November 3-4 | Rhinology

Course Directors
Martin J. Citardi, MD
Amber Luong, MD, PhD
William Yao, MD

Planning Committee
Ashleigh Halderman, MD
Bradley Marple, MD
Matthew Ryan, MD

Guests of Honor
Pete S. Batra, MD
Ralph Metson, MD

November 5-6 | Rhinoplasty

Course Director
Russell Kridel, MD

Planning Committee
Christian Conderman, MD
Tang Ho, MD
Angela Sturm, MD

Guests of Honor
Ira Papel, MD
Jonathan Sykes, MD
Welcome

I am happy to welcome you to 2017 Lone Star Rhinology.

As you know, we have planned an intensive program that focuses on medical and surgical management of chronic rhinosinusitis as well as specific surgical techniques. Our visiting faculty is simply outstanding. Pete S. Batra, MD, from Rush University Medical Center (Chicago, IL) and Ralph Metson, MD, from Massachusetts Eye & Ear Infirmary (Boston, MA) are our guests of honor. Other faculties include Mohamad Chaaban, MD, from University of Texas Medical Branch (Galveston, TX); Philip Chen, MD, from Seth Isaacs, MD from TriHealth (Cincinnati, OH); Kent Lam, MD, from Eastern Virginia Medical School (Norfolk, VA); Li-Xing Man, MD, from University of Rochester School of Medicine & Dentistry (Rochester, NY); Michael Marino, MD, from Mayo Clinic (Phoenix, AZ); K. Christopher McMains, MD, from Uniformed Services University of Health Sciences (San Antonio, TX); Drew Plonk, MD, from Wake Forest Baptist Health (Winston-Salem, NC) and Alok Saini, MD, from McGovern Medical School (Houston, TX). Other speakers include Ashleigh Halderman, MD, Bradley Marple, MD and Matthew Ryan, MD (all from UT Southwestern Medical School in Dallas, TX), who also served on our planning committee.

Before 2017 LSR commences, we need to address a few important logistical issues:

- The program is quite busy. We will work within the time constraints in order to cover all the topics.
- The registration desk opens on Friday, November 3 at 7:00 AM. Breakfast will be available, and the program will start promptly at 7:45 AM.
- All lectures will be held in the Houston Marriott Medical Center, and the laboratory dissection session will be held in the Surgical Skills Laboratory of McGovern Medical School. Directions for both locations are in the latter part of this document.
- Please be sure to visit with our sponsors. Their participation is critical to the success of this type of program.

If you have any questions, please do not hesitate to ask us.

We are looking forward to a busy, education-filled two days.

Martin J. Citardi, MD
Professor & Chair
Amber Luong, MD, PhD
Associate Professor
William C. Yao, MD
Assistant Professor

McGovern Medical School
Department of Otorhinolaryngology
McGovern Medical School
The University of Texas Health Science Center at Houston
The course syllabus will be available for download from www.ent4.me/lsr, by November 1, 2017.
2017 Lone Star Rhinology

Reception

When
Friday, November 3
7:00-8:30 PM

Where
Houston Marriott

Please attend the course reception. This will be a great time to relax after busy day while reconnecting with old friends and making a few new friends.

This event is open to all attendees.
Contact Info

Course Directors

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Rhinology Fellow

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Departmental Administrative Support

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Sharon Clark
sharon.a.clark@uth.tmc.edu
Ground Transportation & Parking for Friday’s and Saturday’s Lectures

All lectures will occur at the Houston Marriott Medical Center.

The hotel’s location is as follows:

6580 Fannin Street (Driveway Entrance on 1730 Dryden Road)

Houston, Texas 77030

For more info about the hotel, please visit


For more information about the hotel’s location and ground transportation to and from the hotel, please visit:


Parking is available at the hotel for an additional fee.
Parking for Saturday’s Laboratory Session

The Saturday’s laboratory session will take place at the Surgical & Clinical Skills Center of McGovern Medical School.

The preferred parking garage is located at the Memorial Hermann Medical Plaza (6400 Fannin Street, Houston, TX 77030).

The garage’s cashier accepts cash and credit cards.

Important: Participants who will require ground transportation from the hotel to the lab session may request assistance at the hotel desk.
Directions to the Dissection Laboratory

Saturday's dissection will take place in the Surgical & Clinical Skills Center of McGovern Medical School at Houston (located in the basement of the Medical School Building.)

The dissection sessions are only open to registrants who are registered for this portion of the course.

The street address for the Medical School Building is:

6431 Fannin Street
Houston, TX 77030

*Please use the main entrance of the medical school to gain access to the lab. On Google Maps, the street address for the main entrance is 1133 John Freeman Boulevard.*

This is a short walk from the Houston Marriott Medical Center.
If you choose to drive to the lab, please park in the Memorial Herman Medical Plaza parking garage. This is a short walk to the entrance of the medical school building.

1. Proceed South on Fannin.
2. Make a left onto Ross Sterling Avenue.
3. Follow Ross Sterling under the Medical School Building. Make an immediate right immediately as you emerge on the far side of the building.
4. Walk through Webber Plaza.
5. The entrance will be on your right.
We invite you to join us for an exciting, 4-day CME meeting in Houston, TX. This course will feature two consecutive, 2-day CME events over a Friday through Monday time span. During the first two days, the rhinology course, which includes 1.5 days of lectures and a half-day dissection lab, will be a comprehensive medical education program dedicated to the study of nasal and sinus disorders. Over the next two days, the rhinoplasty course, which will also include 1.5 days of lectures and a half day-dissection lab, will provide a complementary course on contemporary principles of both functional and aesthetic rhinoplasty.

