad, a city in North East of Iran in 2012. Random cluster sampling was used to choose participants. Signs and symptoms of allergic rhinitis in children were assessed by physician and the parents answered ISAAC questionnaire (International Study of Asthma and Allergies in Childhood) about the other risk factors of disease.

Results:

In the multivariate analysis, parental smoking (odds ratio=1.07; 95% confidence interval: 0.48- 2.41) was not a significant risk factor for allergic rhinitis and among other risk factors only positive family history of allergy (23.64; 11.63-48.04) was significant. Other risk factors such as, being male (1.16; 0.60-2.24), family number (1.06; 0.22-5.05), family income (0.60; 0.24-1.47) and parent's education (1.79; 0.61-5.20) were not statistically significant.

Conclusion:

We found that parental smoking has no significant relationship with allergic rhinitis and only family history of allergy was significant

#66**Patterns and Sequelae of Sphenoid Sinus Fractures**

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Syracuse, NY

Introduction:

The sphenoid sinus is one of the most commonly fractured regions of the central skull base. These fractures may be associated with severe complications such as carotid artery injury and cerebrospinal fluid leakage. The purpose of this study was to evaluate the patterns and complications of sphenoid sinus fractures.

Methods:

A retrospective review of 123 patients sustaining sphenoid sinus fractures was performed. Patient medical records and radiographic images were reviewed. Fractures were classified based on the site of anatomic involvement. Logistic regression was used to analyze the association between fracture subsites and sequelae.

Results:

The most commonly fractured subsites included the carotid canal, sphenoid roof, and lateral wall (60%, 49% and 48%, respectively). CSF leaks were found in 9% of patients while carotid injury was found in 1.6% of cases. On logistic regression analysis, sphenoid roof fractures were found to be significantly associated with

the presence of CSF leaks (OR= 12.4, p=0.0018). No fracture subsites was found to be associated with carotid injury. The positive predictive value (PPV) of sphenoid roof fractures for the presence of CSF leaks was 16.7%, while the negative predictive value (NPV) was 98%. The PPV of carotid canal fractures for carotid injury was 3%, while the NPV was 100%.

Conclusion:

CSF leaks were the most common sequelae of sphenoid sinus fractures, while carotid artery injuries were extremely uncommon. Analysis of fracture patterns can be useful for risk stratification and determining need for additional evaluation.

#67

Phosphaturic Mesenchymal Tumor: A Rare Sinonasal Neoplasm

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Phoenix, AZ

Introduction:

Phosphaturic mesenchymal tumor (PMT) is a benign neoplasm found very rarely in the nose and paranasal sinuses. The significance of this unique entity is its associated paraneoplastic syndrome, tumor-induced osteomalacia, which occurs by secretion of the hormone fibroblast growth-factor-23 (FGF23). This hormone causes renal phosphate wasting leading to bone demineralization. Approximately 95% of PMTs involve the extremities or appendicular skeleton, with only 5% occurring in the nose and paranasal sinuses.

Objectives:

We present a case of sinonasal phosphaturic mesenchymal tumor and discuss this neoplasm's unique features, including tumor-induced osteomalacia.

Methods:

Case report and review of the literature.

Results:

Literature review found 13 cases of sinonasal PMT, which are reviewed here. We also present our case: A 41-year-old man presented with a history of progressively worsening nasal obstruction, discolored rhinorrhea, anosmia and facial pressure. He was found to have a 5-cm expansile, midline mass eroding the skull base with near complete septal destruction. Preoperative biopsy suggested phosphaturic mesenchymal tumor. Serum calcium, urine phosphate, and FGF23 were checked to evaluate for tumor-induced osteomalacia. The tumor was resected endoscopically with negative margins. Final histopathologic diagnosis confirmed PMT. After 6 months of follow-up, the patient has done well, without recurrence.

Conclusions:

Despite the rarity of sinonasal PMT, knowledge of this entity and its associated paraneoplastic syndrome is essential to performing an adequate workup. At the time of diagnosis, patients may already have extensive skeletal pathology. Complete tumor resection with negative margins is curative and may prevent or reverse the progression to osteomalacia.

#68

Predictive Factors that Increase Risk of Revision Sinus Surgery after Lothrop Procedure

Nadia Chan, MD, Jill Mazza, MD, Bozena Wrobel, MD
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Introduction:

The purpose of this study is to identify the patients undergoing EMLP that would need further revision endoscopic sinus surgery (ESS).

Methods:

The study utilized retrospective chart review of patients who underwent endoscopic modified Lothrop procedure (EMLP) between June 2008 and December 2012 at a single institution. Preoperative diagnoses, presence of allergies, sinonasal polyposis, Samter's triad, previous ESS, and need for revision ESS after EMLP were all identified. Endoscopic assessment of frontal sinus patency was evaluated by same single surgeon at post-operative visits.

Results:

A total of 41 patients who met inclusion and exclusion criteria were included. Follow up ranged from 6 months to 5 years. The primary indications for EMLP were chronic rhinosinusitis (56%), mucocele (12%), inverted papilloma (12%), meningioma (5%), skull base fracture (5%), osteoma (5%), ciliary dyskinesia/CF (5%). In 82% of patients, several ESS were performed prior to EMLP. In 17% of patients, a post-Lothrop ESS was needed for recurrent nasal polyposis (86%) and recurrent inverted papilloma (14%). 43% of patients who required revision ESS post EMLP had Samter's triad. The frontal sinus drainage pathway was assessed and scored in the clinic endoscopically at post-operative clinic visits. The patency rate of frontal sinus in 83% was = 80% at their latest visit.

Conclusion:

The presence of nasal polyps and/or Samter's triad significantly increased the risk of a further revision ESS post EMLP.

#69**Preservation of Olfaction after Unilateral Endoscopic Approach for Resection of Esthesioneuroblastoma**

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Ameet Singh, MD
Washington, DC

Introduction:

Esthesioneuroblastoma (ENB) is a malignant tumor of neuroectodermal origin arising from the olfactory epithelium. Recently, endoscopic approaches have demonstrated similar oncologic results compared to open approaches with fewer post-operative complications. Given the intimate relationship of ENB with the olfactory bulb, preservation of olfaction after surgery remains difficult. We report a case of olfactory preservation after a unilateral transcribriform transethmoidal resection of ENB.

Methods:

The clinical course of a 28-year-old female who underwent an endoscopic en bloc resection of ENB through a unilateral transcribriform transethmoidal approach was reviewed. Imaging demonstrated a left-sided nasal mass with cribriform plate erosion. Intraoperatively, the left olfactory bulb and epithelium were sacrificed. Negative frozen sections were obtained from the right olfactory epithelium and dura surrounding the right olfactory bulb. Reconstruction was performed using a multilayered closure of fascia, rigid buttress and nasoseptal flap. No post-operative radiation therapy was performed.

Results:

Histology was consistent with ENB. Post-operative clinical evaluation, endoscopy and imaging demonstrate no evidence of residual or recurrent tumor. UPSIT smell testing revealed normal olfaction pre-operatively, moderate microsmia at 3-months post-operatively and mild microsmia at 18-months post-operatively.

Discussion:

Endoscopic resection of ENB has demonstrated similar oncologic control while reducing postoperative morbidity and mortality over transcranial approaches. The literature reports that 69% of patients with anterior skull-base neoplasms experience smell and taste disturbances. This case illustrates the potential to preserve olfaction while achieving en bloc resection of ENB. Further evaluation of surgical technique is required in order to improve preservation while ensuring adequate oncologic resection.

#70**Pulmonary Function Test Decline Stable after First Sinus Surgery in Pediatric Patients with Cystic Fibrosis**

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Allen Seiden, MD, Kaalan Johnson, MD
Cincinnati, OH

Objective:

Pulmonary Function Tests (PFTs) are well validated predictors of long-term survival for pediatric patients with cystic fibrosis (CF). Controversy exists regarding the effect of endoscopic sinus surgery (ESS) on PFTs in pediatric patients with CF. We sought to assess whether PFT decline was affected by ESS.

