
# 2010 COSM

## PROGRAM & ABSTRACTS

April 29, 2010

Bally's Las Vegas, Nevada

**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.

## Physicians

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

## AMA PRA Statement

The American Rhinologic Society designates this educational activity for a maximum of 6.85 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

## Activity Goal

The goal of this activity is to provide recent and cutting edge information in the areas of patient care and research in the field of Rhinology which will expand physician's knowledge base and capabilities in care of patients.

## Learning Objectives

1. Learn the newest cutting edge information on the medical management of patients with rhinosinusitis and other rhinologic diseases

2. Learn the newest information regarding the surgical management of patients with rhinosinusitis

3. Become familiar with the current research in the pathogenesis and pathophysiology of chronic rhinosinusitis and other rhinologic diseases

4 Become familiar with recent surgical advances in etiology and management of skull base lesions

5. Become familiar with olfactory disorders and their management

6. Review the appropriate relationship between clinicians and industry

## Outcomes

The practitioner should be able to choose appropriate therapy for the different subtypes of chronic rhinosinusitis.

The practitioner should be able to incorporate surgical techniques to manage patients with anterior skull base defects.

## Target Audience

Otolaryngologists in training, practicing otolaryngologists, allied health care professionals

# ARS Officers

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# Program

## Thursday, April 29, 2010

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7:00am
**Residents/Fellows Business Hour**
*Living the Dream: Life after a Rhinology Fellowship*

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8:00am
**Presidential Welcome**
*Stilianos Kountakis, MD*

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8:07am
**Nasal Irrigation in Ostial Configurations: A Cadaver Study**
*Brian Robert Kriete, MD, Eric Weitzel, MD, Deepti Singhal, MD, Peter John Wormald, MD*
*Lackland Airforce Base, TX*

**Introduction:**
Nasal irrigation and debridement is an important facet of post-operative FESS care. Recent studies suggest that ostial size is critical to penetration of nasal irrigants. The purpose of this study is to determine the best method of nasal irrigation to achieve sinus penetration by varying ostial size and head position.

**Methods:**
Ten cadaver heads were sectioned axially to reveal the anterior cranial fossa. Bilateral cannine fossa punctures as well as ostomies into the frontal and sphenoid sinuses were created to accommodate an endoscope. The cadaver heads were then flushed with a non-staining vegetable dye after varying degrees of sinus surgery and at different angles of head position. An ordinal scale from 0-5 was used to assess degree of sinus penetration.

**Results:**
Overall, sinus penetration increases with ostial size. Maxillary

sinuses have decreased sinus penetration than the other sinuses at lower levels of dissection ($p < 0.001$). The frontal sinus showed an irrigant penetration advantage when moving from the 90 to 45 degree position ($p < 0.05$).

**Conclusions:**
Increasing ostial size results in improved delivery of sinus irrigation. Head position is important for improved frontal sinus penetration.

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8:13am

## Oral Corticosteroid Therapy in Chronic Rhinosinusitis without Polyposis: A Systematic Review

*Devyani Lal, MD, Peter Hwang, MD*
*Stanford, CA*

**Background:**
Recent systematic reviews have evaluated use of nasal steroids in chronic rhinosinusitis (CRS), and oral steroids in CRS with nasal polyposis. No such review has been conducted on oral steroid use in CRS without nasal polyposis.

**Objectives:**
Assess evidence on oral steroid use in CRS without polyposis

**Study Design:**
Systematic literature review

**Methods:**
Ovid and Pubmed databases were searched by relevant terms. Nasal polyposis studies were excluded. Allergic fungal sinusitis (AFS) was considered separately, as it perhaps falls in an intermediate spectrum.

**Results:**
The search yielded 125 relevant abstracts. Excluding guidelines and reviews, 6 studies were identified. Of these, two surveys showed that 36% of American Otolaryngologists used oral steroids in CRS, and members of the American Rhinologic Society used them in 50-90% of regimens. Two studies found that corticosteroids reverse inflammatory changes in human sino-nasal tissue. No clinical study on single-modality systemic corticosteroid therapy was found. Two retrospective studies (Level 4 EBM) found that combined use of antibiotics, nasal and oral steroid lead to symptomatic benefit, radio-

logic improvement and prevention of short-term relapse.
When AFS was considered, one randomized controlled trial (RCT) (Level 1), and a case-control study (Level 3) found oral steroids to prevent post-operative recurrence. Another (Level 3) study found systemic steroids yielded greater improvement on computerized tomography in AFS as compared to polypoid CRS patients.
Conclusions: Single-modality systemic steroid therapy in non-polypoid CRS has not been studied. Evidence supporting oral steroid therapy in CRS without nasal polyposis is Level 4 or 5; there is lack of any RCT to support use.

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8:19am

## Oral Antifungal Therapy for Fusarium-Associated Chronic Rhinosinusitis (CRS)

*Annie S. Lee, MD, Barbara Przybyszewski, BS, Donald Lanza, MD*
*St. Petersburg, FL*

**Introduction:**
Fusarium is commonly reported as an organism found in fungus-associated CRS yet it is known to be resistant to commonly used antifungal therapies. The goals of this paper are to report the incidence of Fusarium-associated CRS in fungal cultures and to describe the treatment experience with oral antifungal agent aimed at this problem.

**Methods:**
Patients with sinus cultures obtained from 2005-2008 were retrospectively identified and their medical records evaluated. Cultures were obtained in patients with recalcitrant rhinosinusitis when purulent discharge was observed. Improvement was measured upon the basis of self reported symptom scores and endoscopic examination.

**Results:**
In this 4 year period 2570 outpatient fungal cultures were obtained and 194 (7.5%) were positive for Fusarium. These 194 positive cultures appeared in 94 individuals. Thirty-four (34/94) tested positive multiple times. Twenty-four (25.5%) had severe recalcitrant chronic rhinosinusitis, poorly responsive to standard therapies warranting anti-fungal therapy aimed at Fusarium. Eighteen (18) individuals were treated with voriconazole, 9 with posaconazole, and 3 with both at separate times. Improvement was observed in 10/18 patients on voriconazole and 7/9 patients treated with posaconazole. Nine (9/24 = 37.5%) were forced to discontinue oral antifungal therapy due to untoward effects.

**Conclusions:**
Fusarium appears in 7.5% of outpatient cultures of CRS. Of the patients testing positive for Fusarium, 25% received oral antifungal therapy. A positive response was seen in 15/24 (62.5%) while receiving standard therapies. Since Fusarium is not routinely sensitive to commonly used anti-fungal agents it warrants special attention.

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8:25am
**Discussion/Audience Response**
*Moderators: Samer Fakhri, MD, and Marvin Fried, MD*

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8:35am
**Induction of Antiviral Innate Immune Gene Expression by Influenza-An Infection in Human Sinonasal Epithelial Cells**
*Murugappan Ramanathan, Jr, MD, William Fischer, MD, Andrew Pekosz, PhD, Andrew Lane, MD*
*Baltimore, MD*

**Introduction:**
IInfluenza-A is a global pathogen that infects 10% of the world's population yearly causing morbidity and mortality. With the advent of more virulent forms of influenza such as the H1N1 strain, it is crucial to attain a better understanding of sinonasal mucosal host defense to these pathogens. Specifically, the mechanisms by which human sinonasal epithelial cells modulate antiviral innate immune responses to influenza is poorly understood.

**Methods**:
Sinonasal epithelial cells were obtained from control subjects and grown in culture at the air:liquid interface until differentiated. Ciliated cells were then infected with various influenza-A strains, including wild type (WT) strain, H1N1, and live attenuated influenza virus (LAIV). Real time PCR was employed to measure expression of the innate immune antiviral effectors, ISG15 and Rig-I.

**Results:**
Viral infection of SNECs with all viral strains (WT, LAIV, and H1N1) was associated with significant increases in mRNA expression of the anti-viral innate immune genes ISG15 and Rig-I. The induction was between 64- and 128-fold.

**Conclusion:**
Sinonasal epithelial cells lie at the interface between the host and environmental pathogens such as influenza virus. This study demonstrates that infection of sinonasal epithelial cells with influenza-A causes a robust increase of two innate antiviral defensive genes, ISG15, which is a ubiquitin like protein , and Rig-I, a cytoplasmic sensor of ssRNA. Since chronic rhinosinusitis (CRS) has been associated with decreased epithelial innate immunity, future studies will focus on characterizing the innate immune responses of SNECs from CRS patients infected with influenza.

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8:41am

## Down-Regulation of Sinonasal Innate Immune Gene Expression in a Mouse Model of Experimentally-Induced Eosinophilic Inflammation

*Babar Sultan, MD, Murugappan Ramanathan, MD, Lindsey May, BS, Andrew Lane, MD*
*Baltimore, MD*

**Background:**
CRSwNP is a disorder characterized by persistent eosinophilic inflammation and microbial colonization. Decreased expression of multiple innate immune genes has been observed in sinonasal mucosa derived from CRSwNP patients and in epithelial cells treated with Th2 cytokines in vitro. The impact of Th2 cytokines on the innate immune function of the sinonasal mucosa has not been explored in vivo. In this study, an allergic mouse model was utilized to explore the effect of Th2 inflammation on innate immune gene expression.

**Methods:**
Nasal allergy was generated in BALB/C mice via intraperitoneal injection of antigen and subsequent daily local nasal exposure. Nasal mucosa from sensitized and control mice was isolated, and the expression of antimicrobial innate immune genes was assessed by real-time polymerase chain reaction.

**Results:**
The model was successful in generating histologic evidence of inflammation with significant infiltration by eosinophils. Analysis of RNA extracted from the nasal cavities of sensitized mice showed significantly decreased expression of antimicrobial innate immune markers, including beta-defensin 2, mannose-binding lectin, and cathelicidin.

**Conclusion:**
Mice with experimental allergic inflammation demonstrate decreased nasal expression of innate immune effector genes. This finding is consistent with the hypothesis that the innate immune activity of the sinonasal tract is modulated by the adaptive immune system. Diminished antimicrobial activity in CRSwNP may, in part, be related to the local over-expression of Th2 cytokines. The allergic mouse model has potential for investigating underlying mechanisms of sinonasal mucosal immune regulation.

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8:47am

## Epithelial Tight Junction Alterations in Nasal Polyposis

*Gamwell Aaron Rogers, MD, John DelGaudio, MD, Charles Parkos, MD, PhD, Sarah Wise, MD*
*Atlanta, GA*

**Objective:**
To explore alterations in expression of tight junction proteins (TJPs) in nasal polyposis and in respiratory epithelium under inflammatory conditions.

**Hypothesis:**
The expression of certain intercellular TJPs will be altered in (1) nasal polyp tissue and (2) respiratory epithelium exposed to inflammatory cytokines, as compared to controls.

**Methods:**
Human sinonasal mucosa (3 nasal polyp specimens and 3 non-polypoid controls) were stained with immunofluorescent markers specific for TJPs Claudin-1 and Occludin and examined with confocal scanning laser microscopy. A complementary controlled experiment exposing cultured human bronchial epithelium to interferon gamma and tumor necrosis factor alpha was also performed. Alterations in Claudin-1 and Occludin were localized by immunofluorescence labeling and confocal microscopy and quantified by Western blot.

**Results:**
Nasal polyp epithelium from human tissue specimens had reduced Claudin-1 expression along the basal aspect of the mucosal layer, whereas Occludin expression was reduced in the apical and basal epithelial zones. In vitro experiments demonstrate stable or increased TJP expression 24h post cytokine exposure (43% increase for Claudin-1, 9% increase for Occludin). However, a

reduction in TJP expression followed at 72h post cytokine exposure (18% reduction for Claudin-1, and 43% reductions for Occludin).

**Conclusion:**
Nasal polyposis is associated with epithelial TJP altereations. Further, the expression of TJPs in a model of inflamed respiratory mucosa is reduced in a similar fashion. Research on the histopathology of other epithelial inflammatory disorders suggests TJP alterations contribute to a self-perpetuating inflammatory state. Findings of this preliminary study support a similar process in nasal polyposis.

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8:53am
**Discussion/Audience Response**
*Moderators: Peter Hwang, MD, and Brad Woodworth, MD*

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9:03am
**Presidential Address**
*Stilianos Kountakis, MD*

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9:10am
**An Alternative Management Approach to Paranasal Sinus Fibro-Osseous Lesions**
*Jordan T. Glicksman, MD, Eng Ooi, MD, Allan Vescan, MD, Ian Witterick, MD*
*Toronto, Canada*

**Introduction:**
Fibro-osseous lesions of the paranasal sinuses are an uncommon heterogenous group with variable clinical presentation. It is unclear whether these lesions directly cause symptoms or secondarily obstruct the sinuses with resultant rhinosinusitis. We have used an expectant management approach in selected patients that includes observation with serial scans or endoscopic sinus surgery (ESS) to improve the outflow tract of the affected sinus without resection of the lesion.

**Methods:**
A retrospective chart review of patients with fibro-osseous lesions from 1997 to 2009 was performed.

**Results:**
There were 44 patients identified in this study. The presenting symptoms were pain/pressure (30%), nasal obstruction (20%), and headaches (16%). Twenty-five percent were an incidental finding on CT scans. Fifteen (34%) patients were managed with observation and serial CT scans to document interval growth in these lesions. Fourteen patients were treated with ESS alone with improvement in symptoms in 92%. One patient had ongoing symptoms after multiple operations. There was no CT scan evidence of interval growth in the observation group (mean 27 months, range 6 to 84 months). Eighteen percent (8) of patients in this study had resection of the lesion with 6 of the patients having symptomatic improvement following resection.

**Conclusions:**
Nine patients with fibro-osseous lesions, we support an expectant management approach of asymptomatic patients with observation, treating selected symptomatic patients with ESS and resection of the lesion in patients with orbital complications, growth of the lesion or persistent symptoms.

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9:16am

## Outcomes of Endoscopic Management of Sinonasal Hemangiopericytoma

*Belachew Tessema, MD, Jean Eloy, MD, Adam Folbe, MD, Roy Casiano, MD*
*Hartford, CT*

**Background:**
Sinonasal hemangiopericytomas (SNHPC) are rare perivascular tumors with low-grade malignant potential. Traditionally these tumors have been treated with open approaches such as lateral rhinotomy, Caldwell-Luc, or transfacial approaches. The increased experience with the endoscopic management of benign and malignant sinonasal tumors have led to the shift in the management of SNHPC. We present outcome of the largest series of patients with SNHPC managened endosopically.

**Method:**
A retrospective chart review of all patients who underwent endoscopic management of hemangiopericytoma at the University of Miami between the year 1999 and 2008 was conducted. All endoscopic resection were performed with a curative intent.

**Results:**
Twelve patients with the diagnosis of hemangiopericytoma were treated endoscopically. Mean age was 62.5 years range 51 to 83. There were 6 males and 6 female. The mean follow-up time was 41 months range 15 - 91 months. Seven (58.3%) presented with nasal obstruction while four (41.6%) percent of the group had epistaxis as their initial presenting symptom. Preoperative angiography or embolization was not performed in any of the cases. Mean blood loss was 630 ml. Six patients underwent anterior skull base resection, four patients had complete endoscopic resection all with negative margins. None of patients underwent post operative adjuvant treatment. No recurrence or metastatic disease was observed in our patient population.

**Conclusion:**
Endoscopic management of SNHPC offers marked advantage in the treatment and follow-up without compromising outcomes. Advanced knowledge and skills in endoscopic surgery are necessary to manage patients. Post operative adjuvant therapy is not necessary if complete tumor resection can be achieved.