**Rhinology Course Directors**

**Martin J. Citardi, MD**  
McGovern Medical School (Houston, TX)

**Amber Luong, MD, PhD**  
McGovern Medical School (Houston, TX)

**William Yao, MD**  
McGovern Medical School (Houston, TX)

**Rhinology Planning Committee**

**Ashleigh Halderman, MD**  
UT Southwestern Medical School (Dallas, TX)

**Bradley Marple, MD**  
UT Southwestern Medical School (Dallas, TX)

**Matthew Ryan, MD**  
UT Southwestern Medical School (Dallas, TX)

**Rhinology Guests of Honor**

**Pete S. Batra, MD**  
Rush University Medical Center (Chicago, IL)

**Ralph Metson, MD**  
Massachusetts Eye & Ear Infirmary (Boston, MA)

**Rhinology Faculty**

**Mohamad Chaaban, MD**  
University of Texas Medical Branch (Galveston, TX)

**Philip Chen, MD**  
UTHealth San Antonio (San Antonio, TX)

**Seth Isaacs, MD**  
TriHealth (Cincinnati, OH)

**Kent Lam, MD**  
Eastern Virginia Medical School (Norfolk, VA)

**Li-Xing Man, MD**  
University of Rochester School of Medicine & Dentistry (Rochester, NY)

**Michael Marino, MD**  
Mayo Clinic (Phoenix, AZ)

**K. Christopher McMains, MD**  
Uniformed Services University of Health Sciences (San Antonio, TX)

**Drew Plonk, MD**  
Wake Forest Baptist Health (Winston-Salem, NC)

**Alok Saini, MD**  
McGovern Medical School (Houston, TX)
Rhinology Target Audience

This course is designed for practicing otorhinolaryngologists and residency program trainees as well as other health care professionals with interests in diseases of the nose and paranasal sinuses.

Rhinology Course Overview

The Lone Star Rhinology continuing medical education course focuses on the comprehensive medical and surgical management of diseases of the nose and paranasal sinuses. Specific topics include the diagnosis, pathophysiology and medical treatment of chronic rhinosinusitis, sinonasal polyposis and allergic rhinitis. The course will feature sessions on contemporary frontal sinus surgical techniques and the latest advances in fungal rhinosinusitis. The course will also focus on other important rhinologic issues, including postoperative care and management strategies for the general otolaryngologist. Advanced technology, including image-guided surgery and innovative techniques in management of sinonasal neoplasia, will also be featured. Difficult-to-treat rhinosinusitis will be discussed in detail through both formal didactic lectures and interactive panels. Controversies will be explored through the viewpoints of a diverse faculty of practicing rhinologists.

A hands-on laboratory session, featuring endoscopic surgical and video equipment, surgical navigation, balloon technology, powered instrumentation and cadaveric specimens, will be available.

Rhinology Learning Objectives

Lectures

Upon completion of the formal didactic sessions of the course, participants should be able:

- Identify endoscopic anatomical landmarks and abnormal pathology
- Recognize diseased sinuses and anatomical variants on imaging studies
- Describe management of sinonasal headache
- Implement a comprehensive strategy for the diagnosis, evaluation and management of inflammatory and neoplastic conditions involving the paranasal sinuses
- Discuss the differential diagnosis of inflammatory conditions of the paranasal sinuses
- Determine medical and surgical management for primary chronic rhinosinusitis
- Identify surgical landmarks to assist surgical dissection of paranasal sinuses
- Compare techniques to perform septoplasty and turbinate surgery
- Manage surgical complications encountered during endoscopic sinus surgery
- Identifying patients with rhinitis and summarizing treatment options
- Organize a method to determine anaphylaxis and treatment
- Identify patients with Eustachian tube dysfunction and select the appropriate treatment options
- Understand surgical navigation technology, including its basic principles, clinical applications and problem-solving
- Discuss an integrated postoperative management in patients undergoing sinus surgery
- Describe the role of corticosteroids in managing chronic rhinosinusitis
- Determine methods to identify microbiome data and assemble topical therapy based on culture data
- Discuss the role of biologics in chronic rhinosinusitis management
- Select patients requiring frontal sinus surgery and list the possible approaches in opening the frontal sinus
- Identify various frontal sinus revision techniques, including selection of the patients
- Compare various approaches in managing frontal sinus disease
Determine optimal treatments for patients with fungal rhinosinusitis
List various methods to diagnose allergic fungal rhinosinusitis in addition to organizing a treatment paradigm for patients
Compare various approaches for medical and surgical management of fungal rhinosinusitis through various case presentations
Describe techniques in treatment and monitoring of inverting papilloma
Identify techniques to manage patients with epistaxis
Discuss concepts for endoscopic management of the orbit
List the various methods for endoscopic repair of cerebrospinal fluid leaks
Gain an understanding of endoscopic techniques for sinus surgery with an emphasis upon new instrumentation and innovations
Explain controversies in identifying patients requiring endoscopic sinus surgery
Summarize the controversies that were encountered through the development of the field of rhinology
Explain the various methods to surgically addressing pathologies in the anterior and middle cranial skull base

Laboratory
At the end of the anatomy laboratory session, participants should be to:
Utilize basic principles of endoscopic sinus surgery
Understand advanced applications for surgical nasal endoscopy, including CSF leak repair
Understand the rationale and technique for endoscopic frontal sinusotomy
Integrate powered instrumentation and various angled instruments into endoscopic sinus surgery
Assess the impact of surgical navigation on the endoscopic sinus surgery
Relate preoperative CT imaging to anatomy visualized during dissection

Rhinology Lab
On Saturday afternoon after the conclusion of the day's formal rhinology didactic session, a cadaveric laboratory, in which the course faculty will demonstrate key rhinology techniques and in which participants will practice rhinologic procedures in fresh human cadaveric specimens, will be offered.