Study Design:

Longitudinal retrospective analysis of prospectively gathered cohort.

Setting:

Pediatric tertiary care CF center.

Main Outcome Measures:

Analyze the effect of first ESS on pulmonary function test. Compare PFT outcomes between different socioeconomic demographics.

Subjects and Methods:

A prospectively gathered database of pediatric patients being treated at our CF center from 1999-2012 was analyzed for diagnosis of sinusitis and ESS procedures. MQFEV1 decline before and after first ESS was measured using a mixed model to account for repeat measures controlling for initial MQFEV1, age, and insurance status.

Results:

Our study included 47 ESS patients, 17 male and 30 female. The mean age at time of surgery was 8.3 (range 1.3-17.3). These 47 patients underwent a total of 155 procedures, with a median of 2 (range, 1-25) procedures per patient. Seventeen patients underwent a single procedure, while 30 required revision surgery. There was no statistically significant difference in MQFEV1 decline before and after ESS ($p=0.73$).

Conclusion:

This is the largest series analyzing pediatric CF patients undergoing ESS. We found no statistically significant difference in MQFEV1 decline after sinus surgery. Further studies are indicated to analyze quality of life measures as an indication for ESS in this population.

#71**Recurrence of Inverted Papilloma of the Sphenoid Sinus Overlying a Dehiscent Carotid Artery: Case Report and Literature Review**

Stefan Mlot, MD, Aaron Pearlman, MD
New York, NY

Introduction:

Inverted papilloma (IP) is a benign, locally invasive sinonasal tumor classically originating from the maxillary sinus. In rare cases (1.5%), these tumors originate in the sphenoid sinus. We present a case report of a patient with recurrent IP overlying a dehiscent internal carotid artery (ICA) in the sphenoid sinus.

Methods:

Case report and review of the literature.

Results:

66 year-old male with a history of nasal congestion was found on CT scan to have a mass occupying the left sphenoid sinus and protruding through the natural ostium to involve the posterior ethmoid sinuses and nasal cavity. Initial resection included complete left ethmoidectomy, posterior septectomy, and bilateral sphenoidotomy with removal of tumor. The site of origin appeared to be the left side of the intersinus septum. At 9 months post-op, recurrent disease was seen within the left lateral sphenoid. A CT revealed dehiscence of the posterolateral wall of the sinus into the cavernous segment of the left ICA. Successful revision resection was performed with neurosurgical assistance. The tumor was adherent to the fascial plane overlying the dehiscent left carotid. The patient has done well post-operatively, with no evidence of recurrence.

Conclusion:

Cadaveric studies have shown that the ICA is dehiscent in 8-25% of the population, but there have been no case reports of IP involving the sphenoid in this subset of patients. The patient's tumor was excised without complications and with no evidence of disease on follow-up, demonstrating that these tumors can be removed safely using an endoscopic transsphenoidal approach.

#72**Re-Interpreting the Microbiome: Whole Genome Sequencing of Staphylococcus Aureus Isolates Identifies Bacteriophage Genes in Poor-Evolution CRS Patients**

Martin Desrosiers, MD, Leandra Mfuna Endam, MSc, Jean Barbeau, PhD, Scott E. Dowd, PhD, Joaquin Madrenas, MD, Michael Surette, PhD
Montreal, Quebec

Introduction:

We have previously identified (Bendouah et al, 2007) that clinical isolates of *Staphylococcus aureus* (*S. aureus*) recovered from CRS patients have different in-vitro behaviours, with isolates with greater biofilm-generating capacity associated with a poorer clinical outcome. We thus suspect that genetic differences between isolates underpin these differences and wished to identify potential bacterial virulence genes by comparison of *S. aureus* genomes isolated from poor-evolution and good-evolution CRS patients.

Methods:

DNA was extracted from 5 clinical isolates of *S. aureus* from CRS patients with known evolution (two poor-evolution, three good-evolution) and whole genome sequencing of bacterial DNA performed using a Roche 454 sequencer. *S. aureus* genomes were compared using the SEED viewer / RAST server software to identify differences in presence of known bacterial genes.

Results:

S. aureus genomes were sequenced by 454 for a coverage depth of 6-8X. Size varied from 2.6 - 2.8 Mbp. There was considerable homology between isolates, however, poor-evolution species had genetic elements not seen in the good evolution ones. These consisted of numerous bacteriophages and Superantigen enterotoxins (SEB; SEL).

Conclusions:

Identified differences in clinical evolution attributed to isolate-specific characteristics may be related to differences in genetic makeup of organisms. In addition to variations in bacterial genes, this may potentially be secondary to integration of bacteriophage genes into bacterial DNA. Bacteriophages adhering to mucus at mucosal interfaces have recently been suggested as a mechanism of regulation of bacterial presence and behaviour. These potentially exciting findings will require confirmation in larger series.

#73**Relationship Between Changes in Polyp Size and Patient Reported Outcomes Following Treatment with a Topical Steroid**

Per Djupesland, MD, PhD, John Messina, PharmD, Ramy Mahmoud, MD, MPH
Yardley, PA

Introduction:

In studies involving patients suffering from chronic rhinosinusitis with nasal polyps (CRSwNP), polyp 'size' is typically used as an objective measure of response to treatment. However, symptoms associated with CRSwNP are more relevant to patients and drive treatment. Therefore, the relationship between change in endoscopically measured polyp size (Lildholdt scale) or total polyp burden (lateral imaging) and change in patient-reported outcomes are of interest. This analysis

was performed to identify levels of change in 'objective' polyp measurements associated with meaningful improvements in patient reported outcomes.

Methods:

Data from a previously published study in 109 CRSwNP patients treated with topical fluticasone (administered with an OptiNose Breath Powered™ Device) were analyzed. The changes in objective polyp measurements after 12 weeks of treatment were analyzed against the change in two patient-reported outcomes: combined symptom score (0-12) and patient global impression of change scores (2=much improved/1=improved/0=same/-1=worse/-2=much worse).

Results:

Patient-reported combined symptom scores were significantly correlated with both 'objective' measures of polyp burden (Lildholdt: Spearman $r=0.35$, $p<.001$ and Lateral Imaging $r=0.49$, $p<.0001$). Patient global impression of change was also significantly correlated with both 'objective' measures (Lildholdt: Spearman $r=0.54$, $p<.0001$ and Lateral Imaging: $r=0.65$, $p<.0001$). Patients who rated change as improved or very improved had an average ~40% reduction on bilateral polyp burden and ~0.9 change in polyp score

Conclusions:

There is significant correlation between treatment-related endoscopic measures of polyp change and patient reported outcomes, including global impression of change. Research criteria for clinically significant treatment response and analogy to other therapeutic areas will be discussed.

#74

Safety and Feasibility of In-Office Nasal Polypectomy using the Polypvac Device: The Canadian Experience

Mohammad Al Felasi, MD, Francois Lavigne, MD, Yvonne Chan, MD, Amin Javer, MD, John Lee, MD, Martin Desrosiers, MD
Montreal, QC

Introduction:

Management of primary or recurrent chronic rhinosinusitis with nasal polyposis (CRSwNP) in patients unresponsive to medical therapy but unwilling to undergo surgery is challenging. The PolypVac is a new, self-contained disposable suction-powered instrument which represents an option for in-office CRSwNP resection, and has been used in six centers in Canada during the past year. We wished to review our experience with PolypVac in the management of patients with CRSwNP. **METHOD:** Physicians completed a standardized evaluation form at the time of each procedure performed with the PolypVac. These were assessed as to safety and feasibility of use of the PolypVac in the outpatient setting.