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9:22am

## Reliability of Preoperative Assessment of CSF Pressure for Spontaneous CSF Leak and Encephalocele Repair

*Vijay R. Ramakrishnan, MD, Jeffrey Suh, MD, Alexander Chiu, MD, James Palmer, MD*
*Philadelphia, PA*

**Introduction:**
The association of spontaneous CSF leaks with increased intracranial pressure is well-documented. Accurate assessment of CSF pressure is paramount to optimal long-term outcomes, as failure of endoscopic surgical closure and/or recurrent leaks may be associated with untreated intracranial hypertension. Many surgeons utilize a single opening pressure measured at the onset of the surgical procedure to determine if long-term acetazolamide or shunt placement will be necessary. However, measurement of CSF pressure may be

inaccurate secondary to active drainage or effects of anesthetic agents. The purpose of this study is to determine the accuracy of preoperative CSF pressure measurement in the setting of active CSF rhinorrhea.

**Methods:**
Retrospective review of 65 cases of endoscopic repair of active spontaneous CSF rhinorrhea performed at a tertiary care institution from 2002-2009. Cases in which measurements were poorly documented or potentially unreliable were excluded, as were cases in which acetazolamide therapy was used. Thirteen cases in which reliable preoperative opening pressure and 48-72 hour postoperative CSF pressures were recorded were included in the analysis.

**Results:**
The average preoperative measurement was 24 +/- 9 cm H20, and the average postoperative measurement was 15 +/- 6 cm H20. The average change in CSF pressure from preoperative to postoperative measurement was -9 +/- 11 cm H20.

**Conclusions:**
Our results suggest that a single preoperative measurement of CSF pressure in patients with active CSF rhinorrhea may not be sufficiently reliable to make subsequent long-term clinical decisions.

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9:28am
**Discussion/Audience Response**
*Moderators: Christopher Melroy, MD, and Steven Schaefer, MD*

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9:38
**Where Does Sinusitis Come From?**
*Robert Kern, MD*

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9:59
**Exhibitor Break**

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10:20am

## Allergic Profile of Patients Failing Medical Therapy for Chronic Sinusitis

*Bruce K Tan, MD, Rakesh Chandra, MD, David Lin, MD, Robert Kern, MD*
*Chicago, IL*

**Background:**
Chronic sinusitis (CRS) is an inflammatory condition of the nasal airway and paranasal sinuses. The relationship between CRS and atopy to inhalant allergens remains unclear. We sought to examine the role of atopy in among patients failing medical therapy for CRS.

**Methods:**
A prospectively collected database of 334 consecutive CRS patients who had surgery after failing maximal medical therapy was queried to identify those who underwent complete workup (CT, endoscopy, skin-prick testing) at our institution (n=125). The influence of atopy on radiological disease severity, the presence of nasal polyps and concurrent asthma was assessed for each of the allergen classes we tested. The data was compared to published normative skin prick testing results from the National Health and Nutrition Examination Study III (NHANES III).

**Results:**
Skin-prick positivity was observed in 103/125 (82.4%) patients- a prevalence significantly higher than that found in the NHANES III study ($p<0.05$). There was no association between atopic status, or sensitivity to any particular allergen class, and Lund-Mackay severity. Patients with nasal polyps (n=62) had higher rates of atopy but this did not reach statistical significance. Asthmatics (n=57) were significantly more likely be atopic ($p=0.018$; OR=3.5; 95%CI=1.2-10.1), with higher rates of grass ($p=0.0036$) and ragweed sensitivity ($p=0.046$).

**Conclusions:**
Among our patients failing medical therapy for CRS, higher rates of atopy are found compared with that of the general population. The presence of concurrent asthma but not nasal polyposis was associated with higher prevalence of atopy.

10:26am

## Upregulation of RANTES in Nasal Polyps from Patients with Cystic Fibrosis

*Victor I. Scapa, MD, Pamela Mudd, MD, Todd Kingdom, MD*
*Aurora, CO*

**Introduction:**
Nasal polyps in patients with cystic fibrosis (CF) are believed to be phenotypically different than polyps affecting non-CF patients. The objective of this study was to characterize the expression of inflammatory cytokines within nasal polyps from CF and non-CF, aspirin-tolerant patients using protein microarray technology. RANTES (Regulated on Activation, Normal T-cell Expressed and Secreted) is a chemotactic cytokine involved in the recruitment and activation of eosinophils. Multiple molecular studies of non-CF polyps have established that RANTES may play an important role in nasal polyposis.

**Methods:**
Nasal polyps were prospectively obtained from CF and non-CF, aspirin-tolerant patients. The QuantibodyTM Human Cytokine Array I from RayBiotech, Inc. was used to identify differences in cytokine expression between protein extracts of two polyp groups. Five CF polyp extracts and 5 non-CF, aspirin-tolerant polyp extracts were each incubated on identical antibody sub-arrays, each containing 20 human cytokines in quadruplicate. Western blot analysis confirmed altered expression of a subset of cytokines.

**Results:**
The protein microarrays suggest a greater than two-fold upregulation of RANTES in CF polyps relative to non-CF polyps. This was confirmed with Western blot analysis. The majority of the remaining cytokines included on this inflammation array do not demonstrate a significant difference between CF and non-CF, aspirin-tolerant polyps.

**Conclusion:**
Chemokines such as RANTES are responsible for the activation of inflammatory cells within the lamina propria of nasal polyps. Multiple studies have implicated RANTES activity in non-CF polyps. We have demonstrated increased expression of RANTES in nasal polyps from CF patients compared to non-CF, aspirin tolerant polyp patients.

10:32am

## Mometasone Furoate Gel: A Novel In-Office Treatment of Recalcitrant Postoperative Chronic Rhinosinusitis

*Ibrahim Alava, MD, Samer Fakhri, MD, Martin Citardi, MD, Amber Luong, MD*
*Houston, TX*

**Objective:**
To assess the effect of in-office intranasal application of mometasone furoate (MF) gel in reducing sinonasal mucosal inflammation in patients who have undergone endoscopic sinus surgery (ESS) for chronic rhinosinusitis (CRS).

**Study Design:**
Retrospective review.

**Methods:**
Symptomatic post-ESS patients were evaluated with nasal endoscopy. Sinus mucosa was graded as normal, edematous, polypoid, or with frank polyps; presence or absence of eosinophilic mucin was noted. MF gel was then applied under endoscopic visualization to sinus mucosa demonstrating signs of inflammation. Patients returned to clinic at 2 weeks and 3 weeks for nasal endoscopy and mucosal evaluation, and if indicated, re-treatment with MF gel.

**Results:**
Sixteen patients were treated with MF gel. The volume and concentrations applied were 2 - 10cc and 600 - 1200mcg/5cc respectively. At the initial visit, 94% had polypoid mucosa or polyps and 6% had normal or edematous mucosa. At follow-up visit 1 and 2, 50% had polypoid mucosa or polyps and 50% had normal or edematous mucosa. Initially, 43% percent were on systemic steroid therapy and 80% were on various forms of topical steroid therapy. At follow up visit 2, 37% were on systemic steroid therapy and 50% were on topical steroid therapy.

**Conclusions:**
In-office endoscopic intranasal application of MF gel is a useful adjunct to treat mucosal inflammation in postoperative patients with CRS. It may help reduce the need for systemic as well as topical steroid therapy.

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10:38am

**Discussion/Audience Response**

*Moderators: James Hadley, MD, and Andrew Lane, MD*

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10:48am

**Comparison of Traditional Two-Dimensional Endoscopic Pituitary Surgery with New Three-Dimensional Endoscopic Technology**

*Elina Kari, MD, Nelson Oyesiku, MD PhD, Vladimir Dadashev, MD, Sarah Wise, MD*
*Atlanta, GA*

**Introduction:**
Traditionally, endoscopic trans-sphenoidal pituitary surgery is performed using two-dimensional (2D) endoscopes, which lack depth of field and contribute to image distortion. Recently, the three-dimensional (3D) endoscope has been introduced for improved endoscopic depth perception. Little data exists comparing surgical outcomes with 2D versus 3D endoscopic systems. This study examines perioperative and postoperative factors in patients undergoing pituitary surgery using 2D versus 3D endoscopes.

**Methods:**
Retrospective chart review at a tertiary academic referral center. Statistical comparison was undertaken for perioperative (estimated blood loss, operative time) and postoperative factors (length of stay, complications, and readmission rate).

**Results:**
Sixty-three patients underwent endoscopic pituitary surgery during the 24-month study period (22 functional, 41 nonfunctional lesions). The 2D endoscopic system was used for pituitary tumor resection in thirty-six patients (57%), and the 3D endoscopic system in 27 patients (43%). No significant difference existed between 2D and 3D endoscopic systems for operative time ($p = 0.223$) or estimated blood loss ($p = 0.216$). Additionally, no difference was found between groups for cerebrospinal fluid (CSF) leak rate ($p = 0.526$), postoperative endocrine complications ($p = 0.113$), length of hospital stay ($p = 0.377$), or hospital readmission rate ($p = 0.787$).

**Conclusions:**
3D endoscopy affords the surgeon improved depth of field and stereoscopic vision, attributes that many neurosurgeons prefer for

pituitary and skull base surgery. Our data demonstrate that 3D endoscopy does not result in significantly different perioperative or postoperative outcomes versus 2D endoscopic surgery.

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10:54am

### Sphenoid "Drill-out" for Recurrent Chronic Sphenoid Rhinosinusitis

*William Derek Leight, MD, Lindsay Klocke, MD, Donald Leopold, MD*
*Omaha, NE*

**Background:**
Chronic sphenoid sinusitis refactory to both medical management and one or more sphenoidotomies is a difficult entity to treat. In contrast to the surgical hierarchy which exists for the frontal sinus, there is no systematic approach for addressing persistent disease in the sphenoid. Radical sphenoidectomy with nasopharyngeal flap, or sphenoid marsupialization, has been advocated as a method of addressing recurrent sphenoid sinusitis. While this technique is effective, it can require extensive drilling in the case of a postsellar pneumatization pattern in the marrow-rich clivus. We present a technique called the sphenoid drill-out, which we place between sphenoidotomy and radical sphenoidectomy for use in the management of chronic sphenoid sinusitis.

**Methods:**
The surgical technique involves performing a small posterior septectomy and sphenoid inter-sinus septum drill out to all three boundaries of the sphenoid to create a single common cavity. All remaining rostrum or osteoneogenesis is removed.

**Results:**
Sphenoid drill-out was performed on 10 patients between 2007 and 2009. Patients had an average of 6.3 prior sinus surgeries with 2.7 prior sphenoidotomies. 90% had prior or concomitant modified Lothrop procedures. Average follow up was 10 months. One patient required a revision drill-out procedure. 70% retained a widely patent sphenoid cavity at follow up endoscopy, with the remaining 30% demonstating a patent cavity with mild narrowing.

**Conclusions:**
The sphenoid sinus drill-out procedure is safe and effective for the management of recalcitrant chronic sphenoid rhinosinusitis. It should be considered as an intermediate procedure between sphenoidotomy and sphenoid marsupialization.

11:00am

## Assessing Risk/Benefit of Lumbar Drain Use for Endoscopic Skull Base Surgery

*Evan R. Ransom, MD, David Kennedy, MD, James Palmer, MD, Alexander Chiu, MD*
*Philadelphia, PA*

**Background:**
Lumbar drains (LD) are frequently employed with the goal of post-operative CSF leak prevention. LD placement is not without risk, however, and complications can significantly increase patient discomfort and resource utilization.

**Methods:**
Retrospective review of endoscopic anterior skull base surgeries performed by the senior authors over the past 5 years. Selection of cases with LD using anesthesia and billing records. Analysis of indications, duration, complications, additional care required, and estimated costs.

**Results:**
All LD were placed by anesthesia or neurosurgery staff. Sixty-seven patients had LD placed at surgery: 27 encephaloceles, 20 CSF leak repairs, 13 transsphenoidal approaches or endoscopic resections, 4 revision FESS (complex frontal recess work), and 3 frontal sinus fractures. LD were in place for 62±38 hours. Four cases (6.0%) required revision surgery for postoperative CSF leak (2 patients with intractable hydrocephalus requiring VP shunt, 1 post-endoscopic intracranial resection, and 1 post-FESS CSF leak repair). One readmission was attributable to recurrent leak. Nine complications occurred in 8 patients (13.4%): 5 persistent lumbar leaks, 1 significant overdrainage, 1 retained catheter tip, 1 inadvertent catheter disconnection, and 1 inappropriate opening of a clamped drain after patient transfer. Overall, 6 blood patches, 3 head CTs, 1 spine MRI, and an infectious disease workup were required. Three readmissions and 10 additional hospital days were attributable to LD complications.

**Conclusions:**
Complications of LD are common and may be more frequent than postoperative CSF leaks, adding significantly to hospital resource utilization. Reduction of prospective LD usage may avoid unnecessary morbidity and healthcare costs.

11:06am

**Discussion/Audience Response**

*Moderators: Marc Dubin, MD, and Ralph Metson, MD*

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11:16am

**Bioflavanoid Stimulates Ciliary Beat Frequency and Transepithelial Chloride Transport Through CFTR Dependent and Independent Mechanisms**

*Bradford A Woodworth, MD, Shaoyan Zhang, PhD, Daniel Skinner, BS, Eric Sorscher, MD*
*Birmingham, AL*

**Introduction:**
We have demonstrated that bioflavanoid, an efficacious alternative treatment for respiratory ailments including sinusitis, activates mucociliary clearance (MCC) and transepithelial chloride (Cl-) secretion in vitro and in vivo. The present study investigated effects on ciliary beat frequency (CBF) and the mechanistic actions of this bioflavonoid therapeutic.

**Methods:**
CBF was analyzed following exposures in primary murine (wild-type & CFTR-/-) nasoseptal epithelial cultures and transepithelial Cl- secretion was examined with pharmacologic manipulation in modified Ussing chambers. Fura-2 intracellular calcium [Ca2+]i imaging and cAMP signaling were also investigated.

**Results:**
CBF (fold-change/baseline) was significantly increased following apical [2.05+/-0.15 vs. 1.52+/-0.10(control),p=0.015) and basal [1.37+/-0.09 vs. 0.9+/-0.10(control),p<0.05)] exposures. bioflavanoid-mediated Cl- secretion (∆ISC-uA/cm2) decreased when incubated with the PKA inhibitor, H89 {(19.04+/-1.67 vs. 4.5+/-1.32),p=0.00005] yet exhibited virtually no evidence of stimulation by cellular cAMP. Partial activation of Cl- secretion in CFTR-/- cultures (7.65+/-1.86) was also noted, indicating that transport through a non-CFTR mechanism also contributes to the Cl- secretagogue properties of bioflavanoid, but without increasing [Ca2+]i as a second messenger.

**Conclusion:**
Bioflavanoid stimulates CBF and transepithelial Cl- secretion sug-

gesting 1) a means by which the formulation is likely to enhance MCC and 2) ways that agents utilizing the same therapeutically relevant pathways might be optimized in the future. Our findings suggest that direct effects on CFTR underlie the majority of observed stimulation, but enhanced electrochemical gradients for Cl- secretion (through CFTR independent pathways) may also contribute. Further elucidation of cellular mechanisms using basolateral permeabilized cell monolayers and pharmacologic inhibition of specific transport pathways will be presented.

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11:22am

**Acid and Base Secretion in Freshly Excised Nasal Tissue From Cystic Fibrosis Patients with DeltaF508 Mutation**

*Do-Yeon Cho, MD, Horst Fischer, PhD, Beate Illek, PhD, Peter Hwang, MD*
*Stanford, CA*

**Introduction:**
Airway defenses are affected by the pH of the airway surface liquid (ASL). Patients with cystic fibrosis (CF) have non-functional CFTR transport protein, which contributes to the regulation of ASL pH. The purpose of this study is to assess acid and base secretion in freshly excised human nasal tissues from CF patients with homozygous deltaF508 mutation.

**Methods:**
Human nasal mucosa was collected during sinus surgery and mounted into Ussing chambers. Mucosal equilibrium pH values and rate of proton (H+) and bicarbonate (HCO3-) secretion was determined using the pH-stat technique. The pH of the mucosal solution was maintained at pH 8.0 or pH 6.0 to increase the driving force for H+ and HCO3- secretion, respectively.