Participants must pre-registered for the cadaveric lab session.
Registration for the lab is limited.
FRIDAY, NOVEMBER 3
7:00 AM  Registration/Breakfast
7:45 AM  Welcome
 Martin J. Citardi, MD

Session: Rhinology Fundamentals
Amber Luong, MD, PhD (moderator)
8:00-8:20 AM  Endoscopic anatomy & CT correlates
 Philip Chen, MD
8:20-8:40 AM  Chronic rhinosinusitis diagnosis
 K. Christopher McMains, MD
8:40-9:00 AM  Headache
 Drew Plonk, MD
9:00-9:25 AM  Chronic rhinosinusitis pathophysiology & clinical implications
 Amber Luong, MD, PhD
9:25-9:50 AM  Primary CRS management panel
 Amber Luong, MD, PhD (moderator); Mohamad Chaaban, MD; Philip Chen, MD; Drew Plonk, MD; Matthew Ryan, MD
9:50 AM  Break

Session: Primary Nasal & Sinus Surgery
William Yao, MD (moderator)
10:20-10:45 AM  Five anatomic landmarks
 Ralph Metson, MD
10:45-11:05 AM  Septum & turbinate surgery
 Ashleigh Halderman, MD
11:05-11:30 AM  My 30 years in rhinology
 Ralph Metson, MD

Session: Rhinitis & Eustachian Tube
Matthew Ryan, MD (moderator)
11:30-11:55 AM  Rhinitis diagnosis and treatment
 Matthew Ryan, MD

11:55 AM-12:15 PM  Anaphylaxis
 Mohamad Chaaban, MD
12:15-12:35 PM  Eustachian tube dysfunction diagnosis and treatment
 Michael Marino, MD
12:35 PM  Lunch

Session: Optimizing Chronic Rhinosinusitis Outcomes
Martin J. Citardi, MD (moderator)
1:00-1:30 PM  Surgery Complications
 Pete Batra, MD
1:30-1:50 PM  Navigation
 Martin J. Citardi, MD
1:50-2:10 PM  Postop care
 William Yao, MD
2:10-2:30 PM  Role of steroids
 Bradley Marple, MD
2:30-2:50 PM  Implants
 Bradley Marple, MD
2:50-3:10 PM  Microbiome & topical antibiotics
 Seth Isaacs, MD
3:10-3:30 PM  Biologics
 Kent Lam, MD
3:30 PM  Break

Session: Frontal Sinus Surgery
William Yao, MD (moderator)
3:55-4:15 PM  Primary frontal sinus surgery
 William Yao, MD
4:15-4:35 PM  Revision frontal sinus surgery
 Li-Xing Man, MD
3:30 PM  Break
4:35-5:00 PM  Frontal sinus panel
Pete S. Batra, MD (moderator); Ashleigh Halderman, MD; Seth Isaacs, MD; Li-Xing Man, MD; William Yao, MD

**Session: Fungal Rhinosinusitis**
Bradley Marple, MD (moderator)

5:00-5:20 PM  Fungal rhinosinusitis diagnosis
Martin J. Citardi, MD

5:20-5:40 PM  Allergic fungal rhinosinusitis diagnosis and management
Amber Luong, MD, PhD

5:40-6:00 PM  Fungal rhinosinusitis panel
Bradley Marple, MD (moderator); Philip Chen, MD; Martin J. Citardi, MD, Amber Luong, MD, PhD, Matthew Ryan, MD

6:00 PM  Announcements
William Yao, MD

**SATURDAY, NOVEMBER 4**
7:00 AM  Registration/Breakfast
7:45 AM  Welcome
Amber Luong, MD, PhD

**Session: Office-based Rhinology Procedures**
Amber Luong, MD, PhD (moderator)

8:00-8:20 AM  Patient selection & preparation
Amber Luong, MD, PhD

8:20-8:40 AM  Office technology
Martin J. Citardi, MD

8:40-9:10 AM  Office procedures panel
Martin J. Citardi, MD, (moderator); Pete S. Batra, MD; Amber Luong, MD, PhD; Michael Marino, MD

**Session: Extended Indications for ESS**
William Yao, MD (moderator)

9:10-9:30 AM  Inverted papilloma
William Yao, MD

9:30-9:50 AM  Endoscopic epistaxis management
K. Christopher McMains, MD

9:50-10:15 AM  Endoscopic orbital surgery
William Yao, MD

10:15-10:40 AM  Endoscopic CSF leak repair
Pete S. Batra, MD

10:40 AM  Break

**Session: Rhinology: Past, Present & Future**
Matthew Ryan, MD (moderator)

11:10-11:35 AM  Defining indications for FESS
Martin J. Citardi, MD, (moderator); Pete S. Batra, MD; Bradley Marple, MD

11:35 AM-12:00 PM  Recalcitrant rhinosinusitis
William Yao, MD, (moderator); Martin J. Citardi, MD; Seth Isaacs, MD; Kent Lam, MD; Bradley Marple, MD

12:00-12:30 PM  Rhinology innovations
Amber Luong, MD, PhD, (moderator); Kent Lam, MD; Li-Xing Man, MD; K. Christopher McMains, MD; Matthew Ryan, MD

12:30-1:00 PM  Endoscopic skull base surgery
Pete S. Batra, MD

1:00 PM  Announcements
Amber Luong, MD, PhD

**Rhinology Dissection Lab**
(paid participants only)

1:10 PM  Travel to lab
(lab participants only)

1:30 PM  Lunch
(lab participants only)

2:00-5:00 PM  Lab
Accreditation
This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of The University of Texas Medical Branch at Galveston and The University of Texas Health Science Center at Houston. The University of Texas Medical Branch at Galveston is accredited by the ACCME to provide continuing medical education for physicians. The University of Texas Medical Branch at Galveston designates this live education activity for a maximum of 15.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Faculty Disclosure
Current guidelines state that participants in CME activities should be made aware of any affiliation or financial interest that may affect a speaker’s presentation(s) and/or any discussion of off-label therapies. Each speaker has been requested to complete a Faculty Certification Form. The names of faculty members, who declare a potential conflict of interest, will discuss off-label usage, or decline to sign a statement, will be shown in the activity syllabus.