Results:

Ninety seven patients underwent treatment (59% prior ESS). All procedures were performed in the office or clinic. Average treated NP grade was 2.08/4. Ease of setup was reported as 'good' in 94% and 'acceptable' in 4%. Topical anaesthesia or pledgets only were used in 91%. PolypVac performance was reported as "good" or "acceptable" in 95%, with average reduction in polyp grade 1.3/4. Procedure was completed as planned in 85%. 'Incomplete' were mainly due to fibrous polyps or patient comfort. Comfort of procedure was rated as 'Excellent' in 29%, 'Good' in 38%, 'Fair' in 30%, and 'poor' in 3%. Bleeding was 'None' or 'Light' in 88%, 'Moderate' in 10%, and 'Severe' in only 1 case. No case required admission or transfusion.

Conclusion:

The Canadian experience with the PolypVac suggests it is a safe, well-tolerated tool for CRSwNP resection in the in-office setting.

#75

Safety Assessment of Topical Probiotics for Chronic Rhinosinusitis (CRS): Elevated IL10 Levels Do Not Contribute to Epithelial Hyperplasia in CRS

Joseph Schwartz, MD, Sawsan Al-Mot, MSc, Leandra Endam, MSc, Benoit Cousineau, PhD, Joaquin Madrenas, MD, PhD, Martin Desrosiers, MD
Montreal, Quebec

Introduction:

We have previously documented induction of the anti-inflammatory cytokine IL-10 by topical probiotics as a potential novel therapeutic strategy for chronic rhinosinusitis (CRS). However, probiotics may induce IL-10 production via an epithelial growth factor receptor (EGFR) mediated pathway, raising important concerns regarding undesired epithelial hyperplasia as a potential adverse effect. We wished to verify whether IL-10 correlates with epithelial thickness in the sinus mucosa prior to commencing a clinical probiotic trial.

Methods:

Simultaneously obtained biopsy samples from 9 CRS patients and 4 controls were assessed for epithelial hyperplasia using H&E staining and IL-10 secretion using immunohistochemistry. Student's t-test was used to verify differences between groups and Pearson's correlation coefficient to verify correlation.

Results:

Epithelial hyperplasia was greater in the CRS group although this difference was not significant (CRS: 2.53, CTL: 2, $p = 0.127$). When CRS and control samples were grouped together, no relationship was observed between epithelial thickness and IL-10 levels (intraepithelial: $r = 0.01$, intraglandular: $r = -0.14$). Subgroup analysis demonstrated a strong and a moderate inverse relationship between epithelial thickness and intraep-

ithelial IL-10 levels [CTL ($r = -0.95$), CRS ($r = -0.51$)] amongst controls and CRS samples respectively.

Conclusion:

While epithelial hyperplasia is noted in CRS, it does not appear to be a function of IL-10 levels. Therapies exploiting IL10 induction for the management of CRS such as topical probiotics should thus be free of this potential adverse effect.

#76

Septal Perforation Secondary to Nebulized Steroid Usage

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Hartford, CT

Introduction:

Recently there has been an increase in utilization of nebulized intranasal drug delivery. Intranasal steroids are used in the treatment of chronic rhinosinusitis with nasal polyposis. Nebulized delivery has the benefit of applying medication directly to the site of inflammation. Local adverse reactions include headache, epistaxis, and nasal irritation. Here we report two cases of septal perforation following the use of nebulized intranasal steroids.

Case Reports:

Two patients in our practice with a diagnosis of chronic rhinosinusitis developed septal perforations following the use of nasal steroids delivered by a nebulizer device. Case 1 is a 43-year-old male diagnosed with chronic rhinosinusitis and aspirin sensitivity. He was started on nebulized budesonide one month prior to revision sinus surgery and continued on the medication for five months postoperatively until a septal perforation was noted. Case 2 is a 46-year-old-male with chronic rhinosinusitis, increased IgE levels placed on nebulized budesonide postoperatively for 15 months prior to the development of a septal perforation.

Discussion:

The use of prolonged nebulized budesonide may have contributed to septal perforation in these two patients. Newer low pressure delivery devices may reduce the risk of perforation. Septal perforation as a result of nebulized intranasal steroids has not been reported in the literature to our knowledge.

Conclusions:

Prolonged nebulized intranasal steroids are thought of as a safe medication due to limited systemic effects and have become a common treatment therapy for patients with nasal polyposis. The risk of septal perforation should be discussed with patients using nebulized intranasal steroids.

#77

Sinonasal Squamous Cell Carcinoma and the Prognostic Implications of its Histologic Variants: A Population-Based Study

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Background:

Conventional squamous cell carcinoma (SCC) of the head and neck has been studied extensively, but less is known about the SCC variants. Variants of SCC make up 15% of all cases of SCC of the upper aerodigestive tract. There are five main variants of SCC in the sinonasal region; Verrucous, papillary, spindle cell, basaloid, and adenosquamous.

Methods:

The Surveillance, Epidemiology, and End Result (SEER) database was used to extract frequency and survival data from 1973 to 2009. A total of 4,382 cases of SCC and 328 cases of the five variants of SCC were found. Statistical comparisons of the frequency and survival data for SCC and its variants were carried out with respect to varying demographic and disease specific parameters.

Results:

Basaloid SCC was diagnosed at a significantly lower mean age and the spindle cell variant affected the maxillary sinus a significantly greater proportion of the time when compared to conventional SCC. Basaloid SCC had a relatively similar 5-year survival at 61.7% when compared to conventional SCC, which had a 5-year survival of 52.4%. The 5-year survival rate for the adenosquamous variant was significantly lower at 18.7%.

Conclusion:

Basaloid and adenosquamous SCC are high-grade variants of SCC and have long been considered to have a poor prognosis. This analysis found the survival of the basaloid variant to be similar to conventional SCC. In contrast, adenosquamous demonstrated a significantly lower 5-year survival ($p < 0.05$) and an almost two times greater mortality rate when compared to conventional SCC.

#78

Sinus Microbiome in Health and Disease

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Aurora, CO

Chronic rhinosinusitis (CRS) is an idiosyncratic and multifactorial disease process, in which bacteria may play some role. Culture-independent techniques have demonstrated that the sinuses are not sterile, as has long been the belief, but the normal sinus microbiome

has yet to be thoroughly examined. It has been shown that a rich and diverse suite of commensal bacteria populate the sinuses in the healthy state, and that chronic rhinosinusitis (CRS) is characterized by a loss of bacteria. In addition, patients with *S. aureus*, a common and problematic pathogen in CRS, also were found to have decreased bacterial diversity. When the microbiome of CRS patients is examined by subgroups, the particularly challenging group of CRS patients with nasal polyps and asthma were found to have a higher abundance of *S. aureus*. The relationship of the microbiome, characterized by the loss of diversity, is a fascinating observation. This finding can be the iatrogenic result of administration of medications, the underlying disease etiology, or more likely a source of continued inflammation which allows the cycle of epithelial injury, infection and inflammation to continue. Here we present an examination of the sinus microbiome utilizing 454 pyrosequencing of normal and CRS patients (n=28 and 54), and discuss our findings as they relate to disease state and patient metadata. Future study into temporal relationships in terms of stability and resilience will provide insight into the causal relationship with disease states.

#79

Sinusitis, Sleep Fragmentation, Immunology and Balloons

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Rochester Hills, MI

Recent studies using balloon sinuplasty to treat mild sinusitis have shown improvement in sleep and daytime fatigue as measured by the SNOT-20. Fifteen patients presenting with recurrent acute sinusitis have been diagnosed with narcolepsy. Upon treatment of narcolepsy with stimulants, all 15 patients have noticed marked reductions in their sinusitis episodes. These series would suggest a link between sleep and sinusitis. A likely explanation is that nocturnal sinus pain causes sleep fragmentation similar to narcolepsy. Sleep fragmentation causes changes in the immune system through immunoglobulin levels and leukotrienes. These immune changes predispose to sinusitis and further sleep fragmentation. Sinusitis causes sleep fragmentation and immune changes. Literature review of these hypothesis will be reviewed.