**Results:**
Nasal mucosa from DeltaF508 CF patients (n=5) had an equilibrium pH of 7.24±0.1 (n=5) and secreted H+ at a rate of 23.2±14.3 nmolomin-1ocm-2. This rate was significantly lower compared to normal mucosa (79.8±15.1, n=6) and chronic rhinosinusitis (CRS) (51.4±10.5, n=7) (p=0.046). HCO3- secretions were noted at a rate of 14.1 in CF and 24.4 nmolomin-1ocm-2 in normal tissue. HCO3 secretory rate was further increased by forskolin to 10% in normal but not CF tissues.

**Conclusion:**
Our data suggests that CF patients with homozygous DeltaF508 mutation exhibited significantly lower H+ secretion by the nasal airways and lack the CFTR protein's HCO3- secretion into the ASL. It is possible that improper regulation of ASL pH in CF is predicted to negatively impact the innate host defense system.

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11:28am

**Molecular Modulation of Upper Airway Ciliary Response to a Novel Mechanical Stimulation.**

*Noam A. Cohen, MD, PhD, Andrew Cowan, MD PhD, Bei Chen*
*Philadelphia, PA*

**Introduction:**
Prior work has focused on lower airway ciliary response to mechanical forces encountered during normal respiration, such as shear stress and cyclic pressure. We have developed a novel method of mechanical stimulation resulting in a rapid and transient elevation in ciliary beat frequency (CBF) to interrogate the pathways regulating this critical defense mechanism in upper airway cells.

**Methods:**
A pico-puffer applied an 80 mSec puff of apical pressure to murine nasal epithelial cells grown at an air liquid interface. Changes in CBF were recorded with concomitant pharmacologic manipulation of calcium, purine, or cAMP signaling.

**Results:**
CBF increase in response to a rapid apical mechanical stimulation is dependent upon extracellular calcium, as the response is abolished in the presence of 0.5 mM EGTA. The response is greatly attenuated in the presence of 10 μM BAPTA-AM, a specific intracellular calcium chelator. Disruption of purine signaling with apyrase or inhibition of soluble adenylyl cyclase with KH7 did not effect the ciliary response.

**Conclusion:**
The response of airway cilia to environmental stimuli is a critical component of sinonasal protection and has been demonstrated to be blunted in patients with chronic rhinosinusitis. We demonstrate that extracellular calcium, but not ATP, is critical for upper airway ciliary response to abrupt mechanical stimulation such that may be encountered during a sneeze. This suggests that different pathways

regulate cellular response to this novel stimulation compared to pathways that have previously been proposed in lower airway epithelia in response to milder mechanical stimuli encountered during normal respiration.

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11:34am
**Discussion/Audience Response**
*Moderators: Seth Brown, MD, and Sarah Wise, MD*

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11:44am
**Business Meeting**

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12:00 noon
**Lunch with Exhibitors**

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1:00pm
**Utility of Novel 3-Dimensional Stereoscopic Vision System During Endoscopic Sinonasal and Skull Base Surgery**
*R. Peter Manes, MD, Jacquelyn Brewer, MD, Samuel Barnett, MD, Pete Batra, MD*
*Dallas, TX*

**Introduction:**
The objective of this pilot study was to evaluate the utility of novel 3-dimensional (3D) endoscopy during endoscopic sinonasal and skull base surgery.

**Methods:**
Seven cases were performed between August and October 2009 at a tertiary care academic medical center. High-definition 2D endoscopy system was employed in all cases. The Visionsense stereoscopic system (Orangeburg, New York) was incorporated during key portions of the procedures. Two independent surgeons assessed utility of the technology for the following variables: (1) Ability to facilitate orientation and depth perception and (2) Impact on completeness of surgery and potential complications.

**Results:**
The mean age was 48.8 years and male: female ratio was 5:1. Indications included anterior skull base (ASB) tumor resection (3),

directed skull base biopsies (3), and dissection adjacent to dehiscent skull base/orbit in allergic fungal rhinosinusitis (1). Endoscopic orientation and depth perception was aided using the 3D endoscope in all cases. Additional interventions were performed in 3 cases (42.9%), including tumor resection (1) and removal of remnant partitions (2). Limitations posed included inability to visualize a type III frontal cell (1) and loss of orientation during ASB reconstruction due to over-magnification (1). No complications were observed. Representative cases will be demonstrated to illustrate utility of the technology during endoscopic procedures.

**Conclusions:**
This preliminary study demonstrated effectiveness of binocular 3D endoscopy during sinonasal and skull base surgery. The technology facilitated depth perception and completeness of surgery without increase in complications. Additional experience is warranted to define its role in the endoscopic paradigm.

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1:06pm

## Pre-operative Planning for Endoscopic Frontal Sinus Surgery Using 3-D Image Analysis Tools Including Virtual Endoscopy for Successful Cannulation of the Frontal Sinus Opening

*John Pallanch, MD, David Delone, MD*
*Rochester, MN*

**Introduction:**
The purpose of this paper is to report our 4 year experience evaluating the use of 3-D image analysis tools in pre-operative planning for endoscopic frontal sinus surgery. These tools are helpful for understanding the complexities of the frontal recess. There is a need for information about their usefulness and practicality in preparing for frontal sinus procedures including balloon dilation.

**Methods:**
During the period 2005 to 2009, we used 3-D image analysis tools for pre-operative planning of frontal sinus cases with diverse complexity, noting which tools enhanced understanding beyond conventional views, and which tools were most useful for each type of case. In the subgroup of 52 sides in 38 patients who had 3-D planning done prior to endoscopic frontal sinusotomy by balloon dilation, the percentage of successful cannulations of the pathway to the frontal sinus was compiled.

**Results:**
The 3-D tools that were most useful in more extensive disease were 3-D volume rendering with variable cut planes, and color coding of structures and disease.\r\n3-D surface shading, including virtual endoscopy, was particularly useful to understand the path to the frontal sinus. 100 % of our patients who had 3-D planning before frontal sinusotomy by balloon dilation had successful cannulation with the guide wire.

**Conclusion:**
Pre-operative planning with 3-D image analysis tools resulted in enhanced understanding of the anatomy that would be encountered during frontal sinus surgery. The use of these tools increased efficiency and success. Potential benefits include increased safety and decreased procedure and anesthesia time.

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1:12pm

## Utility of Real-Time Endoscopic Tracking, Preoperative Contouring and Virtual Endoscopy on Image Guided Endoscopic Surgery in a Cadaver Model

*Eitan Prisman, MD, Mike Daly, M.Sc, Harley Chan, MD, Jeff Seiwerdson, MD, Allan Vescan, MD, John Irish, MD*
*Toronto, Canada*

**Introduction:**
Customized software was developed in our lab to integrate intraoperative cone-beam CT (CBCT) images with endoscopic video for surgical navigation and guidance. A cadaveric head was used to assess the accuracy and potential clinical utility of the following software applications: (1) Real time tracking and navigation of the endoscope on intraoperative three dimensional CBCT display. (2) Projecting a reconstructed CBCT image which is orthogonal to the tip of the endoscope corresponding to the 'surgical' plane. (3) Preoperative contouring of anatomical structures of interest. (4) Virtual reality endoscopic representation of CBCT images.

**Methods:**
Anatomical landmarks were contoured on a cadaveric head. An experienced endoscopic surgeon was oriented to the software and asked to employ these features during predefined surgical tasks. Utility was evaluated with a visual analog scale consisting of three categories; (i)Task completion, (ii)safety and (iii)surgical training. Ablative tasks included uncinectomy(1), ethmoidectomy(2), sphe-

noidectomy/pituitary resection(3) and clival resection(4). CBCT images were updated following each ablative task.

**Results:**
As a teaching tool, the software was evaluated as 'very useful' for all surgical tasks. Regarding safety and task completion the software had 'no advantage' for task (1), 'minimal' for task (2), and 'very useful' for tasks (3) and (4). Landmark identification for structures behind bone was 'very useful' for all three categories.

**Conclusion:**
The software increased surgical confidence in safely completing challenging ablative tasks by creating "real-time" image guidance for highly complex ablative procedures. Application of this technology promises to be a valuable teaching aid to surgeons in training.

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1:18pm
**Discussion/Audience Response**
*Moderators: Stephanie Joe, MD, and Donald Lanza, MD*

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1:28pm
**Vitamin D3 Deficiency is Associated with Alterations in Circulating Dendritic Cells and Increased Bone Erosion in CRS**
*Jennifer K. Mulligan, PhD, Rodney Schlosser, MD*
*Charleston, SC*

**Introduction:**
Vitamin D3 is a steroid hormone that can block dendritic cell (DC) differentiation and maturation, thereby preventing the initiation of Th2 responses. We hypothesized that Th2 inflammatory disorders, such as chronic rhinosinusitis with nasal polyps (CRSwNP) and allergic fungal rhinosinusitis (AFRS), have deficiencies in vitamin D3 resulting in increased number of mature DCs.

**Methods:**
Plasma levels of 25-hydroxyvitamin D3, GM-CSF and PGE2 were measured by ELISA in patients with AFRS (n=7), CRSwNP (n= 5), chronic rhinosinusitis without nasal polyps (CRSsNP) (n=8) and controls undergoing CSF leak repair or pituitary tumor resection (n=13). Flow cytometric analysis was used to determine percent of circulating CD86+ DCs.

**Results:**
Mean plasma levels of 25-hydroxyvitamin vitamin D3 were nearly identical between controls and CRSsNP. CRSwNP and AFRS vitamin D3 levels were significantly reduced to nearly half the mean levels observed in CRSsNP or control. Furthermore, vitamin D3 deficiency strongly correlated with increased presence of mature CD86+ DCs and elevated plasma levels of GM-CSF and PGE2 which direct DC maturation and Th2 skewing, respectively.

**Conclusion:**
Patients with CRSwNP and AFRS have significantly lower plasma levels of vitamin D3 which correlate with increased presence of circulating mature DCs and DC regulatory factors. Future studies will examine the contribution of vitamin D3 deficiency to DC direction of Th2 skewing and the therapeutic potential of correcting these deficiencies.

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1:34pm

## Microporous Polysaccharide Hemispheres (MPH) Does not Cause Synechiae Formation After Endoscopic Sinus Surgery: A Blinded, Controlled Study

*Jastin L Antisdel, MD, Jackie Matijasec, MD, Jonathan Ting, MD, Raj Sindwani, MD*
*St. Louis, MO*

**Introduction:**
Absorbable hemostatic agents are commonly used after endoscopic sinus surgery (ESS). Despite their popularity, several of these materials have been shown to contribute to synechiae and granulation formation after surgery. Microporous Polysaccharide Hemospheres (MPH) is a novel, rapidly absorbed hemostatic powder that does not interfere with regenerating sinus mucosa in the rabbit model. The goal of this study was to examine the impact of MPH on postoperative healing and the formation of synechiae after sinus surgery in humans.

**Methods:**
Prospective, randomized, controlled, double-blind study. 40 consenting adult patients with chronic rhinosinusitis requiring symmetric ESS were randomized to receive MPH unilaterally at the conclusion of surgery. The opposite side was left untreated. Standard postoperative care was performed bilaterally. Outcomes measured included blinded observer ratings for synechiae, edema, and infec-

tion. Each side was examined and scored at post-operative day 7, 14, and 30.

**Results:**
19 men and 21 women with an average age of 48.3 yrs were included. There were no complications and all patients were discharged home the same day. There was no significant difference in synechiae formation between sides at any time point postoperatively. The rate of synechiae formation was determined to be 10% (4/40) on the MPH-treated side versus 7.5% (3/40) on the untreated side (p = 0.7639). There were no significant differences in any of the other variables measured (p>0.05).

**Conclusion:**
The use of MPH after ESS does not increase synechiae formation and does not appear to deleteriously affect healing in post-operative sinus cavities.

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1:40pm

## Chronic Rhinosinusitis with Nasal Polyps: Elevated Serum IgE is Associated with Staphylococcus Aureus on Culture

*David W Clark, MD, Ashley Wenaas, BFA, Martin Citardi, MD, Samer Fakhri, MD*
*Houston, TX*

**Background:**
Recent data has implicated Staphylococcus aureus (SA) superantigen as a potential disease modifier in patients with Chronic Rhinosinusitis with Nasal Polyps (CRSwNP).

**Objective:**
To compare serum IgE, serum eosinophils, Lund-Mackay CT scores and Sinonasal Outcome Test-20 scores in CRSwNP patients with positive SA cultures (SA+) versus CRSwNP patients with negative SA cultures (SA-).

**Methods:**
Retrospective review at a tertiary rhinology referral center.

**Results:**
Bacterial cultures were obtained from 79 patients. Staphylococcus aureus was the most prevalent bacteria, isolated in 20 patients (25%). Patients with elevated total serum IgE were more likely to

have SA on culture (p=0.047). Lund-Mackay CT scores were significantly higher in the SA+ versus SA- group (p=0.033). The SA+ group had a higher, but not statistically significant, SNOT-20 score, total serum IgE, fungal-specific IgE, and peripheral eosinophil level. Conclusion: In CRSwNP patients, elevated total serum IgE was statistically associated with SA yield on culture. This supports a possible induction of a Th-2 milieu by SA superantigen through T-cell activation. In addition, SA+ patients had higher Lund-Mackay CT scores at presentation indicating a higher burden of disease in this group of patients.

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1:46pm
**Discussion/Audience Response**
*Moderators: Karen Fong, MD and Mark Zacharek, MD*

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1:56pm
**"What the Rhinologist Needs to Know About Sense of Smell"**
*Avery Gilbert, PhD*

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2:36pm
**Olfactory Function Following Modified Endoscopic Lothrop Procedure**
*Kristin Seiberling, MD, Jia Miin Yip, MD, Peter John Wormald, MD*
*Presented by Michelle Ghostine, MD, Loma Linda, CA*

**Objectives:**
Hypothesis The Modified Endoscopic Lothrop procedure (MELP) is a complex procedure, performed for chronic frontal sinusitis that is refractory to standard functional endoscopic sinus surgery. The procedure involves encroachment into, and possibly obliteration of, important areas of olfaction, hence theoretically affecting olfactory function in a negative way. This study was performed to assess patients' subjective sense of smell following this procedure.

**Study Design:**
Prospective study of retrospective data.

**Methods:**
Sixty-eight patients, who underwent modified endoscopic Lothrop by

the senior author (PJW) between 2003 and 2008, completed a post-operative questionnaire asking about their perception of olfactory function. All patients had their pre-operative sense of smell documented prior to undergoing surgery. Patient records were reviewed for pertinent medical information such as the presence of asthma, aspirin sensitivity and nasal polyps.

**Results:**
This study found that the majority of patients reported improvement in their sense of smell post-operatively, while only a small number reported a negative impact on their smell. Thirty nine patients (57.3%) reported an improvement in their post-operative smell grade. Twenty patients (29%) reported no change in their smell grade, while the remaining 9 patients (13.2%) stated that their sense of smell worsened after surgery. No statistically significant correlation was found between patient outcome and the presence of asthma, nasal polyps, or Samter's triad.

**Conclusions:**
The Modified endoscopic Lothrop procedure has a positive effect on patients' subjective sense of smell post-operatively.

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2:42pm

## Trends in Common Rhinologic Illnesses: Analysis of U.S. Healthcare Surveys

*Charles Ryan Woodard, MD, Jose Mattos, MD, Spencer Payne, MD (Presented by Jose Mattos, MD)*
*Charlottesville, VA*

**Objective:**
To study changes in clinic visits for common rhinologic diagnoses.

**Introduction:**
Up to date information on recent changes in rhinologic disease prevalence is sparse. Current studies may quote data that is over a decade outdated and inaccurate.