Disclaimer
The information in this educational activity is provided for general medical education purposes only and is not meant to substitute for the independent medical judgment of a physician in his or her assessment of the diagnostic and treatment options of a specific patient’s medical condition. The viewpoints expressed in this CME activity are those of the faculty. They do not represent an endorsement by The University of Texas Health Science Center at Houston, McGovern Medical School, UT Physicians, Memorial Hermann-Texas Medical Center, Texas Sinus Institute and/ or Texas Skull Base Physicians. In no event will The University of Texas Health Science Center at Houston, McGovern Medical School, UT Physicians, Memorial Hermann-Texas Medical Center, Texas Sinus Institute and/ or Texas Skull Base Physicians be liable for any decision made or action taken in reliance upon the information provided through this CME activity.

Cancellation Policies
The University of Texas Health Science at Houston reserves the right to cancel or postpone the course due to unforeseen circumstances. In the event of course cancellation or postponement, registration fees will be refunded; however, participants will be responsible for any related costs, charges or expenses, including cancellation fees assessed by airlines and travel agencies.

If a participant wishes to cancel his or her registration, a written request must be received by October 25, 2017. All refunds are subject to a $100 administrative fee.
Meeting Location
All lectures, presentations and panels will be held at the Houston Marriott Medical Center. Situated at the Texas Medical Center, the Houston Marriott Medical Center features first class meeting space as well as the finest accommodations. The hotel, which is located at 6580 Fannin Street, Houston TX, 77030) is within walking distance of all official course activities. The hotel's amenities include Driscoll's Restaurant and Paladora Lounge. The Rice Village area is approximately 1.5 miles from the hotel and offers many additional restaurants and eclectic shopping. The hotel's sleek accommodations feature high-speed internet and luxury bedding; the hotel also has a pool and fitness center.

The cadaveric dissection session will be held in the Surgical & Clinical Skills Center of McGovern Medical School. This state-of-the-art facility, located within the main building of McGovern Medical School (at 6431 Fannin Street, Houston, TX 77030) supports cadaveric dissection sessions for McGovern Medical School trainees and participants in formal didactic courses. In addition, the Center has facilities for simulation of common health care environments.

Hotel Accommodations
A block of rooms has been reserved at the Houston Marriott Medical Center. Participants who make a reservation before October 12, 2017, will qualify for a discounted room rate for $109 (plus applicable taxes and fees) per night. This hotel, located at 6580 Fannin Street, Houston TX, 77030, is the main site for the meeting. To make your reservation, please call 713-796-0080 or follow the links for the hotel on the course website (www.LoneStarCME.org).

Registration
Regular registration is available until October 25, 2017. After this date, please call 713-500-5410 to inquire about registration availability. Registration for the dissection sessions is limited. Registration is available through the course web site (www.LoneStarCME.org).

Registration Fees

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<td>Lecture only</td>
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<td>Lab &amp; lecture</td>
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<td>Lab &amp; lecture (resident)*</td>
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*All resident registrations must be accompanied by a letter from the director of the trainee's program.

To register for this meeting, please visit www.LoneStarCME.org and follow the links for registration.
COURSE TITLE: Lone Star Rhinology & Rhinoplasty  
DATE: November 3-4, 2017  

Continuing Education Statements
This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of The University of Texas Medical Branch at Galveston (UTMB) and The University of Texas Health Science Center at Houston. The University of Texas Medical Branch at Galveston is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The University of Texas Medical Branch at Galveston designates this live activity for a maximum of 13.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Disclosure Announcement
Because CME activities are conducted in the public interest, it is important to assure the public that education received by physicians and other health care professionals through whom patient care decisions are made is conducted with the highest integrity, scientific objectivity, and independence of influence by commercial interests. A conflict of interest exists when individuals have both a financial relationship with a commercial interest and the opportunity to affect the content of CME about the product or services of that commercial interest. The Accreditation Council for Continuing Medical Education (ACCME) holds providers of CME responsible for collecting information from its instructors, planners and managers of CME content and resolving those conflicts prior to the commencement of the CME activity. The intent of the conflict of interest resolution process is to ensure that provider, faculty and planner financial relationships with commercial interests and resultant loyalties do not supersede the public interest in the design and delivery of continuing medical education activities for the profession. The ACCME holds providers of CME responsible for ensuring that the participants in a CME activity are provided disclosure information for all persons involved in decisions related to (1) identification of CME needs; (2) determination of educational objectives; (3) selection and presentation of content; (4) selection of all persons and organizations that will be in a position to control the content of the CME; (5) selection of educational methods; and (6) evaluation of the activity. The UTMB Office of Continuing Education has reviewed financial disclosure information for all presenters, reviewers and planning committee members; determined relevance of relationships and resolved any conflicts of interests prior to the activity. Disclosure information for all presenters and planning committee members for this activity is shown below.

The following presenters, planning committee members and CME reviewers have no relevant financial relationships with commercial interests to disclose:

Mohamad Chaaban, MD; Sean W. Delaney, MD; Ashleigh Halderman, MD; Tang Ho, MD; Seth Isaacs, MD; Russell Kridel, MD; Kent Lam, MD; Li-Xing Man, MD; Michael Marino, MD; Bradley Marple, MD; K. Christopher McMains, MD; Ralph Metson, MD; Ira Papel, MD; Drew Plonk, MD; Matthew Ryan, MD; Alok Saini, MD; Angela Sturm, MD; and William Yao, MD

The following presenters and planning committee members have disclosed relevant financial relationships as stated below:

- **Pete S. Batra, MD** received grant/research support from Medtronic, is a consultant for Acclarent; and has received other financial support from Springer.
- **Philip Chen, MD** is on the Speaker’s Bureau for Spirox.
- **Martin J. Citardi, MD** consults for Acclarent, Biosence Webster, Factory CRO, Medical Metrics, Medtronic and Optinose.
- **Amber Luong, MD, PhD** is a consultant/advisor for 480 Biomedical, Aerin Medical, ENTvantage, Medtronic, and Arrinex, and receives research support from Intersect ENT and Allakos.
Instructions for Online Evaluation, Claiming Credit and Printing Certificate

1. Before leaving, please sign-in with the event staff by providing your full name and email address. Please print clearly.
2. Use Credit Tracking Form (below) to keep track of your credits. Do not turn this form in to event staff.
3. By Tuesday, November 7, 2017, an email will be sent to you with instructions on how to evaluate the activity online, claim credit online and print your certificate.
4. If you do not receive an email with instructions by close of business on Tuesday, November 7, 2017, please contact the UTMB Office of Continuing Education at continuing.ed@utmb.edu. Please check your junk/spam email as sometimes emails may end up there instead of your inbox.