#80

Sinuwave Photodisinfection for the Treatment of Refractory Chronic Rhinosinusitis: A Case Series

Mohammad Al Felasi, MD, Leandra Mfuna Endam, MSc, Monika Knapik, MD, Martin Y. Desrosiers, MD
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Introduction:

Inflammation in refractory chronic rhinosinusitis (RCRS) is complicated by persistent bacterial colonization resistant to treatment by usual means. Antibacterial

photodynamic therapy (PDT) using a diode laser and methylene blue as a photosensitizing agent has been shown effective in eradicating in-vitro biofilms of CRS bacteria (Biel, IFAR, 2013) and offers promise in the management of RCRS. A commercial version of this apparatus is marketed in Canada for the treatment of RCRS as the Sinuwave system. We wished to present our early clinical experience in treating RCRS using the Sinuwave system.

Method:

Patients were treated in the outpatient clinic under topical anesthesia without sedation. Following saline irrigation, the photosensitizing agent was sprayed into the affected sinus(es) and the sinus illuminated with low-level laser light using the Sinuwave catheter. The procedure was repeated if required in other affected sinuses.

Result:

Twenty nine sinuses (13 frontal, 6 ethmoid, 10 maxillary, 0 sphenoid) in nine patients with RCRS persisting following technically successful ESS have been treated with the Sinuwave™ photodisinfection system. (Mean: 2.23 sinuses/patient per treatment session) Four patients underwent two treatment sessions. Treatment was well tolerated, with no evidence of mucosal irritation and the procedure was completed in all. Short term-follow up has shown no delayed complications and somewhat surprisingly, resolution of disease in several patients.

Conclusion:

Patients with RCRS can be safely treated with photodynamic therapy using the Sinuwave™ photodisinfection system under local anesthesia on an outpatient basis. These early results, while promising, will require validation in prospective clinical trials.

#81

Smell Function Following Unilateral Olfactory Bulb Preservation after Esthesioneuroblastoma Resection

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Introduction:

Functional adaptations in the endoscopic resection of esthesioneuroblastoma have allowed preservation of contralateral olfaction without compromising negative surgical margins. While many series have reported decreased morbidity and equal survival outcomes with endoscopic resection compared to craniofacial resection, few have analyzed unilateral olfactory bulb preservation and quality of life measures like sense of smell.

Methods:

The following entry criteria were created for this observational cohort study. Data was collected on patients

who underwent esthesioneuroblastoma surgical resection with preservation of one olfactory bulb between 2003-2012. All patients had negative frozen section margins at primary surgery. Data collected include demographic information, Kadish staging, pathology, operative report, postoperative treatment and survival. After the completion of post operative radiation, patients were administered the Smell Identification Test (SIT) to determine olfactory function.

Results:

Seven patients met entry criteria and were tested for post-treatment olfactory function. All 7 patients received postoperative radiotherapy and one patient also received chemotherapy. The present study demonstrates 100% disease-free survival with an average follow-up of 55 months (14-118 months), consistent with previously reported survival data. Two out of seven patients (29%) had residual olfactory function with a SIT score of 31,38/40 after completing definitive treatment.

Conclusions:

Preservation of contralateral olfactory bulb is oncologically possible in select patients that undergo endoscopic resection of esthesioneuroblastoma. The primary goal of surgery is a complete resection, but long-term quality of life measures should also be considered as our study demonstrates 29% of patients continue to have olfactory function following contralateral bulb sparing surgery and radiotherapy.

#82

Societal and Provider Perspectives on Sinusitis Diagnosis and Treatment

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Justin Antisdell, MD
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Introduction:

Sinusitis is diagnosed in 31 million individuals annually and has a significant impact on healthcare expenditures. Otolaryngologists understand that patient expectations and knowledge of the diagnosis, as well as use of therapeutic options by patients and primary care physicians (PCPs) vary greatly. The intent of this study was to elucidate these differences amongst patients and physicians.

Methods:

Three surveys were developed with questions targeting sinonasal infections: specifically prevalence, diagnosis, treatment, and referral patterns to tertiary providers. Surveys were distributed to general patients (108), PCPs (34), and otolaryngologists (40).

Results:

In a description of viral upper respiratory tract infections (URI), 43% of patients attributed those symptoms to allergies, 28% to the common cold/URI, and 28% to

sinus infections. Despite this, 37% of patients still expected antibiotics. Of patients with symptoms for less than 5 days, 50% of PCPs reported they would treat, whereas only 32% of otolaryngologists would pursue therapy. Among PCPs who choose to treat, 94% would offer an oral antihistamine, 77% topical nasal steroids, and 53% oral antibiotics. Regarding referral patterns, 55% of the general population reported they would expect referral to an otolaryngologist for initial failure of antibiotics or symptoms lasting longer than 14 days. 70% of PCPs reported they would refer to an otolaryngologist in this setting.

Conclusions:

Patients with sinonasal symptoms confuse URI for sinusitis and expect unnecessary intervention, revealing that patients need further education. Practitioners also need further guidance regarding indications for referral and approaches to therapy.

#83

Standardization of the CT Sinus Protocol to Improve Patient Care

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Background:

Computed tomography (CT) of the sinuses is a common diagnostic study in patients with sinonasal symptoms. Currently there is no standardized CT sinus protocol, and patients who meet indications for CT scans and subsequently undergo image-guided endoscopic sinus surgery (IGSS) may require a repeat scan for this purpose. The objective of this study was to evaluate the frequencies of CT scans inadequate for image guidance and repeat CT scans specifically for purposes of IGSS.

Methods:

A chart review was performed at a single institution in a tertiary care rhinology practice over a three-month period. New patients with any sinonasal diagnosis who had existing CT sinus scans at the time of evaluation were included. Scans were considered inadequate for image guidance for any of the following: greater than 1.5 mm slice thickness, missing necessary data, or incompatible for uploading to the image guidance system. The ordering provider, number of scans inadequate for IGSS, and the number of repeat scans ordered for purposes of IGSS was recorded.

Results:

86 patients met inclusion criteria, of which 33(38%) had scans that were compatible with image guidance and 46(53%) underwent endoscopic sinus surgery. 67% of patients undergoing ESS required image guidance, of which 65% required a repeat CT due to the initial scan being incompatible. Otolaryngologists were twice as likely to order a compatible scan versus other providers.

Conclusion:

Standardizing the CT sinus protocol avoids repeat scans for most image-guided systems. Potential advantages include reduced cost and avoidance of unnecessary radiation to the patient.

#84

Supraorbital Ethmoid Cell: A Constant Landmark for Endoscopic Identification of The Anterior Ethmoidal Artery

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Introduction:

The lack of an easy and reliable technique for endoscopic identification of the anterior ethmoidal artery often leads to incomplete surgery of the frontal recess. The objective of this study is to show that the supraorbital ethmoid cell (SOEC) is a constant landmark by which to identify the anterior ethmoidal artery (AEA) even in the setting of severe inflammatory frontal recess disease.

Methods:

This is a retrospective anatomic study. Paranasal sinus CT scans for 78 consecutive patients (156 sides) were evaluated for the presence of SOECs, degree of SOEC pneumatization, and the location of the AEA in relation to fixed anatomic structures. The same analysis was performed on CT scans for a group of 15 patients (19 sides) with anatomic distortion of the frontal recess secondary to inflammatory disease.

Results:

The incidence of SOECs was 53%. 65 of 68 sides (96%) with normal SOECs without frontal recess expansion demonstrated the AEA within or in continuity with the posterior wall of the SOEC. In patients with pathologic frontal recess expansion, the AEA remained within the posterior border of the SOEC in 18 of 19 sides (95%) despite significant expansion of the SOEC superolaterally.