**Methods:**
Survey data from the National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHMACS) were examined from 1995-2006 for common rhinologic illnesses by ICD-9 code. A data mining program was designed

using SAS statistical software. Variables analyzed included: age, sex, and race.

**Results:**
An increasing trend was observed for acute sinusitis, chronic sinusitis, and allergic rhinitis. A bimodal distribution in the age of occurrence of allergic rhinitis was also seen. These data were statistically significant ($p < 0.0125$).

**Conclusions:**
Several interesting trends have occurred among common rhinologic diagnoses. The increase in sinusitis and associated allergic rhinitis may provide validation for the Hygiene Theory.

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2:48pm

### Endoscopic Sinus Surgery Reduces Antibiotic Utilization in Rhinosinusitis

*Naveen D Bhandarkar, MD, Jess Mace, MPH, Timothy Smith, MD*
*Portland, OR*

**Introduction:**
Antibiotics are a mainstay of treatment for chronic rhinosinusitis (CRS) and recurrent acute rhinosinusitis (RARS). Although quality-of-life outcomes following endoscopic sinus surgery (ESS) have been previously studied, the change in antibiotic utilization following ESS is less well known. We aimed to determine the effect of ESS on antibiotic utilization in CRS and RARS.

**Methods:**
A multi-institutional, prospective cohort of patients with CRS and RARS was enrolled between January, 2001 and January, 2009. Patients completed the medication subscale of the Chronic Sinusitis Survey, and the Wilcoxon signed-rank test was used to compare differences in the reported time of antibiotic use pre- and postoperatively.

**Results:**
503 patients were followed for a mean of 17.3 ± 6.6 months. Overall, patients reported a 57.2% reduction in time on antibiotics following ESS. The majority of patients (60.4%) reported significantly less antibiotic utilization after ESS ($p<0.001$) consisting of an 83.7% reduction in the time on antibiotics. Subgroup analysis also

revealed a significant reduction in antibiotic utilization for patients with and without nasal polyposis (59.0% and 58.2%; p<0.001) as well as RARS (61.2%; p=0.001).

**Conclusion:**
ESS significantly reduces antibiotic utilization for CRS and RARS. This finding demonstrates potential for lower health care expenditures related to antibiotics, as well as reduced risk of both antibiotic related morbidity and development of bacterial resistance.

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2:54pm
**Discussion/Audience Response**
*Moderators: Jivianne Lee, MD and Michael Sillers, MD*

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3:04pm
**Exhibitor Break**

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3:24pm
**Work Productivity Improvement through One Year Follow-Up after Balloon Dilation of the Maxillary Sinus Ostium and Ethmoid Infundibulum**
*James Stankiewicz, MD, Theodore Truitt, MD, James Atkins, MD*
*Maywood, IL*

**Introduction:**
Chronic rhinosinusitis has a profound, negative impact on workplace attendance, productivity, and activity. A clinical study (BREATHE I - Entellus Medical, Inc.) measured worker presenteeism, absenteeism, workplace limitations, and activity limitations before treatment and through one-year follow-up after undergoing trans-antral dilation of the maxillary sinus ostia and ethmoid infundibulum.

**Methods:**
Subjects presenting with CRS and CT evidence of disease in the maxillary sinuses alone, or maxillary and anterior ethmoid sinuses, completed two validated surveys including the Work Productivity and Activity Impairment Questionnaire (WPAI) and the Work Limitation Questionnaire (WLQ) at before undergoing balloon dilation and again at 1 week, 3 months, 6 months and 12 months post-procedure.

**Results:**
At baseline, the first 30 subjects reported an 8.9% loss in health-related productivity as assessed by the WLQ. Productivity improved at each follow-up, and at 3 months, 6 months and 12 months post-treatment, lost productivity dropped to 1.8% ($p<0.0001$), 3.4% ($p=0.0003$) and 2.1% ($p=0.0001$) respectively. In this same population, the WPAI was used to measure percent impairment while working (presenteesim), percent overall work impairment, and percent activity impairment due to sinus problems. Before treatment, impairment for each variable was reported to be 29.1%, 31.4%, and 34.3% respectively. At one year, all 3 impairment percentages significantly decreased to 6.1%, 6.6%, and 5.9% respectively.

**Conclusion:**
These results indicate that there is a negative impact on work productivity and activity due to sinus related health problems and treatment of CRS by dilating the maxillary sinus ostia and ethmoid infundibulum can significantly improve work productivity and activity.

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3:30pm

## A New Staging Paradigm for Chronic Rhinosinusitis Using 3-D Volumetric Measurements and Advanced High Resolution CT Imaging

*Robert Hadi Deeb, MD, Baljinder Gill, BS, Preeti Malani, MD, Mark Zacharek, MD*
*Detroit, MI*

**Introduction:**
Multiple chronic rhinosinusitis (CRS) staging systems attempt to correlate clinical symptoms with radiologic imaging results. We sought to develop a new CRS staging paradigm using 3-D volumetric measurements and advanced high resolution CT imaging.

**Study Design:**
Retrospective review

**Methods:**
We reviewed maxillary sinus (MS) CT scans from 50 control subjects and 50 subjects with documented CRS involving at least one MS. The following measures were recorded: 1) volume of MS free air 2) MS mucosal thickening, 3) MS lateral wall bony thickness. Average Hounsfield unit (HU) values for mucosal thickening among CRS subjects were also recorded. Values from the CRS patients

were compared to controls. Values are expressed as mean ± SD. Means were compared using Student\'s t-tests. Results: Among controls (n=50), volume (ml) of right and left MS was 24.1 ± 9.7 and 24.7 ± 9.0 respectively. Among CRS patients (n=50), the portion of mucosal disease to total sinus volume was 51.8% (right) and 50.7% (left). Bony thickness (mm) in controls was 0.98 ± 0.2 (right) and 1.0 ± 0.3 (left). CRS patients had significantly greater bony thickness 1.9 ± 0.8 (right) and 2.0 ± 0.9 (left), (p=0.0001). HU for diseased MS were 30.1 ± 18.7 (right) and 35.7 ± 22.1 (left).

**Conclusions:**
3-D volumetric analysis combined with Hounsfield unit calculations and bony thickness measurements represents a promising strategy to stage CRS. Further studies correlating symptoms with imaging findings are needed to validate the clinical utility of this novel staging paradigm.

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3:36pm

## Ethmoid Histopathology Does Not Predict Olfactory Outcomes after Sinus Surgery

*Zachary M Soler, MD, David Sauer, MD, Jess Mace, MPH, Timothy Smith, MD*
*Portland, OR*

**Background:**
Histologic inflammation correlates with the degree of baseline olfactory dysfunction in patients with chronic rhinosinusitis (CRS), however factors associated with improvement in olfactory status after endoscopic sinus surgery (ESS) remain elusive.

**Objective:**
Our purpose was to compare histopathologic findings in CRS patients with olfactory loss and evaluate whether inflammatory markers can predict long-term olfactory improvement after ESS.
Methods: Adult (>18 years) patients with CRS were prospectively enrolled after electing ESS due to failed medical management. Mucosal tissue specimens were collected at the time of surgery and underwent pathlogic review in a blinded fashion. Subjects completed the 40-item Smell Identification Test (SIT) preoperatively and at least 6 months postoperatively. Multivariate logistic regression was used to identify histologic factors associated with postoperative improvement in SIT score.

**Results:**
The final cohort was comprised of 101 patients with a mean follow-up of 16.7 ± 6.0 months. Mean mucosal eosinophil count was higher in patients with hyposmia and anosmia ($p<0.001$). Patients with pre-operative anosmia were more likely to have greater severity of BM thickening compared to subjects with hyposmia or ormosmia ($p=0.021$). In patients with olfactory dysfunction, 54.7% reported olfactory improvement of at least 4 points on postoperative SIT scores. After controlling for nasal polyposis, histologic variables were not associated with postoperative improvement in olfaction.

**Conclusion:**
Patients with severe olfactory dysfunction were more likely to have mucosal eosinophilia and basement membrane thickening on ethmoid histopathologic examination compared to normosmics. The presence of specific histologic inflammatory findings did not however predict olfactory improvement after surgery.

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3:42pm
**Discussion/Audience Response**
*Moderators: Amber Luong, MD, and Spencer Payne, MD*

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3:52pm
**Indications, Technique, Safety and Accuracy of Office Based Nasal Endoscopy with Biopsy for Neoplasm**
*Abtin Tabaee, MD, Amy Hsu, MD, Ashutosh Kacker, MD*
*New York, NY*

**Introduction:**
Office based nasal endoscopy with biopsy has the potential to provide histopathological diagnosis in patients with sinonasal neoplasms while avoiding operative biopsy. A critical description of this procedure is required to understand its role.

**Methods:**
A retrospective review of the indications, complications and results of office based nasal endoscopy with biopsy for primary indication of neoplasm was performed. When available, comparison was made between the histopathological findings at biopsy versus surgery. The technique of the procedure is described.

**Results:**
61 patients underwent 69 office based endoscopic sinonasal biopsies during the three year study period. The indications included unilateral process, suspicious radiographic findings, atypical sinonasal symptoms, prior history of neoplasm, and incidental finding of sinonasal lesion on examination. The results of the biopsies in this cohort included inflammatory sinusitis in 35 specimens, benign neoplasm in 14 specimens, malignant lesion in 13 specimens, non-diagnostic tissue in 5 specimens and granulomatous/vasculitic lesion in 2 specimens. Comparison of histopathological results from office biopsy versus surgery in 25 patients revealed agreement in 21 patients(84%), 2 false negative results for malignancy(8%), one false negative result(4%) and one false positive result(4%) each for inverted papilloma. No major complications were experienced and two patients experienced self-limited bleeding following the procedure.

**Conclusions:**
Office based nasal endoscopy with biopsy represents an important diagnostic tool in the evaluation of sinonasal neoplasms. The procedure is generally safe and provides diagnostic information that may alter treatment decisions. Limitations of the procedure do exist, notably the potential for both false positive and false negative results.

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3:58pm

## Aggressive Surgical & Postoperative Medical Management For Cystic Fibrosis Chronic Rhinosinusitis

*Frank W Virgin, MD, Mary Wade, Randall Young, MD, Bradford Woodworth, MD*
*Birmingham, AL*

**Background:**
Chronic rhinosinusitis (CRS) has a major impact on the quality of life of patients with cystic fibrosis (CF). While many individuals have had multiple sinus surgeries by adulthood, the maxillary sinuses are a recurrent problem area. The modified endoscopic medial maxillectomy (MEMM) permits debridement in clinic, improves mucus clearance with nasal irrigations, and increases access for topical delivery of therapeutics. However, the clinical outcomes of aggressive sinus surgery with regimented postoperative medical treatment during the healing process have yet to be elucidated. The purpose of this study was to evaluate the effects of this treatment paradigm on sinonasal symptoms and pulmonary function.

**Methods:**
In this prospective cohort study, CF patients completed a Sinonasal Outcome (SNOT)-22 questionnaire before surgery and at each postoperative visit. Culture-directed antibiotics, prednisone, and saline irrigations were initiated postoperatively. Primary outcome measures included symptoms at 8 weeks and change in FEV1.

**Results:**
Sixteen patients (mean age 27, 4.2 prior procedures) underwent MEMM and sinus surgery. There were no adverse effects. Symptom scores were significantly reduced at 8 weeks (61.5 pre vs.29 post; p=0.0001) with robust improvements in facial pain/pressure (4.3 vs. 1.7, p=.0006), post-nasal drip (3.9 vs.1.7,p=0.001) and nasal obstruction (4.1 vs. 1.75,p=0.01). Significant reduction was still noted > 120 days postoperatively (61.5 vs. 45,p=0.04). There were no differences in FEV1 (57 pre vs. 55 post).

**Conclusion:**
Early results indicate marked improvement in symptoms with this clinical approach. Ongoing prospective follow-up is necessary to determine whether this treatment paradigm will decrease pulmonary exacerbations in cystic fibrosis.

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4:04pm

### Effects of Various Submucous Resection Techniques of Septal Cartilage on Nasal Tip Projection

*Richard Abraham Zoumalan, MD, Luc Morris, MD, Zeitler Daniel, MD, Shah Anil, MD*
*New York, NY*

**Objectives:**
Assess the effect of various septoplasty techniques on nasal tip projection in a fresh cadaver model.

**Methods:**
Nasal tip projection was measured on 6 fresh cadaver heads and compared postoperatively after a sequence of submucous septoplasty maneuvers. Technique one consisted of the removal of a central square of septal cartilage. Technique two consisted of removing a portion of cartilage posterior to the square near the bony cartilaginous junction. Technique three consisted of removing cartilage anterior to the square by making but preserving a large caudal component along the floor. Technique four consisted of removing the sep-

tal cartilage along the caudal portion of cartilage along the floor of the nose. Fixed bony landmarks were used to standardize measurements.

**Results:**
Technique one resulted in a loss of projection in 3/6 (50%) heads with an average tip projection loss of 7.76%. Technique two resulted in a loss of projection in 0/6 head with an average loss of nasal tip projection loss of 0%. Technique three resulted in a change loss in nasal projection in 1/6 (17%) cadavers. Technique four resulted in a loss of projection in 2/6 (33%) heads with average percent change in tip projection of 9.08%. After all maneuvers were performed on each cadaver, all cadavers experienced loss of projection. When all maneuvers were taken in total, there was a statically significant average decrease in projection of 8.93% percent (range 5.00-13.04%).(p=.008).

**Conclusion:**
Primary septoplasty carries a risk of nasal tip projection, with certain maneuvers carrying higher risk.

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4:10pm
**Discussion/Audience Response**
*Moderators: Rodney Schlosser, MD and Michael Setzen, MD*

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4:20pm
**Panel - "Rhinology and Industry: Can't We All Just Get Along?"**
*Bradley Marple, MD*

# Posters

Poster Reception
Thursday, April 29, 2010
5:30 - 7:00 pm

Poster Reception
Thursday, April 29, 2010
5:30 - 7:00 pm

# Posters

Poster 189

## A Clinical Evaluation of the Middle Turbinate Implant for Affixing the Middle Turbinate to the Nasal Septum

*Ronald Kuppersmith, MD, James Atkins, MD, Daniel Fleming, MD, Jedidiah Grisel, MD*
*College Station, TX*

**Introduction:**
During endoscopic sinus surgery (ESS), lateralization of the middle turbinate post-operatively can lead to scarring and obstruction of key drainage pathways, including the osteomeatal complex. The technique of suturing the middle turbinate to the nasal septum to enhance exposure can be difficult and time consuming. This study presents the first clinical results using the Middle Turbinate Implant (MTI), a device composed of absorbable copolymer polylactide-co-glycolide and intended to medialize the middle turbinate during surgical procedures such as ESS.

**Methods:**
The trial included 22 implantations on 14 subjects (6 unilateral and 8 bilateral implantations). The primary outcome measure was the position of the middle turbinate at 1, 2 and 4 weeks post-operatively. The extent of tissue reaction at the site of implantation was also evaluated.

**Results:**
At 1, 2 and 4 weeks post-operatively, 100% of the middle turbinates were held medially or in the neutral position with no significant synechiae present. At 1, 2 and 4 weeks post-operatively, there was either no (81%, 86%, 86%) or mild (18%, 14%, 14%) tissue reaction at the site of implantation. No complications were noted during implantation.

**Conclusion:**
The use of the bioresorbable MTI appears to be a safe and effective method of medializing the middle turbinate during ESS.

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Poster 190

## A Theoretical Cause of Nasal Obstruction in Patients with Repaired Cleft Palate

*Matthew Moldan, null, Andrew Scott, MD, Robert Tibesar, MD, James Sidman, MD*
*Minneapolis, MN*

**Objective:**
During cleft palate repair, mucoperiosteal flaps are elevated from the palatal shelves and the nasal septum to accomplish tension-free closure of the nasal floor. Our goal was to geometrically describe how palate repair inherently limits airflow by decreasing nasal cavity cross-sectional area and increasing nasal airflow resistance. We also sought to demonstrate that the width of the repaired cleft palate directly affects the degree of postoperative airflow resistance.