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### Use this form to record your participation in this activity

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<tr>
<td>8:00am</td>
<td>Endoscopic Anatomy &amp; CT Correlates</td>
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<td>4:30pm</td>
<td>Frontal Sinus Panel</td>
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<td>4:55pm</td>
<td>Fungal rhinosinusitis diagnosis</td>
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<td>5:15pm</td>
<td>Allergic fungal rhinosinusitis diagnosis and management</td>
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<td>Fungal rhinosinusitis panel</td>
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<td><strong>SATURDAY, NOVEMBER 4, 2017</strong></td>
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<tr>
<td>8:00am</td>
<td>Patient Selection &amp; Preparation</td>
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<td>8:20am</td>
<td>Office Technology</td>
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<td>8:40am</td>
<td>Office Procedures Panel</td>
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<td>9:10am</td>
<td>Inverted Papilloma</td>
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<td>9:30am</td>
<td>Endoscopic Epistaxis Management</td>
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<tr>
<td>9:50am</td>
<td>Endoscopic Orbital Surgery</td>
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<tr>
<td>10:15am</td>
<td>Endoscopic CSF Leak Repair</td>
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<tr>
<td>11:10am</td>
<td>Rhinology Innovation Panel</td>
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<tr>
<td>11:35am</td>
<td>Defining indications for FESS Panel</td>
<td>0.50</td>
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<tr>
<td>12:00pm</td>
<td>My 30 years in Rhinology</td>
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<tr>
<td>12:30pm</td>
<td>Endoscopic Skull Base Surgery</td>
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<tr>
<td>2:00pm</td>
<td>Lab</td>
<td>3.00</td>
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**MAXIMUM CREDITS AVAILABLE FOR THE ENTIRE ACTIVITY**

15.50
Lone Star Rhinology Conference

November 3-4, 2017 – Houston, Texas

EVALUATION & CREDIT CLAIMING INSTRUCTIONS

IMPORTANT: To evaluate the conference and claim credit, follow these steps:

STEP #1: Create/Update Your Profile: It is essential that your information is correct in our system. Please complete the following steps. **If you have previously created or updated your profile, skip STEP #1, and go directly to STEP #2.**

1. Click the following link to create a new profile or update your existing one: [http://cmetracker.net/UTMB/Login?formname=RegLoginProfile](http://cmetracker.net/UTMB/Login?formname=RegLoginProfile)
2. When your profile is complete, click the Continue button.
3. You will be directed to the Activity Catalog page. Close this page by clicking the X in the upper right hand corner, and then proceed to STEP #2.

STEP #2: Sign in

1. Click the following URL or copy to your browser: [https://cmetracker.net/UTMB/Login?FormName=getCertificate](https://cmetracker.net/UTMB/Login?FormName=getCertificate).
2. Enter the email address and password you used when creating/updating your profile. If you have forgotten your password, click on the “forgot my password” link. Your password will be emailed to the email address you entered into your profile.
3. Enter CME Code **300262** on line 3.
4. Click the Sign In button.

STEP #3: Complete the Evaluation and Claim Credit

1. Complete the brief online evaluation and click Submit. This will direct you to the page where you will indicate the number of credits you are claiming.
2. Follow the instructions for entering the number of credits you are claiming. Please note:
   - The number next to the credit type is the maximum number of credits available to claim.
   - **MDs and DOs**: please claim only the “**AMA PRA Category 1**” credit.
   - **All other Health Care Professionals**: please claim only the “**Attendance**” credit.
3. Click Continue.
4. Click Display Certificate.
5. Print or Email your certificate.