Conclusion:

This is the first study to demonstrate a constant landmark by which to identify the AEA even in cases of expansile inflammatory disease of the frontal recess. Identification of the SOEC is a practical and reliable way to allow safe dissection of the frontal recess with minimal risk of injury to the AEA.

#85

Surgical Anatomy and Variations of the Infraorbital Nerve

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Objectives:

To assess relevant variations in the anatomical course of the infraorbital nerve (ION). This understanding may reduce the risk of surgical injury.

Methods:

100 consecutive CT sinus studies obtained in a tertiary referral center were reviewed and measurements made of the 200 IONs using a flat panel CT scanner. Anatomic variants were classified into three types based on the degree to which (if any) the nerve's course descended from the maxillary roof into the sinus lumen.

Results:

60.5% of IONs were entirely contained within the sinus roof. In 27.0%, the nerve canal descended below the roof but remained juxtaposed to it. In 12.5%, the ION traversed within the sinus lumen. The proportion within the sinus significantly increased to 27.7% when an infraorbital ethmoid cell was present (chi-square=12.9, p<0.001) and to 50% when the nerve was contained within a lamella of such a cell (chi-square=35.1, p<0.001). Mean maximum distance between a descended nerve and the sinus roof was 8.6+-2.9mm. Descended nerves traversed the sinus lumen diagonally for a mean length of 15.4+-3.1mm and terminated in a foramen located an average 11.9+-2.5mm below the infraorbital rim. Overall, the foramen was a mean distance of 12.0+-2.5mm lateral to the canine root, and this did not significantly vary according to descension type.

Conclusions:

Descent of the ION within the maxillary sinus is a common anatomic variant, which is more prevalent in the setting of an ipsilateral infraorbital ethmoid cell. These observations may help surgeons avoid iatrogenic ION injury.

#86

Suture Medialization of the Middle Turbinates after Endoscopic Sinus Surgery in Patients not Undergoing Septoplasty

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Introduction:

Lateralization of the middle turbinate (MT) is one of the major causes of refractory chronic rhinosinusitis after endoscopic sinus surgery (ESS). The aim of this study is to investigate the feasibility of performing a suture medialization technique of the MT through the bony septum in patients who have not undergone septoplasty.

Methods:

A prospective, nonrandomized cohort study was performed to investigate the feasibility of suture medialization of the MT after ESS in patients who had not undergone prior septoplasty. A 4-0 Vicryl Rapide suture was

used under endoscopic guidance. Secondary outcomes were measured at 4-6 weeks postoperatively. The endoscopic access into the ethmoid cavity was graded on the ability to easily pass a 3-mm rigid nasal endoscopy past the middle turbinate. The extent of MT medialization was measured based on its distance from the septum.

Results:

The study sample included 17 patients (34 sides). Group 1 (No Suture) included 4 patients (8 sides) who had no suture medialization technique performed. Group 2 (Septal Mucosa) included 3 patients (6 sides) in which a single suture was used to attach the MT to the septal mucosa without penetrating the bone. Group 3 (Whipstitch Closure) included 10 patients (20 sides) in which a classic nasal septal whipstitch closure was performed through the cartilaginous septal and the thin areas of the posterior bony septum. Ethmoid sinus cavity access was achieved in 25%, 67%, and 85%, respectively.

Conclusions:

Suture medialization of the MT after endoscopic sinus surgery is feasible even without prior septoplasty.

#87

Swing Technique for Middle Turbinate Preservation

Henry Barham, MD, Vijay Ramakrishnan, MD
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Introduction:

Endoscopic endonasal approaches to the middle fossa and orbital apex have traditionally included resection of the middle turbinate to improve visualization and operating space. The aim of this publication is to demonstrate a surgical technique that affords similar visualization and space but preserves the middle turbinate.

Methods:

We describe a technical modification that allows for conservation of the middle turbinate and describe an illustrative case. As current surgical techniques evolve towards progressively less morbidity, preservation of anatomic structures such as the middle turbinate will be pursued.

Results:

In the case described, middle turbinate preservation did not negatively affect access or visualization and did not appear to alter postoperative wound healing.

Conclusions:

With middle turbinate preservation, the principle function of airflow conditioning and potential olfactory regeneration are maintained.

#88

Temporal Development of Silent Sinus Syndrome

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Introduction:

Silent sinus syndrome is a known, but poorly defined entity in the otolaryngology literature. It is thought to occur secondary to maxillary sinus outflow obstruction with gradual negative pressure and collapse of the bony walls ultimately resulting in enophthalmos and diplopia. Currently there is no reported time course over which radiographic changes can be observed.

Case report:

42-year-old female with no significant past medical history presented with new onset right sided headaches with facial pressure and a MRI of her head was obtained in August of 2007. The MRI showed no evidence of sinonasal or intracranial pathology. Maxillary sinuses had normal anatomy. In September of 2009 she was evaluated by an ophthalmologist for visual changes. She was noted to have hypoglobus and enophthalmos. A CT scan of the paranasal sinuses showed evidence of silent sinus syndrome with hypoglobus and an atelectactic uncinata process.

Discussion:

This case report demonstrates the development of silent sinus syndrome over the course of 25 months. The MRI shows no opacification of the sinus at initial presentation. MRI is not adequate to visualize early radiographic findings associated with silent sinus syndrome.

Conclusions:

MRI may not be adequate for diagnosis of silent sinus syndrome. Patients presenting with facial pressure/pain with an atelectactic uncinata process or obstructed sinuses should have early intervention to prevent progression of disease. This case represents also shows the temporal progression of silent sinus syndrome over the course of two years.

#89

The Effect of Middle Turbinate Resection on Topical Drug Distribution into the Paranasal Sinuses

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Introduction:

Topical drug delivery to the paranasal sinuses is gaining popularity. During sinus surgery, partial or complete resection of the middle turbinate (MT) is sometimes

necessary to maximize drainage pathways. The purpose of this study was to examine the role of the MT and MT resection in topical drug distribution to the sinuses via irrigation and nebulization.

Methods:

Complete endoscopic sinus surgery (bilateral maxillary antrostomies, total ethmoidectomies, sphenoidotomies, and frontal sinusotomies) was performed on cadavers. Heads were positioned in the correct anatomic position for irrigations. Irrigations were performed using methylene blue stained saline in a squeeze bottle. Direct visualization was achieved via endoscopic access through trephinations into the maxillary and frontal sinuses and an opening through the intra-sphenoidal septum. Penetration of solution was graded in real time using a Likert scale of 1 to 5. The distribution of solution was scored after irrigation: 1) prior to MT resection, 2) following partial MT resection and 3) following total MT resection. These steps were repeated using fluorescein stained saline delivered via a large-particle nebulizer.

Results:

The impact of partial and complete resection of the MT on the distribution of solution varied depending on the sinus being examined. Penetration of solution into the sphenoid and frontal sinuses appeared to be significantly improved by MT resection.

Conclusion:

MT resection does appear to effect the distribution of irrigated and nebulized solutions within operated sinuses. Resection of the MT may improve penetration of topical medications into some surgically opened sinuses but this concept deserves further study.

#90

The Efficacy of an Herbal Based Spray for Nasal Decongestion: A Pilot Study

Presented by: Craig Fichandler, MD
Frederick Kuhn, MD, Craig Fichandler, MD, Christopher Melroy, MD, Jack Anon, MD, Boris Karanfilov, MD, Timothy Haegen, MD
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Objective:

Rhinitis medicamentosa results from decongestant nose spray's rebound effect and its immediate reuse to overcome nasal obstruction. If a nose spray were available, which did not have a rebound effect, it could decrease the problem's incidence. The object of the study was to determine whether a new herbal nose spray was better than placebo in relieving nasal obstruction.