**Methods:**
A simplified geometric model of normal nasal cavity anatomy was compared to an equivalent schematic representing an individual with an un-repaired palatal cleft. Mathematical equations approximating the cross-sectional areas of normal and cleft nasal cavities were created. The theoretical postoperative loss of nasal cavity cross-sectional area was then considered for both unilateral and bilateral palatal clefts.

**Results:**
According to this geometric model, the cross-sectional area of the nasal cavity is decreased in patients who undergo cleft repair. Repaired bilateral clefts experience a greater area loss than their unilateral counterparts.

**Conclusion:**
Nasal cavity resistance is higher in patients who have undergone cleft repair than in non-cleft individuals, because tension-free closure of the nasal floor inherently reduces cross-sectional breathing area. The wider the cleft, the higher the resistance to nasal airflow postoperatively. This iatrogenic source of nasal resistance is likely additive to other anatomic contributors to airflow resistance observed in individuals with cleft nasal deformities.

Poster 191

## Addition of a Minimally Invasive Medial Orbital Approach in the Endoscopic Treatment of Advanced Sino-orbital Disease: Cadaver Study and Case Descriptions

*Vijay Ramakrishnan, MD, Jeffrey Suh, MD, Alexander Chiu, MD, James Palmer, MD*
*Philadelphia, PA*

**Introduction:**
Access to the medial orbit has been traditionally gained via an external incision with potential for associated soft tissue and lacrimal disruption. Endoscopic transnasal approaches may be limited in certain scenarios by tumor presence or patient-specific factors. The medial transconjunctival approach, or transcaruncular approach, has been used successfully for access to the medial orbit in orbital decompression and repair of medial blowout fractures. The aim of this study is to determine the utility of this minimally-invasive open approach in the endoscopic management of advanced sino-orbital disease.

**Methods:**
The transcaruncular approach was combined with a transnasal endoscopic approach in cadaver dissections performed on 8 sides. Five cases were reviewed in which the transcaruncular approach was used to supplement endoscopic sinus surgery.

**Results:**
nIn cadaver dissection, the transcarucular approach is a simple, reliable method to ligate the ethmoid arteries and place bony cuts along the medial orbital wall. In certain anatomic configurations, supraorbital dissection into the frontal sinus or anterior fossa may be achieved. In the cases examined, exposure of the medial orbital subperiosteal plane allowed for ligation of ethmoid arteries, assessment of periorbital invasion of disease and placement of a malleable retractor for protection of orbital contents.

**Conclusions:**
The transcaruncular approach to the medial orbit has certain advantages over the traditional open approach. Ligation of the ethmoid arteries, assessment of the lacrimal sac and periorbita for tumor invasion, protection of orbital contents, placement of bony cuts, and transcranial dissection are possible through this route.

Poster 192

## Case report: Primary Sphenoid Sinus Esthesioneuroblastoma Presenting as Nasal Congestion, Diplopia and Headache

*Maher Abu-Hamdan, MD, Kia Jones, Adam Folbe, MD*
*Detroit, MI*

Esthesioneuroblastoma is a rare malignant tumor derived from the round basal cells of olfactory epithelium. These cells are located in the area of the cribiform plate, superior turbinate and upper nasal septum. Thus, these tumors most commonly occur in the superior nasal cavity and extend to surrounding structures. The occurrence of esthesioneuroblastoma in a site outside of where olfactory epithelium exists is exceedingly rare. Isolated esthesioneuroblasma has been described in the ethmoid sinus, maxillary sinus, nasopharynx and pituitary gland. We report a rare case of esthesioneuroblastoma occurring in the sphenoid sinuses, the pathogenesis, clinical manifestations, treatment and prognosis. There have been just three such cases described in the literature to date.

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Poster 193

## Comparing Endoscopic Sinus Surgery Between Image Guidance and Intraoperative CT Scan?

*Joseph Han, MD, Brad Rawlings, MD*
*Norfolk, VI*

**Objectives:**
Compare the dissection for endoscopic sinus surgery using real time intraoperative CT versus CT image guidance system (IGS).

**Study Design:**
Cadaver study

**Methods:**
CT scans were performed prior to endoscopic sinus dissections. Each side of the cadavers was randomized to one of two groups. The first group was dissected using a CT IGS to perform maxillary antrostomy (MA), anterior ethmoidectomy (AE), posterior ethmoidectomy (PE), sphenoidotomy (SP), and frontal sinusotomy (FS). The second group only used updated intraoperative CT scans after each phase of the dissection to decide if further dissection is needed. Residual cells were documented for both groups at the completion the dissection. All post dissection CT scans were evaluated for

incomplete dissection and lamina paprycea or skull base violation. Comparisons were made between the two groups.

**Results:**
There were 10 cadavers with 20 independent sinus cavities with 10 sinus cavities in each group. There was no difference in residual unopened air cell between the 2 groups for MA, AE, and SP. For the PE and FS, there was higher percent of complete dissection using the intraoperative CT scanner (100% for both PE and FS) versus the CT IGS (80% for both), but it did not reach statistical difference (p=0.2). There we no orbital or skull base violation.
Conclusions: Endoscopic sinus dissection is similar between using the intraoperative CT scan alone and using a CT IGS. It is possible that the intraoperative CT scanner may be helpful in challenging endoscopic sinus procedures such as the frontal sinusotomy.

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Poster 194

## Endonasal Control of Anterior Skull Base Cerebrospinal Fluid Leaks Using High Viscosity Polymethylmethacrylate Cement

*Deya Jourdy, MD, Aaron Pearlman, MD, John Boockvar, MD*
*New York, NY*

**Introduction:**
Cerebrospinal fluid (CSF) leaks can be responsible for significant patient morbidity and mortality. While some anteriorly based CSF leaks will seal without intervention, spontaneous or iatrogenic CSF leaks often require intervention. Low viscosity versions of polymethylmethacrylate cement have been difficult to work with. However, the recently developed high viscosity polymethylmethacrylate (HV-PMMA) based cement may be ideal for reconstructing the anterior skull base, as it possesses initial malleability prior to hardening. Previous data has suggested that using HV-PMMA in the anterior skull base is effective and well tolerated. We describe a new method of bone reconstruction using HV-PMMA for anteriorly based CSF leaks.

**Study Design:**
Retrospective cohort analysis.

**Methods:**
Medical records of two consecutive patients who were treated for spontaneous CSF leak with endoscopic endonasal repair using HV-PMMA were reviewed. Clinical presentation will consist of medical

history, radiography, and intra-operative and post-operative treatment.

**Results:**
The patients presented for treatment between December 2008 and October 2009. Both patients demonstrated cessation of CSF leak intrao-peratively. Post-operative CT scan confirmed satisfactory placement of the HV-PMMA in both cases. Mean follow-up was 6 months after surgery. Neither of the patients experienced CSF leaks or infection associated with the surgery or graft subsequent to the surgery.

**Conclusions:**
We conclude that HV-PMMA may be an excellent choice for reconstructing the anterior skull base for patients with CSF leaks. Further studies are needed to better assess the long-term outcomes of skull base reconstruction with HV-PMMA cement.

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Poster 195

## Endoscopic drainage of Anterior Clinoid Process Mucocele with Optic Nerve Compression and Vision Loss

*Naveen Bhandarkar, MD, Nathan Sautter, MD*
*Portland, OR*

**Introduction:**
We present a rare case of anterior clinoid process pneumatization and mucocele formation resulting in optic nerve compression with consequent optic neuropathy in a patient with contralateral blindness following traumatic optic neuropathy. The management of this condition is discussed.

**Methods:**
Case report and review of literature

**Results:**
A 46 year old male with history of left traumatic optic neuropathy resulting in permanent left-sided blindness presented for an annual exam. A new, asymptomatic, large right-sided superior visual field deficit was noted and the patient was sent for further workup. Radiographic imaging including CT and MRI revealed a mucocele in a pneumatized right anterior clinoid process resulting in mass effect on the right optic nerve. The patient failed to improve with medical therapy and opted for surgery. Endoscopic right sided ethmoidecto-

my and sphenoidotomy with drainage of the mucocele were performed. The patient's visual exam significantly improved post-operatively with a slight persistent superior nasal field deficit that is stable at 10 months follow-up.

**Conclusion:**
Anterior clinoid process mucocele is a rare but potentially serious condition that can result in visual loss or blindness. The extenuating circumstance of this process in an only-seeing eye, however, presented a management dilemma. Endoscopic sinus surgery with minimally invasive drainage of the mucocele was performed and resulted in significant improvement in visual field defects. Consequently, the patient was spared the morbidity of more invasive alternative approaches such as orbitotomy and/or craniotomy.

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Poster 196

## Endoscopic Management of Skull Base Defects: Salvage after Craniotomy

*Rishi Vashishta, BS, Joseph Goodman, MD, Fabio Roberti, MD, Ameet Singh, MD*
*Washington, DC*

**Objective:**
Review the endoscopic repair of persistent skull base defects and cerebrospinal fluid (CSF) leaks after craniotomy.

**Methods:**
Case series and review of the skull base literature

**Results:**
A 19-year-old male who suffered multiple skull base fractures and cerebrospinal fluid (CSF) rhinorrhea underwent repair and duraplasty via a transcranial, bicoronal approach. Two months later, he presented with CSF rhinorrhea, and a middle fossa encephalocele. The patient underwent resection of the encephalocele and successful endoscopic closure of the skull base defect with a vascularized nasoseptal flap. A 69-year-old male experienced complications of endoscopic sinus surgery, which included multiple penetrating injuries of the fovea ethmoidalis, as well as pneumocephalus and a frontal lobe hematoma. He underwent a transcranial repair of the skull base defects with split-thickness calvarial bone grafts and pericranial flap. Four weeks later, he presented with altered mental status, pneumocephalus and CSF rhinorrhea. The patient underwent

successful closure of multiple skull base defects which included the left frontoethmoidal region, right fovea ethmoidalis and left sphenoethmoidal junction. Lumbar drainage was utilized for 3-5 days in both patients, who were discharged after one week without complications. They continue to do well with a mean follow-up time of six months.

**Conclusions:**
Endoscopic repair of skull base defects and CSF rhinorrhea has been extensively discussed in the literature. Given the low morbidity and high rate of success, endoscopic techniques are the preferred approach for salvaging unsuccessful intracranial repairs.

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Poster 198

## Endoscopic Transnasal Approach for Diagnosis and Management of Orbital Pseudotumor

*Harrison Lin, MD, Frederick Jakobiec, MD, Gady Har-El, MD, Ralph Metson, MD*
*Boston, MA*

**Background:**
Orbital pseudotumor is an uncommon disease with a poorly understood pathophysiology. For this reason diagnostic and therapeutic management strategies, the majority of which have demonstrated limited success, continue to be studied and debated. Surgical excision or biopsy, an intervention which contributes to both diagnosis and therapy, has consistently been shown to provide rates of cure much higher than those of systemic therapy alternatives, including steroids, chemotherapy or radiation therapy. However, external or transconjunctival access to the posteriorly-located orbital pseudotumor can be limited and frequently involves an external skin incision and manipulation of the extraocular musculature. The aim of this study is to describe a role for endoscopic surgery in the management of posteriorly-located orbital pseudotumor.

**Methods:**
Case series and a review of the literature.

**Results:**
Four cases of orbital pseudotumor managed with the assistance of endoscopic surgery are presented. In these cases, tissue specimens obtained through the transnasal or transnasal/transmaxillary endoscopic approach provided pathological confirmation of the diag-

nosis and in some cases furthermore provided therapeutic benefit. Conclusions: We present a description of the role of endoscopic surgery in the management of orbital pseudotumor. Although our patients benefited from this surgical modality in combination with medical therapy, further research should be conducted to provide additional insight into the role of endoscopic surgery as a diagnostic and therapeutic intervention for patients with orbital pseudotumor.

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Poster 197

## Endoscopic Trans-Antral Posterior Ethmoidectomy

*Yosef Krespi, MD, Victor Kizhner, MD*
*New York, NY*

**Introduction:**
Isolated posterior ethmoid (PE) disease or recurrence may require extensive or unnecessary dissection via transnasal approach. Endoscopic trans-antral approach provides direct route avoiding the drawbacks of transnasal anterior ethmoid dissection.

**Methods:**
A prospective study treating ten patients with limited maxillary and posterior ethmoid disease was conducted. Data collected included: demographics, SNOT and Lund-Mackay scores, facial swelling and pain grading. Sinus culture and mucosal biopsy was also obtained. Post operative intranasal endoscopic findings namely crusting, bleeding, scarring and synechia were recorded. Two small sheaths inserted into the maxillary sinus via sublabial canine fossa approach. One port accommodating an endoscope and second one surgical instrumentation. PE was localized at the superior-medial dome of the maxillary sinus. The paper thin bony wall between maxillary sinus and PE can be easily identified, gently cracked and drained into the maxillary sinus. The procedure can be assisted using navigation, confirming its location.

**Results:**
Mean Lund McKay score was five. Symptoms were graded with SNOT test, showing improvement from 1.96 to 0.59 ($P<0.05$) in ten patients. Facial swelling, numbness or complications were not observed. The need for post-operative packing and extensive debridement was avoided.

**Summary:**
Via endoscopic trans-antral approach PE can be easily entered,

drained into maxillary sinus and maintain its clearance through functioning maxillary-ethmoid infundibulum. We assume that ciliary activity around the maxillary ostium can overcome the PE mucus production. Direct endoscopic visualization of the maxillary sinus and PE via canine fossa puncture, without violating the uncinate and anterior ethmoids is safe, effective, requires limited postoperative care.

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Poster 199

## High definition Digital Recording for Practical use in Endoscopic Endonasal Sinus Surgery

*Tetsuya Monden, MD, Yasuyki Hinohira, MD, Harumi Suzaki, MD*
*Tokyo, Japan*

**Introduction:**
Recently, the high-definition digital (HDD) camera for endoscopic endonasal sinus surgery (ESS) has come to be available. However, the recording system which can connect to the camera unit has not yet been prevalent because archiving the data for presentation is complicated. In this study, the HDD recording system for practical use was described, and the surgery movie with excellent quality was demonstrated using a notebook.

**Methods:**
The HDD recording system included the 3-CCD camera unit, the Xenon light source, the liquid crystal display, and the mpeg recorder. 720p HDD movies were stored into the mpeg recorder as the data files although the camera unit had a capacity for showing 1080i resolution. The data files were archived in a notebook for editing and presentation.

**Results:**
The recording was not complicated as compared with a conventional recording system. The bright and accurate visualization using the HDD system helped the ESS especially in treating the sphenoid and the frontal sinus. One hour movie file required approximately 12 GB to the hard disk. The editing software that was commercially available could easily edit the mpeg-HD file, and a notebook with dual core CPU could smoothly display the movie edited. The movie file could work on Power Point 2007 for presentation. Conclusion: The HDD recording system was useful and practical in ESS, and contributed to educate not only physicians but also operating team because of the excellent visualization.

Poster 200

## Impaired Ethmoid Mucociliary Clearance in Chronic Rhinosinusitis

*Kate Perry, BS, Joseph Goodman, MD, Ameet Singh, MD*
*Washington, DC*

**Introduction:**
Mucus recirculation within the paranasal sinuses has been well-reported since the advent of functional endoscopic sinus surgery. This has been frequently noted in association with an accessory maxillary sinus ostium, by which secretions re-enter the sinus after exiting the natural ostium. Impaired mucociliary clearance has been noted in patients with allergic rhinitis and chronic rhinosinusitis. We illustrate reorganization of mucociliary clearance in the ethmoid sinuses with resulting mucus recirculation, leading to chronic sinusitis in a patient with Churg-Strauss syndrome.