If you need assistance contact UTMB Office of Continuing Education continuing.ed@utmb.edu
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Dscope Systems
Entellus
Integra
Karl Storz
Medtronic
Olympus
Scopis
Stryker
Xoran
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<tr>
<td>Acclarent</td>
<td>33 Technology Drive, Irvine, CA</td>
<td>512-745-5494</td>
</tr>
<tr>
<td>D-Scope Systems</td>
<td>270 North Avenue, Suite 412,</td>
<td>914-633-5720</td>
</tr>
<tr>
<td>Entellus Medical</td>
<td>3600 Holly Lane, Plymouth, MN</td>
<td>763-463-7042</td>
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<tr>
<td>Hemostasis, LLC</td>
<td>5000 Township Parkway, St. Paul, MN</td>
<td>651-233-2074</td>
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<tr>
<td>Inhealth Technologies</td>
<td>1110 Mark Avenue, Carpinteria, CA</td>
<td>805-576-5304</td>
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<tr>
<td>Integra Life Science</td>
<td>311 Enterprise Drive, Plainsboro, NJ</td>
<td>609-936-5589</td>
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<tr>
<td>Intersect ENT</td>
<td>1555 Adams Drive, Menlo Park, CA</td>
<td>650-282-6159</td>
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<tr>
<td>Karl Storz Endoscopy America Inc.</td>
<td>2151 E. Grand Avenue, El Segundo, CA</td>
<td>800-421-0837</td>
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<tr>
<td>Medtronic</td>
<td>6743 Southpoint Drive North, Jacksonville, FL</td>
<td>904-332-8319</td>
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<tr>
<td>MicroGen DX</td>
<td>5796 Hoffner Avenue, Suite 1004, Orlando, FL</td>
<td>708-638-3515</td>
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<tr>
<td>Olympus America Inc.</td>
<td>3500 Corporate Parkway, Center Valley, PA</td>
<td>405-625-2551</td>
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<tr>
<td>OptiNose US, Inc.</td>
<td>1020 Stony Hill Lane, Yardley, PA</td>
<td>267-934-1511</td>
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<tr>
<td>Richie’s Specialty Pharmacy</td>
<td>12820 Highway #105 W, Conroe, TX 77304</td>
<td>936-588-5603</td>
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<td>Scopis, Inc.</td>
<td>1 Broadway, Cambridge, MA 02142</td>
<td>512-578-9127</td>
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<tr>
<td>Stryker</td>
<td>750 Trade Centre Way, Suite 200, Portage, MI 49002</td>
<td>269-389-4459</td>
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<tr>
<td>Xoran Technologies</td>
<td>5210 South State Road, Ann Arbor, MI 48108</td>
<td>734-846-9311</td>
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<tr>
<td>7:00 AM</td>
<td><strong>Registration/Breakfast</strong></td>
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<tr>
<td>7:45 AM</td>
<td>Welcome</td>
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<tr>
<td></td>
<td>Martin J. Citardi, MD</td>
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<tr>
<td>8:00-8:20 AM</td>
<td><strong>Endoscopic anatomy &amp; CT correlates</strong>          Philip Chen, MD</td>
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<tr>
<td>8:20-8:40 AM</td>
<td><strong>Chronic rhinosinusitis diagnosis</strong>                          K. Christopher McMains, MD</td>
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<tr>
<td>8:40-9:00 AM</td>
<td><strong>Headache</strong>                                                           Drew Plonk, MD</td>
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<tr>
<td>9:00-9:25 AM</td>
<td><strong>Chronic rhinosinusitis pathophysiology &amp; clinical implications</strong> Amber Luong, MD, PhD</td>
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<tr>
<td>9:25-9:50 AM</td>
<td><strong>Primary CRS management panel</strong>                       Amber Luong, MD, PhD (moderator); Mohamad Chaaban, MD; Philip Chen, MD; Drew Plonk, MD; Matthew Ryan, MD</td>
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<tr>
<td>9:50 AM</td>
<td>Break</td>
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<tr>
<td>10:20-10:45 AM</td>
<td><strong>Five anatomic landmarks</strong>                          Ralph Metson, MD</td>
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<tr>
<td>10:45-11:05 AM</td>
<td><strong>Septum &amp; turbinate surgery</strong>                           Ashleigh Halderman, MD</td>
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<tr>
<td>11:05-11:30 AM</td>
<td><strong>My 30 years in rhinology</strong>                                         Ralph Metson, MD</td>
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<tr>
<td>11:30-11:55 AM</td>
<td><strong>Rhinitis diagnosis and treatment</strong>                          Matthew Ryan, MD</td>
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<tr>
<td>11:55 AM-12:15 PM</td>
<td><strong>Anaphylaxis</strong>                      Mohamad Chaaban, MD</td>
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<tr>
<td>12:15-12:35 PM</td>
<td><strong>Eustachian tube dysfunction diagnosis and treatment</strong>                  Michael Marino, MD</td>
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<tr>
<td>12:35 PM</td>
<td>Lunch</td>
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<tr>
<td>1:00-1:30 PM</td>
<td><strong>Surgery Complications</strong>                              Pete Batra, MD</td>
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<tr>
<td>1:30-1:50 PM</td>
<td><strong>Navigation</strong>                                                        Martin J. Citardi, MD</td>
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<tr>
<td>1:50-2:10 PM</td>
<td><strong>Postop care</strong>                                                      William Yao, MD</td>
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<tr>
<td>2:10-2:30 PM</td>
<td><strong>Role of steroids</strong>                                                Bradley Marple, MD</td>
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<tr>
<td>2:30-2:50 PM</td>
<td><strong>Implants</strong>                                                         Bradley Marple, MD</td>
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<tr>
<td>2:50-3:10 PM</td>
<td><strong>Microbiome &amp; topical antibiotics</strong>                               Seth Isaacs, MD</td>
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<tr>
<td>3:10-3:30 PM</td>
<td><strong>Biologics</strong>                                                       Kent Lam, MD</td>
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<td>3:30 PM</td>
<td>Break</td>
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<tr>
<td>3:55-4:15 PM</td>
<td><strong>Primary frontal sinus surgery</strong>                               William Yao, MD</td>
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<tr>
<td>4:15-4:35 PM</td>
<td><strong>Revision frontal sinus surgery</strong>                               Li-Xing Man, MD</td>
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</table>

**Session: Rhinology Fundamentals**
Amber Luong, MD, PhD (moderator)

- 8:00-8:20 AM: Endoscopic anatomy & CT correlates (Philip Chen, MD)
- 8:20-8:40 AM: Chronic rhinosinusitis diagnosis (K. Christopher McMains, MD)
- 8:40-9:00 AM: Headache (Drew Plonk, MD)
- 9:00-9:25 AM: Chronic rhinosinusitis pathophysiology & clinical implications (Amber Luong, MD, PhD)
- 9:25-9:50 AM: Primary CRS management panel (Amber Luong, MD, PhD (moderator); Mohamad Chaaban, MD; Philip Chen, MD; Drew Plonk, MD; Matthew Ryan, MD)

**Session: Primary Nasal & Sinus Surgery**
William Yao, MD (moderator)

- 10:20-10:45 AM: Five anatomic landmarks (Ralph Metson, MD)
- 10:45-11:05 AM: Septum & turbinate surgery (Ashleigh Halderman, MD)
- 11:05-11:30 AM: My 30 years in rhinology (Ralph Metson, MD)

**Session: Rhinitis & Eustacian Tube**
Matthew Ryan, MD (moderator)

- 11:30-11:55 AM: Rhinitis diagnosis and treatment (Matthew Ryan, MD)
Endoscopic Anatomy & CT Correlates

Disclosures

• Speaker for Latera Spirox

Objectives

1. Apply the CLOSE system to radiographic review
2. Review the new nomenclature of frontoethmoidal cells
3. Develop a surgical plan for frontal recess dissection based on tri-planar CT review

The “CLOSE” system

C – Cribriform plate
L – Lamina papyracea
O – Onodi cells and Optic nerves
S – Sphenoid sinus and Skull Base
E – anterior Ethmoid arteries