Methods:

20 patients completed an IRB approved, randomized, double blind, placebo controlled, cross over study. The study compared an herbal nasal spray with placebo. The spray contained two Chinese herbs, *Scutellaria Baicalensis* and *Eleutherooccus Senticosus*. Each

patient used Bottle A for 7 days. After a 3 day "wash-out" period, they used Bottle B for 7 days. The 5 question nasal congestion questionnaire and the 12 question, Brief Smell Identification Test - Version B were administered before the study, after bottle A and after bottle B. The contents of bottles A & B were randomized to vary the starting order of drug first or placebo first.

Results:

A Wilcoxon Test for paired samples revealed significant improvement from baseline with both the herbal spray ($p = .0002$) and placebo ($p=0.002$). Additionally, the herbal nose spray was statistically superior to placebo in relieving nasal congestion ($p=.026$). There was no change in the smell test results with either spray. No patient developed rhinitis medicamentosa during the study.

Conclusion:

The herbal nasal spray relieved nasal congestion significantly better than placebo without any reported rebound effect.

#91

The Incidence of Concha Bullosa in Patients with Allergic Fungal Sinusitis

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Background:

The pathogenesis of allergic fungal sinusitis (AFS) remains unclear as is the explanation of unilateral disease. The aim of this study is to determine the incidence and possible role of concha bullosa (CB), and thus an anatomically constricted middle meatus, in AFS.

Methods:

Analysis of prospectively collected data. Sixty-six consecutive patients with AFS who underwent primary surgery were selected. The presence of CB and of disease were noted for each side of the CT scan. The same analysis was performed for forty-one consecutive patients with eosinophilic chronic rhinosinusitis with nasal polyposis (eCRSwNP) but not AFS. Since variables are presented as frequencies, the chi-square test was used for statistical analysis.

Results:

In the AFS group, 36 (54%) had unilateral disease, of which CB was found in 18/36 sides (50%) with AFS and in 9/36 (25%) without disease ($\chi^2=4.8$, $p=0.028$). The incidence of CB in AFS patients with bilateral disease was 29 of 60 sides (48%) vs. 18 of 68 sides (26%) in patients with eCRSwP ($\chi^2=6.557$, $p=0.010$).

Conclusion:

When patients are used as their own control (unilateral AFS), the incidence of CB is higher in the sides with AFS compared to healthy sides, suggesting anatomic

constriction of the middle meatus possibly playing a role in the pathogenesis of AFS. In addition, the incidence of CB was higher in patients with bilateral AFS when compared to patients with non-AFS mucosal disease (eCRSwP) supporting a similar conclusion. More work is needed to elucidate the exact mechanism of AFS disease development.

#92

The Nasoseptal Flap for Reconstruction of the Medial and Inferior Orbit

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Jonathan Ting, MD, Benjamin Bleier, MD
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Objectives

1. Determine whether the nasoseptal flap may be applied for reconstruction of maximal medial and inferior orbital defects.
2. Correlate the appropriate flap dimensions with relevant anatomic landmarks.

Methods:

Morphometric measurements were taken in five cadavers to determine the dimensions of an orbital defect comprising the entire lamina papyracea and orbital floor. The dimensions of a contralateral nasoseptal flap required to reconstruct each orbital subsite were then calculated.

Results:

The average medial orbital defect was a depth of 47.3 mm (\pm SD 2.52) and height of 13.67mm (\pm SD 2.73), with a width of 13.33 (\pm SD 1.03) for the floor. The average flap dimensions required to completely reconstruct both sites were a width of 55mm, height of 48mm, and depth of 70mm (\pm SD 6.16 x 4.47 x 3.54). The flap incisions were correlated with the mucocutaneous junction anteriorly, the inferior meatus laterally, the attachment of the middle turbinate superiorly, and the choanal arch posteriorly.

Conclusions:

The nasoseptal flap has promoted advancements in endoscopic skull base surgery by enabling the closure of large defects. Endoscopic orbital surgery follows a similar progression and is a nascent field which may result in massive orbital defects and exposure of intracanal structures. Autologous tissue coverage for the orbit obviates the need for allogenic implants and may reduce the incidence of enophthalmos, diplopia, and infection. This study demonstrates that a contralateral nasoseptal flap is capable of complete coverage of maximal medial and inferior orbital defects.

#93

The Natural History and Clinical Characteristics of Paranasal Sinus Mucoceles: A Clinical Review

George Scangas, MD, David Gudis, MD, David Kennedy, MD
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Background:

A retrospective data analysis at a university tertiary referral center was conducted to characterize the natural history, clinical characteristics, management principals, and outcomes of paranasal sinus mucoceles.

Methods:

A chart review was performed on 102 patients with a total of 133 paranasal sinus mucoceles who were treated between 1987 and 2011 at the Hospital of the University of Pennsylvania.

Results:

The study population included patients with a mean age of 53.1 years (ranging 22-82 years). Patients were diagnosed with a mucocele on average 5.3 years following prior functional endoscopic sinus surgery (FESS); 17.7 years following prior paranasal sinus trauma; and 18.1 years following prior open sinus surgery. The most common presenting symptoms were headache (42.1%) and maxillofacial pressure (28.6%). The most common sites were the frontal, frontoethmoidal, and ethmoid sinuses. Fifty-seven mucoceles (44.9%) had intraorbital extension, intracranial extension, or both. Out of 133 mucoceles, 114 underwent endoscopic sinus surgery without complication.

Conclusion:

The length of time between prior surgery or trauma and mucocele presentation highlights the importance of long-term follow-up in both patient care and in the understanding and reporting of surgical outcomes. In this study, most patients exhibited nonspecific symptomatology despite extensive mucoceles and a significant incidence of orbital and skull base erosion. The endoscopic approach can be safely used for the management of such lesions.

#94

The Prevalence of Uncinate Process Osteitis in Chronic Rhinosinusitis Patients Versus Controls

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Background:

Chronic rhinosinusitis (CRS) is a common inflammatory condition with varied etiologies. Osteitis of the underlying bone and in particular the uncinat process (UP) is postulated as one of the main causes for CRS.

Objectives:

The prevalence of bone remodeling changes in the uncinata process (UP) of healthy controls has not been previously examined. This study was conducted to determine and compare the prevalence of osteitis of the uncinata bone in patients with CRS versus healthy controls.

Methods:

Prospective histopathologic examination for the presence or absence of osteitis of the UP/uncinate bone was performed in the study group (patients undergoing sinus surgery for CRS) and a similar-sized control group. The presence of osteitis was determined as bone remodeling and the formation of woven bone using polarized light microscopy.

Results:

A total of 20 uncinata bones were examined: 10 from patients with CRS and 10 controls. Mean age of patients was 43 and 44 years in the two groups. Pathologic evidence of osteitis was found in 50% of the CRS patients and in 30% of the control group.

Conclusions:

Osteitis of the uncinata bone is present in both asymptomatic control patients as well as those undergoing surgery for CRS. These results question the contribution of UP osteitis as a significant factor in the pathogenesis of CRS. This preliminary data needs to be further evaluated in large-scale CRS and healthy populations.

#95

The Role of Feeding During Infancy on Nasopharyngeal Colonization with Common Respiratory Pathogens in Children

Mehdi Bakhshaei, MD, Kiarash Ghazvini, MD, Hossain Akhlaghi, MD, Mohsen Rajati, MD, Sara Jafari Ashtiani, MD
Mashhad, Razavi Khorasan

Introduction:

Breast-feeding has been associated with decreased frequency of otitis media episodes. It might be due the fact that infants who are breast-fed, compared with those who are formula-fed, have a lower prevalence of nasopharyngeal colonization with the respiratory pathogens.

Methods and Materials:

We obtained nasopharyngeal specimens to culture for *S. pneumoniae*, *H. influenzae* and *M. catarrhalis* from 1125 day-care center children aged between 2 to 6 years. Factors which effect on colonization and medical history were recorded. Carriage rate was analyzed on the basis of feeding type during first 6 months of infancy.