**Methods:**
Case report and literature review.

**Results:**
A 66 year-old male with Churg-Strauss syndrome and chronic rhinosinusitis, presented for management of acute rhinosinusitis. Previous medical therapy included multiple rounds of antibiotics, steroids, decongestants, and topical sprays and irrigation. Previous surgical treatment included functional endoscopic sinus surgery at an outside hospital. Nasal endoscopy revealed multifocal vasculitis, septal perforation, hyperplastic mucosa, and multiple ostia obstruction. Endoscopic visualization of the left ethmoid sinus, revealed thick mucus recirculating in real-time within a large ethmoid cell, with an inability to be transported out, despite a surgically widened ostium.

**Discussion:**
Impaired mucociliary clearance has been postulated in chronic rhinosinusitis. Mucus recirculation has been frequently studied in association with an accessory maxillary sinus ostium. In this case, real-time derangement of mucociliary clearance and mucus recirculation in the ethmoid sinus was noted in a patient with Churg-Strauss suffering from chronic rhinosinusitis. It is unclear whether this impaired mucociliary clearance was a result of scarring after sinus surgery or secondary to rhinosinusitis seen in patients with Churg-Strauss syndrome.

Poster 201

## Intracranial Mucocele: Delayed Complication of Chronic Rhinosinusitis

*Paul Schalch, MD, David Keschner, MD, Terry Shibuya, MD, Jivianne Lee, MD*
*Orange, CA*

**Objective:**
The purpose of this study is to present a series of intracranial mucoceles that developed as delayed complications of chronic rhinosinusitis.

**Study design:**
Retrospective review of 3 cases of intracranial mucoceles in patients with and without previous history of functional endoscopic sinus surgery (FESS). The study was conducted at a University-affiliated institution.

**Methods:**
Three patients, two male and one female with the ages 19, 51 and 73, presented to the rhinology/anterior skull base clinic with complaints of headaches, retro-orbital pain, blurry vision, ptosis, and/or nasal obstruction. All patients had previous history of chronic rhinosinusitis; only one of them had previously undergone FESS. Computer tomography and magnetic resonance imaging revealed the presence of an extra-axial right frontal lobe mucocele arising from the ethmoid roof in one case, a fronto-ethmoidal mucocele eroding the posterior table of the frontal sinus in another, and bilateral frontal sinus mucoceles extending into the anterior cranial fossa and the right orbit in the third.

**Results:**
All patients underwent endoscopic transnasal removal of mucoceles with repair of the anterior skull base, and in two cases, subfrontal approach to the anterior skull base. We present our intra-operative findings as well as the surgical techniques employed. All patients were followed for at least 6 months. No recurrences were observed.

**Conclusion:**
Intracranial mucoceles presenting as delayed complications of chronic rhinosinusitis are uncommon and constitute a surgical challenge. Endoscopic removal, with or without combined open approaches to the anterior skull base are effective, safe and have excellent long-term outcomes.

Poster 202

## Inverted Papilloma of the Sphenoid Sinus: Risk Factors for Disease Recurrence

*Jeffrey Suh, MD, James Palmer, MD, Alexander Chiu, MD, David Kennedy, MD*
*Philadelphia, PA*

**Introduction:**
Inverted papilloma (IP) of the sphenoid sinus can be more difficult to treat when compared to other sites in the nasal cavity and paranasal sinuses. Identifying the site of attachment and achieving complete surgical extirpation can be more challenging when compared to IP found at other sites. The purpose of this study is to illustrate the clinical presentation, management, and risk factors for disease recurrence for sinonasal IP based within the sphenoid sinus.

**Methods:**
A retrospective review of endoscopic resections of IP based within the sphenoid sinus was performed. Charts were reviewed for standard demographic data, operative technique, specific sites of IP attachment, complications, and postoperative follow up-times.

**Results:**
Twenty-three patients underwent endoscopic resection of sphenoid sinus inverted papillomas. Median follow up time was 44.2 months. Six patients suffered disease recurrences and required further endoscopic resections. Median time to recurrence was 13.1 months. IP attached to the carotid artery or optic nerve is a statistically significant risk factor for disease recurrence compared to other sites in the sphenoid sinus ($p = 0.01$). Nasal airway obstruction (39%) and headache (30%) and were the most common presenting symptoms.

**Conclusions:**
Treatment of IPs of the sphenoid sinus is associated with a higher rate of recurrence than IPs treated at other sites. Preoperative radiologic and intraoperative assessment is critical to reduce the risk of injury to the carotid artery and optic nerve. Close follow-up in the postoperative period is essential, especially for IPs based on the carotid artery and optic nerve.

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Poster 203

## Irrigation Penetration of Different Delivery Systems

*Wesley Abadie, MD, Erik Weitzel, MD*
*Lackland AFB, TX*

**Objective:**
To determine the degree of sinus penetration of several commercially available irrigation systems in maximally operated sinus cavities, in an effort to simulate the efficacy of irrigations in a postoperative patient with advanced sinus disease.

**Study Design:**
Primary lab research

**Setting:**
Tertiary care center

**Subject and Methods:**
Seven fresh cadaver heads with brains removed were maximally dissected to include a Draf III frontal sinusotomy, wide maxillary antrostomy, and complete sphenoethmoidectomy. 4mm drill-holes were placed to allow visualization of the irrigations from within the respective sinus cavity. Seven commercially available irrigation systems were then used to determine the degree of sinus penetration, and the data recorded using an ordinal scale for comparison.

**Results:**
Among the three atomized particle delivery systems tested, the squeeze atomizer took 1.15 attempts, the pump atomizer took 1.85 attempts, and the mechanized atomizer required 30 seconds of continuous application for delivery ($p = 0.009$). Penetration with four heavy irrigators showed significant variability depending on the sinus cavity being tested. The irrigator showed more consistent penetration than any other tested modality ($p < 0.01$). The other modalities tested had varying degrees of efficacy, dependent on sinus cavity irrigated.

**Conculsion:**
Delivery of irrigant to maximally operated sinus cavities is variable and highly dependent on the method used. Use of these delivery systems should be appropriately tailored for the desired effect.

Poster 204

## Nasoseptal Flap Dimensions

*Amy Anstead, MD, Stephanie Joe, MD*
*Miami, FL*

**Objective:**
To study the size limitations when harvesting a nasoseptal flap for skull base repair and to study the vascular supply of the harvested flap based on its vascular pedicle the posterior septal artery.
Methods: Seven open dissections of nasoseptal flaps from fixed cadaveric heads and 14 endoscopic nasoseptal flap dissections of fresh frozen heads were obtained for a total of 21 dissections. The maximum height, length and surface area of harvested flaps were measured. Height measurements with and without the nasal floor were also taken. The posterior septal artery was injected with methylmethacrolate or methylene blue to see the extent of the vascular supply.

**Results:**
The average surface area without nasal floor was 22cm2 compared to 26cm2 when including the nasal floor. The average additional surface area obtained by adding the nasal floor was 6.4cm2 in the open dissection and 3.4cm2 in the endoscopic dissections. Average length was significantly different between males (8cm) and females (7.1cm). Length of the flap was not significantly increased with open dissection, however height of the flap was greater in open dissection. Posterior septal artery injection showed the the floor was not significantly supplied.

**Conclusions:**
When comparing average measurements of our dissected specimens with published radiological studies of hypothetical single area skull base defects the nasoseptal flap is sufficient in size to cover the defect.

Poster 205

## Novel Characterization of B Cell Subsets in Chronic Rhinosinusitis with Nasal Polyps (CRSwNP)

*Annalisa Overstreet, MD, James Hadley, MD, Inaki Sanz, MD*

**Introduction:**
The focus on the role of B cells in CRSwNP has classically been limited to antibody production. However, the ability of B cells to contribute important antibody-independent functions, such as cytokine and chemokine production, in other chronic inflammatory disease processes has been well documented. Investigation into these effector functions involves characterizing memory B cell subsets.

**Methods:**
Nasal polyps were analyzed from patients after endoscopic sinus surgery. Peripheral blood was also collected for comparison. Lymphocytes were isolated from both polyps and peripheral blood and analyzed by flow cytometry for cell surface markers CD3 (T cell exclusion marker), CD19, CD27, CD38 and IgD.

**Results:**
Distinct populations of B cell subsets were identified in nasal polyps, including CD27+ and CD27- switched memory, unswitched memory (CD27+/IgD+), and naïve (CD27-/IgD+). A significantly higher percentage of CD27+ and CD27- switched memory cells and a significantly lower percentage of naïve B cells were found in polyps relative to blood.

**Conclusions:**
This study is the first of its kind to identify distinct subsets of memory B cells in nasal polyps. The skewed representation of B cell subsets in nasal polyps relative to peripheral blood suggests a localized expansion of, or selection for, distinct subsets. Characterization of these subsets is the first step in uncovering the potential antibody-independent role of B cells in nasal polyposis. This has promise in improving comprehension of the immunologic mechanisms involved in the pathophysiology of CRSwNP. Ongoing experiments aim to elucidate the pattern of B cell cytokine secretion in nasal polyps.

Poster 206

## Olfactory Dysfuntion in Cystic Fibrosis

*Andrew Thamboo, MD, Amin Javer, MD,*
*Vancouver, BC*

**Background:**
Cystic Fibrosis (CF) is an unfortunate hereditary disease which majority of them require sustained medical therapy for chronic rhinosinusitis (CRS) following endoscopic sinus surgery. Quality of life is improved for CF patients following endoscopic; however, they appear to complain of their olfactory dysfunction. This persistent complaint is perceived as a significant detriment to their quality of life.

**Objective:**
This study aims to correlate subjective reporting of olfactory function with endoscopic staging and performance on the Sniffin' Sticks test in patients with CF patients.

**Methods:**
10 patients with CF seen in a tertiary rhinology clinic were recruited to undergo olfactory testing following routine endoscopic follow up. Patients were included if they genetically diagnosed with CF and had undergone bilateral functional endoscopic sinus surgery. The Sniffin' Sticks test was used to derive their TDI score and a visual analogue score was used for their perceived olfactory ability. Patients were also asked to complete a short form 36 questionnaire for quality of life scores. An endoscopic staging score was given for each patient.

**Results:**
The 10 patients with CF underwent olfactory testing. The mean TDI score was 17 showing a poor level of function in this group. There was a significant correlation between patients' performance on the Sniffin' Sticks and endoscopic staging and with their reported olfactory ability.

**Conclusion:**
All patients with significant CF disease should receive evaluation with olfactory testing and be treated on their merit in order to lessen the impact on their quality of life.

Poster 207

## Outcomes after Dacryocystorhinostomy in Patients with Nasolacrimal Duct Obstruction Secondary to Sarcoidosis

*Justin Wudel, MD, Todd Kingdom, MD, Vikram Durairaj, MD*
*Aurora, CO*

**Introduction:**
The purpose of this study was to evaluate outcomes of both endoscopic and external dacryocystorhinostomy for the management of acquired nasolacrimal duct obstruction secondary to sarcoidosis. Methods: A retrospective review was performed of patients undergoing both endoscopic and external DCR from June 2002 to August 2009 at a tertiary referral medical center. Seven procedures were performed on four patients with epiphora secondary to acquired nasolacrimal duct obstruction due to sarcoidosis. All patients had mitomycin-c in a concentration of 0.2 mg/mL applied to the osteotomy site for 3 minutes. Main outcome measures were subjective improvement in epiphora and assessment of anatomic patency based on lacrimal irrigation.

**Results:**
Mean follow up was 15 months. Complete resolution of epiphora was noted in 86% (6/7) of procedures. Two patients (3 procedures) were available for lacrimal irrigation at a mean of 15 months follow-up. Of these two patients (3 procedures), anatomic patency was confirmed in 100%.

**Conclusions:**
Our results suggest that endoscopic and external DCR are viable treatment options for patients with nasolacrimal duct obstruction secondary to sarcoidosis. The application of mitomycin-c to the osteotomy site in this patient population may serve to improve the long term patency of the nasolacrimal duct.

Poster 208

## Outpatient Management of Rhinosinusitis Prior to Endoscopic Sinus Surgery

*Claire Mansell, MD, Elizabeth Ingall, MD, Andrew Casrwell, Claire Langton-Hewer, MD*

**Aim:**
Rhinosinusitis is a significant and increasing health problem which results in a large financial burden on society. In 2007 an evidence based position paper was published which describes what is known about rhinosinusitis and nasal polyps and offers evidence based recommendations on diagnosis and treatment. This audit aims to evaluate adherence with the European Position Paper on Rhinosinusitis and Nasal polyps. (EPOS)

**Method:**
Retrospective case-note review of patients undergoing endoscopic sinus surgery. The inclusion criteria was adult patients undergoing sinus surgery at St Michael's hospital between February and August 2009. The exclusion criteria was adult patients operated on with complicated acute rhinosinusitis. Results: A total of 25 of case notes were reviewed. All of those evaluated underwent endoscopy, the vast majority underwent pre operative imaging in the form of CT sinuses. 56% had nasal douching. Majority of patients 88% had topical steroids. 48% of patients had oral antibiotics. 48% of patients with chronic sinusitis with nasal polyps had oral steroids. Only 8% of patients had symptom scoring and 16% had allergy testing carried out.

**Conclusion:**
This initial stage of the audit cycle suggests overall poor adherence to symptom scoring. This has implications for their management, as management is predicated by symptom scoring. We have proposed to introduce routine symptom scoring and make guidelines available in the clinic area. We aim to re audit once this intervention has taken effect.

Poster 209

## Practical Reduction of the Bulky Inferior Turbinate

*Andrew Lerrick, MD, Alexis Mandli, PA-C*
*Chicago, IL*

**Introduction:**
Inferior turbinate bones vary in size and shape. Most turbinates are pedunculated and easily permit partial resection using either a "submucosal" or "en-bloc" technique. One anatomic variant is the "bulky" turbinate, which, due to developmental, traumatic, or disease conditions, becomes hypertrophic from base to apex. In this instance, turbinate reduction utilizing a combination of both techniques is effective.

**Background:**
The normal inferior turbinate is pedunculated, having a bulbous medial aspect, a narrow neck, and a slightly widened base, which anchors it to the lateral nasal wall. Turbinates with this profile easily permit medialization and lateralization maneuvers. The "bulky" inferior turbinate is diffusely hypertrophic, having a rounded medial contour, thick neck, and broad base. This structure is far less amenable to manipulation and requires significant bone reduction to change its contour.

**Methods:**
"Submucosal resection" is more difficult to perform on the "bulky" turbinate. More flap elevation is necessary, soft-tissue bleeding is increased, and the flaps are more apt to tear. Extensive bone debridement causes further bleeding, necessitating additional cautery. With "en-bloc" resection, after medialization a straight clamp is applied along the length of the inferior turbinate to demarcate the desired amount of bone and soft-tissue to be removed. The pedunculated turbinate is amenable to these maneuvers, whereas the "bulky" turbinate is not. Crimping and cutting the bone, debriding bone fragments, and achieving hemostasis is more difficult with the "bulky" turbinate. Thermal damage is greater and more bone is exposed to intra-nasal pathogens. Our method combines a modified version of both techniques. Without requiring in-fracturing, a narrow clamp is insinuated on each side of the anterior aspect of the turbinate. Following compression and release, bipolar cautery is applied, the bone is cut, and the clamp re-positioned further posteriorly. The steps are repeated until the medial segment has been removed. Submucosal flaps are then elevated from the open medial aspect, the bone debrided to achieve the necessary reduction, and the flaps re-positioned and thermally sealed to the underlying turbinate remnant to avoid bone exposure.

**Conclusion:**
Using the combined techniques of “en-bloc” and “submucosal” resection effective reduction of “bulky” inferior turbinate bones can be achieved while minimizing progressive post-operative bone loss.