C – Cribriform plate
L – Lamina papyracea
O – Onodi cells & Optic nerves

S – Sphenoid and Skull base

E – anterior Ethmoid Artery

Frontal sinus

Slide courtesy Dr. Marc Tewfik
International Frontal Sinus Anatomy Classification

Agger nasi
Supra-agger cell
Supra-agger frontal cell

Ethmoid bulla
Suprabulla cell
Suprabulla frontal cell

Supraorbital ethmoid
Frontal septal cell

Wormald et al. IFAR 2016

Agger Nasi

Supra Agger

Supra Agger Frontal

Supra Bulla Cell

Supra Bulla Frontal

Wormald et al. IFAR 2016
Supraorbital Ethmoid

Wormald et al. IFAR 2016

Supra Bulla Frontal

Wormald et al. IFAR 2016

Surgical Planning - Building Block Concept
Reconstruction of the Anatomy of the Frontal Recess

• Agger nasi
• Tri-planar CT scan review
  • Coronal
  • Sagittal
  • Axial

Building Block Concept
Reconstruction of the Anatomy of the Frontal Recess

Endoscopic Sinus Surgery. Wormald P.J. 2013

Rhinology – High Fidelity

Surgical Planning - Frontal Sinus Masterclass

• 3-D building block conceptualization
  • Triplanar CT view
  • Block for each cell
  • Drainage pathway
  • Review of anatomy
  • Video of dissection
  • Graduated difficulty
Surgical Planning

Conclusions
Apply CLOSE to all cases
Study CT scans for frontal sinus anatomy
Master frontal sinus anatomy

Thank you
Philip Chen
chenpg@uthscsa.edu
DIAGNOSIS OF CHRONIC RHINOSINUSITIS

K. CHRISTOPHER McMAINS, MD
ASSOCIATE PROFESSOR OF SURGERY, USUHS

Lone Star Rhinology
Houston, TX
October, 2017

CRS SYMPTOM COMPLEX

Major Symptoms
- Facial Pain/Pressure
- Nasal Obstruction or Congestion
- Purulent Nasal Discharge
- Hyposmia/Anosmia
- Cough not due to Asthma
  (in children only)


Minor Symptoms
- Headache
- Fever
- Halitosis
- Fatigue
- Dental Pain
- Cough (in adults)


CRS SYMPTOM COMPLEX

Major Symptoms
- Facial Pain/Pressure
- Nasal Obstruction or Congestion
- Purulent Nasal Discharge
- Hyposmia/Anosmia
- Cough not due to Asthma
  (in children only)

Plus: Endoscopic or CT Evidence

Minor Symptoms
- Headache
- Fever
- Halitosis
- Fatigue
- Dental Pain
- Cough (in adults)

DIAGNOSTIC CRITERIA

Etiologies of CRS

Super-antigen
Osteitis
Allergy
Bacteria
Fungi

IL-5, IL-4
IL-8, IF-γ
GM-CSF
What is Chronic Rhinosinusitis?

- Disease: a particular abnormal condition that affects part or all of an organism.
- Syndrome: a set of medical signs and symptoms that are correlated with each other.

I Suffer From CRS (Can't Remember Sinus)

Phenotypic Distinction

Endotypes


How the immune system breaks:

Endotypes

Tobacco use and smoking

Microbiome

Hyperresponse

Deficiency

Autoimmune

Immunodeficiency and CRS: Presentation

- Presentation:
  - Recurrent respiratory infections
  - Chronic Diarrhea
  - True incidence in CRS unknown

- Implicated in 8-22% of patients with recalcitrant CRS.
- Respond to antibiotics, recur upon withdrawal.


Vanderberghe L, B-ENT, 2:161-166.

PRIMARY IMMUNE DEFICIENCIES

- Associations:
  - Autoimmune cytopenias (35%)
  - Atopic disease (55%)


FUNCTIONAL ANTIBODY DEFICIENCY

- AKA:
  - Specific Polysaccharide
  - Ab Deficiency
  - Ab Deficiency with Normal Ig
  - Normal Ig levels
  - After Pneumovax injection, failure of 4x increase in at least 7 of 14 tested epitopes.
  - 67% of patients with recalcitrant CRS.


COMMON VARIABLE IMMUNE DEFICIENCY

- AKA: Acquired Hypogammaglobulinemia
- Associations:
  - Auto-immune disease
  - Malignancies
  - Non-Hodgkins Lymphoma
  - Stomach Cancer
- Dx Requires:
  - IgG > 2 SD below mean and
  - Isotype of IgA or IgM > 2SD below mean
  - Onset > 2 yo
  - Defect in specific Ab response after immunization


COMMON VARIABLE IMMUNE DEFICIENCY

a: age at symptom onset
b: age at CVID diagnosis


IMMUNODEFICIENCY EVALUATION

- Complete blood count with differential
- Quantitative immunoglobulins: IgA, IgG, IgM
- Immunoglobulin subclasses: secretory IgA, IgG1, IgG2, IgG3, IgG4
- T cell subpopulations: CD4, CD8
- Pneumococcal antibody titers before and 4 weeks after pneumococcal vaccination

Also consider:
- CF carrier testing
- Vitamin D3 levels
- Response to protein immunizations (Dyptheria, etc)
- Mannan Binding Lectin
- High Resolution CT Chest
**FIRST REFERENCE**

- The hypothesized autoimmune pathogenesis of hyperplastic chronic sinusitis: detection of anti-epithelium antibodies in the serum of patients with chronic sinusitis.