Results:

Of 1125 children, who enrolled in the study, 46.9% were males and 53.1% were females. The mean age was

5.05 ± 0.980 (range 2 to 6 years). The overall carrier rate of nasopharyngeal pathogens was 29.3%. Most of the children (297, 90%) carried only one pathogen (Table 1). 885 were exclusively breast-fed (78.7%), 69 were exclusively formula-fed (6.1%), and 171 were mixed-fed (15.2%). These were matched regarding the confounding factors except feeding. They did not differ significantly in the proportions found to have one or more respiratory pathogens ($P > 0.5$).

Conclusion:

It seems feeding in infancy appears not to substantially influence the prevalence of nasopharyngeal colonization with common bacterial respiratory pathogens during childhood.

#96

The Use of Lid Crease Orbitotomy to Augment the Intranasal Endoscopic Approach to Removal of Inverted Papilloma

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Introduction:

With an acceptable rate of recurrence (10-20%), endoscopic approaches to the removal of sinonasal inverted papillomas have become standard of care. Presence of disease in the frontal sinuses or orbit can present a significant obstacle in the removal of these tumors and may necessitate an open or extended combined approach.

Methods:

Case study and review of literature

Results:

We present a case of inverted papilloma arising from aberrant bone within the left frontal sinus with bilateral intranasal extension and ipsilateral extension into the superior orbit. In this case, a small lid crease orbitotomy was used to augment the intranasal approach and ultimately allowed for complete excision of inverted papilloma through the existing frontal sinus defect, thus avoiding a more extensive open or combined approach.

Conclusion:

Endoscopic removal of sinonasal tumors may be, in some instances, enhanced by orbitotomy and/or frontal sinus trephination. Endoscopic instrumentation and image guidance facilitate such solutions.

#97

Topical Colistimethate for the Treatment of Pseudomonas Infections in the Surgical Sinus Patient

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Background:

The management of *Pseudomonas aeruginosa* (PA) induced acute exacerbations in chronic rhinosinusitis (CRS) remains difficult and controversial.

Objectives:

We sought to evaluate our clinical experience with topical colistimethate (CMS) irrigations in the treatment of acute exacerbations of CRS with positive PA cultures.

Method:

We reviewed charts of 48 patients with 80 PA positive cultures that were treated with CMS irrigations between January 2008 and June 2012. Cultures and subjective questionnaires before and after treatment along with physician's assessment of treatment were reviewed.

Results:

Sixty of the 80 (75%) exacerbations treated with CMS irrigations were considered clinically improved or resolved. Of the twenty-three exacerbations treated with CMS irrigation alone, 69.6% (16/23) resolved clinically. In the other 57 exacerbations, CMS irrigations were combined with other antimicrobials based on culture results. Of these, oral fluoroquinolone was added to topical CMS irrigations for PA positive cultures in 43 exacerbations. Similar success rate was seen with the addition of oral fluoroquinolone to CMS irrigations (32/43 or 74.4%). Before and after rhinosinusitis disability index (RSDI), sino-nasal outcome test (SNOT-20) and nasal symptom inventory (NSI) scores were available for 29 of the 80. Raw scores for RSDI, SNOT-20 and NSI improved by mean of 4.33, 10.5 and 1.58, respectively, for those with clinical improvements.

Conclusion:

This retrospective review provides clinical evidence for the utility of colistimethate sodium topical antibiotic irrigations in the treatment of *Pseudomonas aeruginosa* infections of the sinonasal cavity.

#98

Treating Chronic Rhinosinusitis with Balloon Dilation in Patients with Mild to Moderate Septal Deviation

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Background:

This study investigates the impact of septal deviation on balloon dilation success, tolerability, and symptom improvement.

Methods:

Prospectively-collected data from patients undergoing balloon dilation between 2007 and 2012 were retrospectively analyzed. The angle of septal deviation was measured from coronal CT images at the level of the ostiomeatal complex (OMC) and area of the most

severe deviation. Patients reported procedure discomfort on a scale from 0 (no pain) to 10 (severe pain). Symptom improvement was measured using Sino-Nasal Outcome Test (SNOT-20) and Rhinosinusitis Symptom Inventory (RSI) validated surveys. Patients were divided into two septal deviation groups: $<10^\circ$ and $=10^\circ$.

Results:

171 patients underwent balloon dilation of the sinus ostia and ethmoid infundibula with or without turbinectomy. The mean deviation was $5.1^\circ \pm 3.3^\circ$ in the $<10^\circ$ group and $13.5^\circ \pm 3.3^\circ$ in the $=10^\circ$ group. Overall, balloon dilation was successfully performed in 417/422 sinus ostia (98.8%), mean procedure pain was 2.4 ± 2.2 , and there were no significant differences in either of these measures between septal deviation groups. At 6-month follow-up, overall mean SNOT-20 improvement was clinically and statistically significant ($p < 0.0001$) in both septal degree groups and there was no significant difference between groups. In 11/12 major and minor rhinosinusitis symptoms, improvement was also statistically significant ($p < 0.05$) within each group and similar between the two populations.

Conclusion:

Patients with chronic rhinosinusitis and mild to moderate septal deviation do not require concomitant septoplasty to achieve successful balloon dilation of the sinus ostia and experience significant, meaningful improvement in sinonasal symptoms.

#99

Trends in Ambulatory Sinus Surgery for Chronic Sinusitis in California 2005-2011

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Objective:

To examine the trends in rates and demographics of ambulatory endoscopic and open sinus surgery for chronic sinusitis in California

Methods:

Patient records with CPT procedure codes for endoscopic or open sinus surgery, and diagnosis codes for chronic rhinosinusitis were extracted from the California Ambulatory Surgery Datasets from 2005-2011. Population-adjusted surgery rates were calculated as number of surgeries per 100,000 California residents. Location of surgery was analyzed in two contexts: free-standing ambulatory surgery center (ASC) versus any hospital setting, and academic (teaching hospital) versus non-academic centers (ASC and non-teaching hospital combined). Patients' age group, gender, and ethnicity were also examined.

Results:

A total of 92,918 sinus surgeries were performed during 2005-2011. The overall population-adjusted surgery rate declined 23%, from 39.2 to 30.0 ($p < .001$). Although the

rates for both endoscopic and open surgeries declined, the frequency of endoscopic procedures increased from 87.3% to 92.5% ($p < .001$). Over the studied period, there was an increase in the proportion of sinus surgeries performed in hospitals (73.3% to 91.4%; $p < .001$), in academic centers (5.9% to 10.1%; $p < .001$), on patients > 65 years (14.9% to 18.0%; $p < .001$), and on non-Caucasians (10.3% to 16.9%; $p < .001$). Gender distribution remained unchanged (51% male).

Conclusion:

The overall rate of ambulatory sinus surgery in California declined over the study period. A shift from open to endoscopic procedures, from ASCs to hospitals, and from non-academic to academic centers was observed. Further investigation of the observed trends with respect to factors such as physician training, disease severity, or outcomes may be warranted.

#100

Trends in Chronic Rhinosinusitis Research in the Past Three Decades

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Objectives:

To identify trends in chronic rhinosinusitis (CRS) related publications for the past three decades.

Study design:

Bibliometric analysis

Methods:

PubMed was searched using the terms sinusitis, chronic rhinosinusitis, chronic disease, ethmoid sinusitis, sphenoid sinusitis, frontal sinusitis and maxillary sinusitis. Abstracts were divided into three decades: 1983-1992, 1993-2002 and 2003-2012. For each decade, we compared the total number of publications and journals, study design, use of validated outcome measures, quality of evidence, number of authors, country of origin and clinical versus basic science.