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Poster 210

## Radiographic correlation of anterior ethmoidal artery to endoscopic surgical landmarks

*Francisco Pernas, MD, Andrew Coughlin, MD, Roy Riascos, MD, Patricia Maeso, MD*
*Galveston, TX*

**Objective:**
To adequately describe and correlate the anterior ethmoidal artery (AEA) radiographically to useful endoscopic surgical landmarks commonly encountered during endoscopic sinus surgery (ESS). Methods: A retrospective review and software analysis by 3 independent observers of 200 CT scans performed at a university tertiary center obtained with a 64-row CT GE scanner.

**Results:**
We measured the average distances from three common endoscopic surgical landmarks: takeoff of the middle turbinate (MT) from skull base (referred to as axilla of the MT), nasal beak and nasal crest to the AEA. The mean distance from the axilla of the MT to the AEA was 2.23 cm at an angle of 42°. The mean distance from the nasal beak to the AEA was 3.83 cm at an angle of 31.6°. The average distance from the nasal crest to the AEA was determined to be 5.285 cm at an angle of 50.5°. The landmark with the most reliability and less variability was determined to be the axilla of the MT. The least reliable of the landmarks was the nasal beak secondary to variations in angulation.

**Conclusion:**
To avoid the complications that can develop from inadvertent injury to the AEA during ESS we have set out to determine landmarks that can be used to properly identify and avoid the AEA. The present study has shown that the axilla of the MT serves as the most reliable and consistent radiographic landmark that is at an average distance of 2.23 cm and at an angulation of 42°.

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Poster 211

## Retrieval of projectile foreign bodies from the paranasal sinuses and skull base: Indications and Considerations

*Bharat Yarlagadda, MD, Michael Platt, MD*
*Boston, MA*

**Introduction:**
Penetrating trauma to the paranasal sinuses and skull base presents unique challenges for head and neck surgeons. Associated injuries and the proximity to vital neurovascular structures can complicate the management of retained projectile foreign bodies in these patients.

**Methods:**
We report a series of 6 patients who suffered penetrating trauma to the head with retained metallic foreign bodies in the paranasal sinuses and skull base. The clinical presentation, medical management, indications, timing, and surgical approach for foreign body removal are discussed.

**Results:**
All patients underwent endoscopic or open removal of foreign bodies which were accessible without compromise to adjacent structures. In one patient with multiple retained projectiles, select fragments were not removed due to the morbidity of such intervention. A subgroup of patients experienced CSF leakage that required additional treatment.

**Conclusions:**
While not all foreign bodies need to be removed, retrieval of select projectile foreign bodies in the sinuses and skull base can be performed safely. The risks for removal must be weighed with the possibility of associated complications seen with retained foreign bodies, such as meningitis or aspiration. The timing of removal, surgical approach, and management of CSF leak are dictated by the clinical scenario and associated injuries.

Poster 212

## Rhinologic Applications of Radiofrequency Coblation

*Seth Isaacs, MD, Amber Luong MD, Samer Fakhri, MD, Martin J. Citardi, MD*
*Houston, TX*

**Introduction:**
Coblation technology applies radiofrequency energy through a conductive solution to create a plasma discharge that causes molecular dissociation and tissue disintegration upon contact. Because of its relatively low temperature (40o-70o C) and its hemostatic action, coblation has attracted interest from rhinologic surgeons.

**Methods:**
Retrospective review of rhinologic procedures involving the coblator and performed at a tertiary rhinology practice between January 1, 2007 and September 30, 2009.

**Results:**
Indications for coblation included chronic rhinosinusitis with nasal polyps (20 patients), encephalocele (4 patients), hereditary hemorrhagic telangiectasia (2 patients), benign neoplasm (7 patients) and malignant neoplasm (4 patients). The PROciseXP and PROciseEZ wands were used at a primary setting of 7 and 3. Coblation was recognized to have a unique interaction with tissue, and thus, standard techniques required modification for optimal use of this technology. In each case, the senior surgeon noted that coblation achieved its surgical objective. It permitted a precise resection of the lesion, provided adequate hemostasis, and improved endoscopic visualization. The ergonomics, shape, and malleability of the instrument allowed it to access regions of the skull base beyond the reach of standard electrosurgical devices. An important limitation of the instrument was the conduction of energy to surrounding tissue, however no long term sequelae were noted.

**Conclusion:**
Coblation technology's unique properties have specific applications during rhinologic procedures. This technology may precisely remove tissue, and provide hemostasis with low risk to adjacent structures. Optimal use requires small modifications of standard techniques.

Poster 213

## Septal Dislocation for Endoscopic Access of the Anterolateral Maxillary Sinus and Infratemporal Fossa

*Vijay Ramakrishnan, MD, Jeffrey Suh, MD, Alexander Chiu, MD, James Palmer, MD*
*Philadelphia, PA*

**Introduction:**
Transnasal approaches to the anterolateral maxillary sinus and infratemporal fossa are potentially limited with traditional endoscopic techniques and instrumentation. Additional angulation in the anterior and lateral direction can be obtained with modified or total endoscopic medial maxillectomy (MEMM, TEMM). In more extreme circumstances, a transseptal approach has been advocated for the introduction of the endoscope or instruments from the opposite side at a more favorable angle. As an alternative, we have utilized a septoplasty technique with septal dislocation to allow for a similar angle of approach. The aim of this study is to determine the utility of septal dislocation for anterolateral reach.

**Method:**
Cadaver dissection was performed on 8 sides. MEMM, TEMM, and septal dislocation were sequentially performed according to standard techniques. Image-guided axial photographs were used to identify the extent of anterolateral reach in each stage by measuring the angle of access from the midline.

**Results:**
TEMM adds twelve degrees of anterolateral reach when compared to MEMM. With septal dislocation, an average of twenty additional degrees is provided over TEMM. These findings were statistically significant. The anterior maxillary sinus is routinely reached with straight instruments after septal dislocation. The limiting factors appear to be individual variation in the concave nature of the anterior wall of the sinus and protrusion of the opposite piriform aperture.

**Conclusions:**
Endoscopic surgery of the anterolateral maxillary sinus and infratemporal fossa are commonly limited by visualization and instrument design. Septal dislocation allows for additional visualization and access for commonly used instruments in these areas.

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Poster 214

## Sinonasal and Nasopharyngeal applications of Hand -Held CO2 LASER fiber

*Garima Agarwal, MD, Michael Kupferman, MD, Ehab Hanna, MD*
*Houston, TX*

**Background:**
CO2 LASER, in sinonasal surgery, offers advantages of excellent hemostasis and healing with minimal discomfort and complications. The application of CO2 LASER has been limited in the sinonasal region due to difficulty in delivering LASER energy to deep, narrow and confined sinonasal space. The availability of flexible fibers and custom designed hand pieces for the delivery of CO2 LASER energy now ensures access to difficult to reach areas of sinonasal cavity. We report our experience with flexible fiber CO2 LASER and describe its various applications in sinonasal and nasopharyngeal surgery. Methods: We did a retrospective chart review of patients who underwent surgery of sinonasal lesions with hand-held CO2 LASER fiber at MD Anderson Cancer center between 2007 and 2009.

**Results:**
12 patients met our inclusion criteria. 3 patients had post radiotherapy adhesionolysis, 2 patients had recurrent mucoepidermoid carcinoma and 1 patient each had ganglioneuroblastoma of nasopharynx , recurrent spindle cell melanoma of nasopharynx, juvenile nasopharyngeal angiofibroma, papilloma of nasal cavity, pituitary adenoma , spindle cell lipoma of nasopharynx and intranasal Rosai Dorfman disease. CO2 LASER fiber was used in these 12 patients to assist in excising the disease along with conventional endoscopic techniques & instruments.

**Conclusion:**
In sinonasal and nasopharyngeal regions, use of CO2 LASER fiber provides precision and excellent hemostasis; and minimizes tissue manipulation and the risks to underlying structures. It can be an important tool in the armamentarium of rhinologists and skull base surgeons, especially for revision and post radiotherapy cases with distorted anatomy.

Poster 215

## Sinonasal epithelial cells in cystic fibrosis have increased toll-like receptor-9 expression

*Sandra Lin, MD, Thuy-Ahn Melvin, MD, Andrew Lane, MD, Mai-Tien Nguyen,MD*
*Baltimore, MD*

**Objective:**
To compare expression of TLR-9, a marker associated with antimicrobial innate immune activity, in sinonasal epithelial cells derived from cystic fibrosis subjects versus normal controls.

**Methods:**
Prospectively collected data from the Johns Hopkins Otolaryngology-Head and Neck Surgery outpatient clinic. Flow cytometry was performed on freshly collected sinonasal epithelial cells via endoscopically-guided middle meatal brushings from nineteen adult subjects. Subjects were divided into normal (N=7) and cystic fibrosis (N=12) groups. The presence of cystic fibrosis was confirmed by prior genetic testing. Inclusion criteria for normal subjects included negative history of cystic fibrosis, negative inhalant allergen skin testing, and absence of clinical history of sinusitis.

**Results:**
There was a significant ($p<0.001$, Mann-Whitney U test) difference between the two study groups. TLR9 was found to be expressed in 74% ± 8% of normal sinonasal epithelial cells, and in 91% ± 6% of cystic fibrosis sinonasal epithelial cells. All cystic fibrosis subjects had evidence of chronic mucosal thickening on CT scan as well as prior endoscopic sinus surgery.

**Conclusions:**
The significantly greater expression of TLR9 in cystic fibrosis sinonasal epithelial cells may reflect an active antimicrobial innate immune response in chronically colonized and frequently infected cystic fibrosis individuals. This finding contrasts with previously reported decreased epithelial TLR9 expression in eosinophilic chronic rhinosinusitis, and may indicate differential modulation of innate immunity in Th1 vs Th2-dominated chronic sinonasal inflammatory diseases.

Poster 216

## Spontaneous CSF Rhinorrhea from a Clival Defect: A Case Report and Literature Review

*Benjamin Johnston, MD, Celeste Gary, BSc, Sanjay Athavale, MD, Paul Russell III, MD*
*Nashville, TN*

**Introduction:**
Less than five percent of cases of CSF rhinorrhea are spontaneous. The majority of spontaneous leaks involve dehiscences in the region of the fovea ethmoidalis and cribriform plate. Clival defects resulting in spontaneous CSF rhinorrhea are exceedingly rare and are sparsely found in the literature, especially in the rhinologic literature. Methods: Case report and literature review.

**Results:**
Our case involves an 81 year old female who developed meningitis via a spontaneous CSF fistula of the clivus. She was subsequently taken to the operating room for a septoplasty, endoscopic sphenoid sinusotomy, and repair of the clival defect. The defect was closed using abdominal fat and portions of her resected bony septum. A review of the literature showed that since 1980 there have been a total of nine publications documenting a spontaneous CSF leak via a clival defect. The patient population includes a 3:5 male to female ratio with the age range being 36-63 years old. The most common presenting symptom was CSF rhinorrhea. There was a variability amongst the imaging used to diagnose the defect with seven of the eight patients being diagnosed via computed tomography. All patients were repaired endoscopically with the majority receiving autologous grafts and fibrin glue. The etiology of spontaneous clival defects continues to be debated in the literature and there is by no means a general concensus on the pathophysiology.

**Conclusions:**
Spontaneous CSF rhinorrhea via a clival defect is an exceedingly rare finding in a highly varied patient population, and is almost exclusively repaired endoscopically.

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Poster 217

## Tension Pneumocephalus Without CSF Leak After Endoscopic Sinus Surgery for Extensive Sinonasal Polyposis

*Paul Frake, MD, Kate Perry, null, Joseph Goodman, MD, Ameet Singh, MD*
*Washington, DC*

**Introduction:**
Tension pneumocephalus is a rare but serious complication of endoscopic sinus surgery (ESS). It is characterized by air trapping within the cranial cavity and subsequent displacement of the brain. Patients may present with a combination of neurologic findings including muscle weakness, ataxia, paresthesia, cranial nerve palsies and cereberospinal fluid (CSF) rhinorrhea.

**Methods:**
Case report and literature review.

**Results:**
A 63 year old male presented with an acute onset of ataxia, unilateral distal muscle weakness, and lethargy without CSF leak, one day after ESS for sinonasal polyposis. Imaging studies demonstrated extensive pneumocephalus with mass effect in the presence of anterior skull base erosion. The patient was taken to the operating room for endoscopic skull base exploration for a presumed defect and repair of CSF leak. No CSF leak was identified despite skull base erosion. Significant residual frontoethmoid polyps were removed and the anterior skull base was reinforced with onlay grafting and tissue sealants. The tension pneumocephalus resolved rapidly and the patient's neurological status normalized.

**Conclusion:**
Tension pneumocephalus is a serious complication after endoscopic sinus surgery. Incomplete resection of sinonasal polyps created a “ball-valve” effect over a microscopic bony defect leading to intracranial air trapping. This effect resulted in a slowly evolving neurological injury without a CSF leak. Understanding the pathogenesis and treatment options of tension pneumocephalus is critical for surgeons who perform endoscopic sinus surgery.

Poster 218

## The Effect of Low Dose Rrepetitive Allergen Challenge on Nasal Responsiveness: Priming or Tolerance?

*Nara Orban, MRCS, Stephen Durham, Andrew Menzies-Gow, MD, Hesham Saleh, MD, FRCS*
*London*

**Introduction:**
Allergic rhinitis is a common and troublesome disease, often accompanied by comorbid conditions. We designed and executed a novel repetitive low -dose allergen challenge (RAC) model to faithfully replicate natural seasonal exposure.

**Methods:**
Ten seasonal allergic rhinitis sufferers were recruited out of season. Participants had 7 visits for the diluent phase and 7 visits for the allergen challenge phase of the study. For each phase, 5 visits were for the challenge and 2 were for nasal biopsy. Biopsies took place after the first and the last challenge in both phases. We used participant questionnaires during both phases to monitor the severity of nasal symptoms.

**Results:**
Early Phase Reactions (0-1 hr) and Late Phase Reactions (1-24 hr) were monitored and area under the curve (AUC) analysed (Wilcoxon signed rank test). EPR demonstrates evidence of priming between first and 5th day post challenge. LPR show such priming between the first and last, 10th day of RAC protocol. We monitored safety of our RAC protocol by assessing for pain during and 24 hours post procedure, the worst day during the recovery period and how long it took for participants to return to normal (Wilcoxon signed rank). There was no statistically significant difference in the amount of pain recorded post procedure either during or 24 hours post biopsy visits. Similarly, there was no evidence of longer recovery periods as the study progressed.

**Conclusion:**
Two week low dose repetitive allergen challenge results in priming. Furthermore this RAC model is safe, effective and well tolerated.

Poster 219

## The Frontal Inter-Sinus Takedown Procedure: Re-Visiting a Technique for Surgically Refractory Unilateral Frontal Sinus Disease

*Douglas Reh, MD, William Bolger, MD, Thuy Melvin, MD, Andrew Lane, MD*
*Baltimore, MD*

**Background:**
Unilateral frontal sinus obstruction presents a surgical challenge when outflow tract osteoneogenesis or dense scarring is present. Frontal sinus obliteration is often employed as a last resort, but this procedure has potential long-term complications. In some cases, endoscopic modified Lothrop or unilateral drill-out procedures may be effective options, however re-stenosis rates are often high. Here we report our experience using frontal intersinus septum takedown (ISST) to address unilateral obstruction while preserving the opposite frontal outflow tract.

**Methods:**
A retrospective review was performed of 13 patients with unilateral frontal sinus opacification due to irreversible frontal recess obstruction who underwent ISST. Surgical outcomes were assessed based on symptoms and CT resolution of frontal sinus disease.

**Results:**
Ten patients presented with osteoneogenesis or stenosis of the frontal recess after endoscopic sinus surgery. One patient had facial trauma, 1 had previous craniofacial reconstruction, and 1 had a fibro-osseous orbital lesion causing obstruction or obliteration of the frontal recess. Headache was the most common presenting symptom. Eleven ISST procedures were performed via trephination and 2 were achieved endoscopically. All of the patients had significant improvement in their symptoms while a majority had resolution of radiographic frontal sinus disease.

**Conclusion:**
In patients with one obstructed frontal sinus and a functional contralateral sinus, removal of the intersinus septum allows for adequate sinus drainage and significant clinical improvement. The success of frontal ISST may be surprising given knowledge of mucociliary clearance patterns, but may be effective because of the naturally dependent position of the frontal sinus ostium.

Poster 220

## The Impact of the Nasal Septal Body on Airflow: Analysis using Computational Fluid Dynamics

*Thomas Lee, MD, Parul Goyal, MD, Jianbo Jiang, MD, Yuehao Luo, MD, Kai Shao, PhD*
*Syracuse, NY*

**Introduction:**
The nasal septal body (SB) is a soft tissue mound located along the anterior nasal septum in close proximity to the internal nasal valve. A prominent SB can contribute to nasal obstruction by causing significant narrowing of the nasal valve region. The goal of this study was to investigate the impact of the septal body on nasal airflow by using computation fluid dynamics (CFD).

**Methods:**
A maxillofacial CT with evidence of significant SB hypertrophy without septal deviation was selected for this study. The SB was 30.6 mm x 12.5 mm x 18.1 mm in size. Amira software was used to perform virtual resection of the septal body. The SB was reduced by 3.1 mm on the right and 3.4 mm on the left. Using Fluent software, CFD analysis was performed to determine airflow and regional velocity using parameters to simulate restful breathing.

**Results:**
Before CT manipulation, the predominant airflow was located between the superior aspect of the inferior turbinates and the SB bilaterally. Before the SB manipulation, the flow rates were 63.3 and 57.8 (ml/s) on the right and left sides, respectively. The flow rates after CT manipulation were 71 and 62.7 (ml/s) on the right and left sides, respectively. Overall, the flow rates increased by 12.1% on the right and 8.5% on the left.

**Conclusion:**
This CFD analysis reveals that simulated SB resection can lead to significant changes in nasal airflow. Based on these results, SB reduction may play a role in the treatment of nasal obstruction.

Poster 221 ***(Poster moved to slot 142B)***

## The Role of Oral Erosive Lichen Planus in the Genesis of Squamous Cell Carcinoma

*Terah Allis, MD, William Lydiatt, MD*
*Omaha, NE*

**Background:**
Oral Lichen Planus (OLP) is considered a premalignant lesion for squamous cell carcinoma (SCC) by much of the medical and dental community today. OLP affects 0.02-1% population worldwide primarily age 30-60 years old, females greater than males 2:1.2. OLP most commonly involves the buccal mucosa then in descending frequency the gingiva, tongue, palate, vermillion border, and floor of mouth. Six forms of oral lichen planus exist; atrophic, reticular, bulla, erosive, plaque, and papular. The erosive form characterized clinically by erosion and ulceration, keratotic striae, and erythema with supportive histology comprised of focal hyperparakeratosis, irregular acanthosis, eosinophilic amorphous band at the basement membrane, superficial bandlike infiltrate of lymphocytes, basal cell liquefaction, and the presence of Civatte bodies. The etiology of OLP remains unknown although inflammatory and immune-mediated factors contribute to the disease. Premalignant transformation is established in the literature dating back to 1910. Case series and retrospective studies since generally agree that the erosive form has the highest likelihood of malignant transformation. However, the role erosive lichen planus (ELP) plays in the development of invasive SCC remains controversial. ELP is not given the same consideration as other lesions such as leukoplakia in regards to patient follow up, early biopsy, excision and surveillance. Certainly, ELP's progression to advanced oral cavity cancer remains fairly ambiguous today.

**Methods:**
Retrospective, medical records case series. We report five cases of previously documented ELP in patients who presented to our institution with clinically advanced stage oral cavity SCC arising in a bed of ELP. Records were reviewed for a clinical or pathological diagnosis of ELP. Inclusion criteria consisted of a confirmed diagnosis of oral ELP and biopsy-proven SCC. Surgical pathology reports were obtained and reviewed for confirmation of pathological stage utilizing the accepted TMN staging system (AJCC 6th edition) for Head and Neck Cancer specific to the oral cavity. Reports were reviewed for a concurrent diagnosis of ELP found at the time of surgical resection for these patients oral cavity cancer. Results: For the five patients all data collected was formatted into a table including patient variables such as age, sex, tumor location, length of ELP

lesion until confirmed malignant transformation, fungal association, tobacco and alcohol use, clinical and pathological TMN staging, and recurrence. Histology and/or pathology reports confirmed ELP and SCC in the same specimens at the time of surgical cancer resection. The lesion's time to malignant progression was greater than one year's duration for all five patients and 3/5 patients had fungal infections confounding their clinical picture. 4/5 patients had stage IV disease and 3/5 patients had recurrence.

**Conclusion:**
ELP is intimately involved with SCC in a select patient population. ELP-SCC lesions are associated with advanced TMN stage cancers and recurrence after treatment. The importance of early diagnosis, biopsy, and careful examination and monitoring of ELP lesions is paramount to avoid malignant transformation.

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Poster 222

## The Tyrosine Kinase c-Abl Regulates CD4+ T-Cell Differentiation by Catalyzing T-bet Phosphorylation

*Kevin Lollar, MD, Deyu Fang, PhD*
*Columbia, MO*

**Introduction:**
Differentiation of CD4+ T cells into Th1 and Th2 is a critical process during the immune response. Th2 effecter cells produce Il-4, 5, 13 and are responsible for promoting allergic reactions to environmental antigens. The tyrosine kinase c-Abl is required for the full activation of T cells. T-bet is a nuclear transcription factor that is induced in developing Th1 but not Th2 cells. The c-Abl protein, a tyrosine kinase, is a known regulator of the immune system. This study seeks to examine if c-Abl regulates T cell differentiation by phosphorylating the Th1 lineage specific transcription factor, T-bet, and thus playing a major role in the T-cell differentiation signaling pathway. Methods: Jurkat T cells were transfected with pRL-TK (control) and IFN−ã or IL-4-luciferase plasmids, along with various expression plasmids (c-Abl, c-Abl mutants, T-bet and T-bet mutants) using the Lipofectamine transfection reagent. Transfected cells were lysed, and the luciferase activities in the cell lysates were analyzed using a Dual Luciferase Reporter assay kit.

**Results:**
Expression of c-Abl significantly enhanced IFN-ã-luciferase activity and mildly suppressed IL-4-lucferase activity. c-Abl catalyzes T-bet tyrosine phosphorylation.

**Conclusions:**
T cell stimulation causes nuclear translocation of c-Abl where it phosphorylates the Th1-lineage specific transcription factor, T-bet. T-bet then binds to the IFN-ã promotor region leading to TH1 differentiation. Therefore loss of c-Abl function results in reduced Th1 and elevated Th2 differentation. Th2 cells play an integral role in the allergic response and thus this pathway may play a crucial role in the pathophysiology of allergic disease.

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Poster 223

## Transnasal Endoscopic Repair of a Frontal Sinus Fracture

*Amir Ajar, MD, Gary Landrigan, MD*
*Burlington, VT*

The frontal sinus is estimated to account for approximately 5-15% of all maxillofacial fractures. Generally accepted decision algorithms for proceeding with surgical repair have been well established. More recently, trends toward conservative management, as well as the adoption of minimally invasive techniques of fracture reduction, are becoming increasingly prevalent in the literature. To our knowledge, we present only the second ever reported case of endonasal frontal sinus fracture repair. A 25 year old male presented after sustaining a softball injury to the midface. Fine cut reformatted CT scans revealed a depressed and comminuted medial anterior table frontal sinus fracture. Suggestion of frontal recess involvement was difficult to ascertain secondary to soft tissue edema and obstructing loose bony fragments. The patient underwent bilateral image-guided anterior ethmoidetomy and frontal sinusotomy. Endonasal reduction of the anterior table fracture was accomplished using standard blunt sinus instrumentation and digital external counterpressure. The frontal recess was assured to be widely patent and the repair was reduced without plating, with internal merocel packing serving as splints. Packing was removed at 10 days and serial outpatient endoscopic cleanouts and examination were performed. The patient remains symptom free with excellent cosmesis at 12 months follow up without evidence of sinusitis or mucocele. As understanding of frontal sinus fracture treatment evolves toward conservative management and minimally invasive operative techniques, we present

our experience successfully managing a depressed, comminuted anterior table fracture. Endonasal fracture repair using standard endoscopic blunt instrumentation is a safe alternative in appropriately selected cases.

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Poster 224

## Transnasal Endoscopic Repair of Cerebrospinal Fluid Leaks: An Undated Meta-Analysis and Literature Review

*Nithin Adappa, MD, Madeleine Schaberg, MD, Satish Govindaraj, MD*
*New York, NY*

**Introduction:**
2000, Hegazy et al. reported a meta-analysis of repair of endoscopic transnasal cerebrospinal fluid (CSF) fistula. Since this time, endoscopic repair of CSF fistula has become increasingly common with high success rate and with minimal complications. The purpose of our study was to perform an updated meta-analysis adding the last 9 years of experience in CSF leak repair, and to identify any new trends in repair that may present changes in outcomes and management.

**Methods:**
All published studies encompassing the period from 2000 to 2009 and addressing the surgical repair of CSF fistulae using a transnasal, endoscopic approach were identified using a MEDLINE search. These studies were then analyzed for a number of different data points include etiology of fistulae, method of repair, failure rates, and intrathecal fluorescein use.

**Results:**
Eleven articles comprising 669 fistulae met the inclusion criteria. The successful endoscopic repair rate on first attempt was 90%, which increased to 97% on the second attempt. Statistical analysis did not demonstrate any significant differences in the success rate of different techniques or the success rate based on etiology of leak. Intrathecal fluorescein was used to identify CSF leaks in 193 patients with one minor complication demonstrated.

**Conclusion:**
Endoscopic CSF fistula closure continues to evolve as a successful technique for repair. With the increasing number of reported cases, we demonstrate that there are no statistical differences in success rate based on etiology of leak. Additionally, low-dose intrathecal fluorescein appears to be a safe method of fistula localization.

Poster 225

## Trends in Common Rhinologic Illnesses: Analysis of U.S. Healthcare Surveys

*Charles Woodard, MD, Jose Mattos, BS, Spencer Payne, MD*
*Charlottesville, VA*

**Objective:**
To study changes in clinic visits for common rhinologic diagnoses. Introduction: Up to date information on recent changes in rhinologic disease prevalence is sparse. Current studies may quote data that is over a decade outdated and inaccurate.

**Methods:**
Survey data from the National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHMACS) were examined from 1995-2006 for common rhinologic illnesses by ICD-9 code. A data mining program was designed using SAS statistical software. Variables analyzed included: age, sex, and race.

**Results:**
An increasing trend was observed for acute sinusitis, chronic sinusitis, and allergic rhinitis. A bimodal distribution in the age of occurrence of allergic rhinitis was also seen. These data were statistically significant ($p < 0.0125$).

**Conclusions:**
Several interesting trends have occurred among common rhinologic diagnoses. The increase in sinusitis and associated allergic rhinitis may provide validation for the Hygiene Theory.

Poster 226

## Turbinate Reduction Utilizing Acoustic Rhinometry

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**Introduction:**
Turbinate size can vary as a result of physiologic effects and disease. Acoustic rhinometry measures nasal airway dimensions, providing a topographic display of the septal-turbinate relationship. A better understanding of intra-nasal anatomy, prior to surgical intervention, assists the surgeon in performing turbinate reduction with greater accuracy.

**Methods:**
Acoustic rhinometry provides quantitative measurements by emitting wide-band noise and digitally analyzing the incident and reflected waves. Pre-operative intra-nasal dimensions are optimally obtained in the pre-medicated, congested, and decongested states to determine the baseline, soft tissue, and bony contributions to nasal airway obstruction, respectively. Allergic and non-allergic stimuli can be inhaled to trigger nasal congestion. Injection of a vasoconstrictive agent determines the maximal potential pre-operative nasal airway, which is limited by the presence of bony barriers. Comparison can be made between the three physiologic conditions and standardized norms of intra-nasal anatomy. Ideally, the septum is midline and does not contribute to nasal obstruction. Turbinate-to-turbinate cross-sectional measurements can account for septal deflections.

**Results:**
Possessing knowledge of the contribution made by each turbinate to nasal obstruction, selective removal of soft-tissue and boney resection of hypertrophic turbinates can be achieved. Intra-operative rhinometric measurements can be obtained to calculate the extent of turbinate reduction to achieve the desired result. Optimally, equal distances are established between the septum and the inferior and middle turbinates at the respective level of each.

**Conclusion:**
Acoustic rhinometry provides data to gauge the degree to which turbinate reduction is necessary to establish an adequate, symmetric nasal airway.

Poster 227

## Unsuccessful Balloon Sinuplasty for Frontal Recurrent Sinus Barotrauma

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**Objective:**
1) Describe the surgical and medical options regarding the management of recurrent sinus barotrauma (RSB). 2) Present previously unreported complications associated with balloon sinuplasty in the surgical management of patients with RSB. 3) Review existing literature.

**Methods:**
Illustrative case report and pertinent literature review.

**Results:**
This is a report of a patient who initially presented with left-sided frontal pain and pressure associated with altitude changes. After unsuccessful maximal medical therapy, she underwent a left maxillary antrostomy and balloon sinuplasty of the left frontal outflow tract; which resulted in persistent symptoms of ipsilateral frontal pain and pressure. This was correlated endoscopically with polypoid inflammation; which completely obstructed the left frontal outflow tract and required further surgery. Only after a complete sphenoethmoidectomy with a Draf IIA revision frontal dissection, did the patient experience symptom relief, demonstrate endoscopic and radiographic patent ostia, and was cleared for flight status. To date, there has been no literature describing the development of obstructive polypoid inflammation as a consequence of balloon sinuplasty of the frontal outflow tract. We describe the presentation and management of this condition as it relates to the management of patients with recurrent sinus barotrauma (RSB).

Poster 228

## Use of Tissue Glues in Endoscopic Pituitary Surgery: A Cost Comparison

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**Background:**
Post-operative cerebrospinal fluid (CSF) leaks are a relatively common complication of endoscopic pituitary surgery and account for a significant proportion of hospital costs associated with this procedure. Tisseel is a tissue glue commonly used as an adjunct in dural repair but is not optimal for this purpose. DuraSeal has several properties advantageous for dural repair but is not widely accepted partly due to its increased cost.

**Objective:**
Conduct a cost analysis of DuraSeal versus Tisseel in endoscopic pituitary surgery. Methods: A cost analysis was performed based on typical endoscopic pituitary surgery cases performed at our tertiary care institution. Operating room, hospital admission, and surgical sealant costs were obtained directly while estimates of patient recovery time and post-operative CSF leak rates were based on consensus values reported in the literature. Outcomes were reported for various possible clinical scenarios of sealant use.

**Results:**
In a model where surgical sealant is employed only in high-risk cases, use of DuraSeal in lieu of Tisseel allows for a yearly cost savings of at least $4127.78. If surgical sealant is used in all cases, regular use of DuraSeal instead of Tisseel either marginally reduces yearly costs or slightly increases them, depending on case volume and estimated post-operative CSF leak rate.

**Conclusion:**
In most clinical scenarios, use of DuraSeal in endoscopic pituitary surgery would reduce overall yearly hospital costs compared to Tisseel use.

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**COSM 2012**
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**COSM 2013**
April 10-14, 2013
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**56th Annual Meeting**
September 25, 2010
Boston Park Plaza
Boston, MA
Abstract Submission
Deadline: 5/21/2010
Manuscript Submission
Deadline: 8/28/2010

**57th Annual Meeting**
September 10, 2011
San Francisco, CA

**58th Annual Meeting**
(Location: TBD)

**59th Annual Meeting**
(Location: TBD)

Questions?
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