Results:

3406 abstracts were identified. There was a statistically significant increase in the number of publications with a 637% increase from 1983-1992 to 2003-2012 ($p < 0.05$). Likewise the number of journals with CRS-related publications significantly increased during the study period (117 to 350, $p < 0.05$). Prospective studies increased (15.3% to 27.5%, $p < 0.05$) and retrospective studies decreased (33.0% to 16.0%, $p < 0.05$). Cohort studies were the most common type of design study (18.7% to 36.5%), however systematic reviews and meta-analysis significantly increased in the past decade (3.2% vs 0.2%, $p < 0.05$). In studies reporting outcome measures, the use of validated measures significantly increased over time (2.56% to 50.10%, $p < 0.05$). Although most

clinical publications for all three decades were grade C (47.8-55.1%), the number and percentage of grade A and grade B significantly increased over time (6.5% to 0.9%, $p < 0.05$ and 6.1% to 4.2%, $p < 0.05$).

Conclusions:

CRS-related publication quantity and quality have increased over the last 3 decades.

#101

Two Rare Manifestations of Advanced Rhinoscleroma - Dysphagia and Trismus. A Case Report

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Introduction:

Rhinoscleroma is a chronic, progressive, inflammatory disease of the upper aerodigestive tract caused by infection with *Klebsiella Rhinoscleromatis*, a gram negative aerobic coccobacillus. While endemic in parts of Central America, Africa, Southeast Asia, and Eastern Europe, the disease is exceedingly rare in the United States. We report a case of advanced rhinoscleroma with two rare manifestations that have failed to improve despite full course antibiotic therapy.

Case Description:

A 45 year old Hispanic male presented in July of 2012 with a six month history of progressive dysphagia, trismus, dyspnea, nasal obstruction and a 25lb weight loss. Physical exam revealed a polypoid mass filling the bilateral nasal passages with an erosive mass of the soft palate extending into the right tonsil. Due to the severe trismus and nasal obstruction, the patient underwent awake tracheostomy, flexible esophagoscopy, and direct laryngoscopy with biopsies. Pathology revealed Mikulicz cells with organisms highlighted with the Gomori-methenamine-silver stain, confirming the diagnosis of rhinoscleroma.

Discussion:

Rhinoscleroma is classified clinically and pathologically into three stages: catarrhal, proliferative, and fibrotic. The disease manifests with variable clinical symptoms, depending on the stage of the infection and presents both a diagnostic and treatment dilemma for the physician. Trismus is thought to occur through spread of the granulomatous lesion along tissue planes or as a result of inflammation at the site of disease. Oropharyngeal involvement occurs in 18-40% of patients, and persistent trismus and dysphagia are rare sequelae.

#102**Undifferentiated Squamous Cell Carcinoma of the Nasopharynx: A Comprehensive Analysis of 1,020 Cases**

Leila Mady, PhD, Neal Patel, BA, Saurin Sangvhi, MD, Mohemmed Khan, MD, Soly Baredes, MD, FACS, Jean Anderson Eloy, MD, FACS
Newark, NJ

Background:

Squamous cell carcinoma (SCC) accounts for a majority of malignant tumors in the nasopharynx (NPSCC), though differences in histopathologic and anatomic sub-sites contribute to substantial variability in disease presentation and survival. Undifferentiated squamous cell carcinoma of the nasopharynx (NPUC) has been reported to have better survival than the other variants of NPSCC. Our objective is to compare the survival of patients with NPUC in a series of patients with NPSCC using a population-based database.

Methods:

Retrospective analysis of the Surveillance, Epidemiology, and End Results: (SEER) database from 1973 to 2009.

Results:

Epidemiological factors affecting survival were compared between 1,020 patients with NPUC to 4,654 with other NPSCC patients. Patients with NPUC exhibited 20-year survival of 44.64%, which was significantly higher than patients with NPSCC with a 20-year survival of 27.68% ($p < 0.05$). Survival between races was significantly different in patients with NPSCC, with whites having the lowest long-term survival at 22.54% ($p < 0.001$). Examining the pathologies by local, regional, and distant disease demonstrated significant differences in both disease groups ($p < 0.001$). Treatment analysis also revealed significantly better survival outcomes for patients with NPUC who were treated with surgery, radiation, or both when compared to NPSCC ($p < 0.001$).

Conclusions:

Patients with NPUC demonstrated better survival when compared to NPSCC patients categorized by gender, race, extent of disease, and treatment. This study is the first of its kind to report a detailed comparison between factors influencing the survival of NPUC patients to those afflicted with other NPSCC.

#103**Unplanned Admissions Following Sino-Nasal Surgery**

Anni Wong, BA, Ashutosh Kacker, MD
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Introduction:

There has been an increasing trend in the transition from hospital based surgeries to ambulatory center surgeries (ASC) due to advantages to the patients. Otolaryngological procedures serve as a significant portion of ASC cases with sino-nasal surgeries as one of the most common. However, admissions into the hospital from the ambulatory center can be difficult for patient and provider. This study will evaluate the incidence of unplanned admissions for sino-nasal surgeries in a 6 year period and will identify the factors for these admissions.

Methods:

A retrospective study of patients who had ambulatory sino-nasal surgeries from January 2007 to December 2012 at Weill Cornell Medical Center/New York Presbyterian Hospital performed by the senior author(AK). Electronic medical records were reviewed for age, gender, procedure/surgery performed and admission and/or discharge information.

Results:

A total of 763 patients who underwent sino-nasal surgeries from January 2007 to December 2012 were eligible for review. The study sample had a mean age of 46.1 years and 55.57% were male. There were a total of 26 admissions where 11 of them were unplanned (1.4%). Reasons for unplanned admissions included pain as the most common (58.3%), followed by epistaxis, nausea and others.

Conclusion:

The rate for unplanned admissions for sino-nasal surgeries is 1.4%, which is lower than the national rate (2.65%), indicating that sino-nasal surgeries are appropriate as ambulatory cases. Reason for admission was highest for pain and therefore patients should be further evaluated for more effective methods of pain and nausea control either post-operatively or preemptively.

#104**Use of Custom Silastic Button Prosthesis in Hereditary Hemorrhagic Telangiectasia Patients with Septal Perforation**

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Phoenix, AZ

Background:

Patients with hereditary hemorrhagic telangiectasia (HHT) may develop a septal perforation following

repeated septal procedures to control bleeding. A perforation with bleeding margins and crusting may further challenge effective management. We report a novel approach to the treatment of large septal perforations using a customized septal prosthesis in HHT patients.

Methods:

Two patients (ages 83 and 77) with HHT and large perforations were treated with a customized silastic septal button. The prosthesis is manufactured from a computer generated 3-D septal model. A non-contrast, maxillofacial CT scan provides the information necessary to make the mold. A prosthetic specialist then creates the silastic prosthesis. Prosthesis placement was conducted in the operating room in conjunction with telangiectasia electrocautery and submucosal bevacizumab injection.

Results:

Both patients were followed for 6 weeks postoperatively. The first patient died six months following the procedure from complications related to a stroke. He consistently reported 80 percent improvement in both epistaxis frequency and duration. The second patient died 24 months after prosthesis placement from congestive heart failure related to chronic blood loss from bleeding due to gastrointestinal telangiectasias. He noted 95 percent improvement in epistaxis frequency and duration. Both prostheses remained in place through the follow-up period.

Conclusion:

Customized septal prostheses made of soft silastic effectively control epistaxis in patients with a septal perforation. We present two patients with HHT who were managed effectively with a custom prosthesis. It is hypothesized that the improvement was due to protective covering of both the perforation margin and anterior septal telangiectasias.

UPCOMING ARS MEETINGS

COSM 2014

MAY 14 - 18, 2014

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LAS VEGAS, NEVADA**



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**60TH ARS
ANNUAL MEETING
SEPTEMBER 20, 2014
ORLANDO, FLORIDA**