**ADDITIONAL DATA**

- Granulomatosis with PolyAngitis
  - Biphasic (ENT first phase)
  - Ab against neutrophilic enzymes proteinase 3 and myeloperoxidase


- Nuclear-targeted autoantibodies (anti-dsDNA IgG and IgA antibodies) in revision CRSwNP
  - Increased anti-BP180 autoantibodies in CRS patients compared with normal controls


**AUTO IMMUNITY WORK UP**

- CBC with diff (SLE)
- CMP (Sarcoid)
- ESR, CRP
- Auto-Ab:
  - RF, ANA, anti-ssDNA, anti-ENA (prev SSA, SSB), ANCA (cANCA, pANCA, MPO, PR-3)
- Immunoglobulins


**HOW THE IMMUNE SYSTEM BREAKS: HYPER-RESPONSE**

**ALLERGY AND CRS**

- CRSsNP
  - Grade of Evidence: D
  - Recommendation: Option

- CRScNP
  - Grade of Evidence: D
  - Recommendation: Option

  International Consensus Statement on Allergy and Rhinology-Rhinosinusitis
  - Tan, BK, et. al. JACI, 2011.

**ENTOPY**

- Local allergen sensitization without systemic atopy.
- Secondary lymphoid follicles in NP tissue.
- Local antigen-specific IgE present in NP tissue taken from 57% of “non-atopic” patients

**ASTHMA**

- Asthma rates higher in CRSwNP than CRSsNP
- CRSwNP present in >50% of non-atopic asthma
- CRSwNP:
  - Grade of Evidence: B
  - Recommendation: Recommend evaluation

**ASPIRIN EXACERBATED DISORDERS**

- Arachidonic Acid
- COX1/COX2
- Membrane Phospholipids
- Aspirin
- PGG2
- Aspirin
- LTC4 Synthase
- LTC4
- LTD4
- LTE4
- 5-LO
- LTA4 hydrolase
- LTA4
- LTC4 Synthase
- LTC4
- LTD4
- LTE4
- FLAP
- LTA4 hydrolase
- LTB4
- LTC4 Synthase
- LTC4
- LTD4
- LTE4
- LTA4 hydrolase
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- LTC4
- LTD4
- LTE4
- FLAP
- LTA4 hydrolase
- LTA4
- LTC4 Synthase
- LTC4
- LTD4
- LTE4

**NON-IGE MAST CELL DEGRANULATION**

- Pathogens
- Drugs
- Other Immunoglobulins (IgG)
- Toll-like Receptors
- Complement proteins
- Some cytokines and positively charged peptides (e.g. S. aureus-derived protein A)


**STAPH AUREUS SUPERANTIGENS**

- Colonization rates higher in CRScNP (63.6%) than CRSsNP (27.3%)
- Enterotoxins induce polyclonal IgE, continuous activation of mast cells.
- SE-B increases Th2 response, and decreases Treg, IL-10, and TGF-β1.


[http://immense-immunology-insight.blogspot.com](http://immense-immunology-insight.blogspot.com)

**HOW THE IMMUNE SYSTEM BREAKS**
LEARN FROM A WORM?

Endosymbionts

REDUCTIVE EVOLUTION

S. AUREUS IN NASAL MUCOSA

Microbiome Matters

MICROBIOME MATTERS

EARTH FROM VOYAGER

• Antibiotic use increases:
  • Risk of developing CRSsNP (OR 2.21)
  • Burden of CRS disease


WHAT FACES US

“The dogmas of the quiet past are inadequate to the stormy present.”

• Abraham Lincoln

HOW THE IMMUNE SYSTEM BREAKS

- Microbiome
- Hyper-response Deficiency
- Auto-Immune
Neuralgia vs Neuropathy

- Neuralgia
  - Pain in the distribution of a nerve that is otherwise normal in function
  - Most severe at onset; often sudden
  - Lancing, electric-shock-like, stabbing
- Neuropathy
  - Disturbance in function in a nerve

‘Anesthesia Dolorosa’

- Painful Post-traumatic trigeminal neuropathy
  - Unilateral facial or oral pain
  - In distribution of nerve
  - Identifiable traumatic event
    - Within 3-6 months of sx onset
    - Mechanical / Chemical / Thermal / Radiation
  - Need additional symptom of dysfunction
    - Hypoesthesia, Allodynia, hyperalgesia, hypoalgesia
  - Rhizotomy most common cause
    - 2% when done for TN

Treatment

- TCAs 1st line
  - Amitriptyline
- Gabapentin or Pregabalin 2nd line

Patient 1

- Left facial pain
- Facial skin ulceration
- Foreign body sensation in eye
- Complains of left nasal obstruction
- History of recent stroke

Trigeminal trophic syndrome

- Facial skin ulceration
  - Usually infraorbital
- Dysesthesia
  - Burning, crawling, itching, ocular FB, nasal obstruction
- Facial pain (50%)
**Trigeminal trophic syndrome**

- Damage in TN pathway
  - Peripheral or central
  - TN ablation
  - Medullary / pontine stroke
  - Surgery
  - Trauma
  - Zoster
  - Ulcer mechanism unknown

**Cluster-Tic Syndrome**

- Characterized by 3 types of pain
  - TN
  - Cluster HA
  - Mixture of both → exacerbated by trigger point or neck movement
- Chronic or episodic
- Difficult to treat
  - Surgery for TN may make cluster HA more treatable

**Glossopharyngeal Neuralgia**

- Paroxysmal, severe, stabbing pain
  - Seconds to minutes; awaken from sleep
- IX and X distribution
  - Ear, tonsillar fossa, tongue base, angle of jaw
- Typical triggers
  - Chewing, swallowing, coughing, talking, yawning, certain tastes, touching neck or EAC
- Idiopathic or secondary
  - Demyelinating lesions, CPA tumor, PTA, Carotid aneurysm, Eagle syndrome, Vascular compression

**Patient 2**

- Short bursts of electric-shock-like facial pain
- Icepick behind left eye
- Tearing
- Triggered by neck movement

**MRI / MRA almost always indicated**

- Rule out mass lesion and vascular compression
- Medical treatment similar to TN
- Oropharyngeal injection of lidocaine
- Surgery
  - Intracranial sectioning of IX and rootlets of X

**Occipital Neuralgia**

- Paroxysmal, stabbing pain
- Occipital nerve distribution
  - Radiates to forehead
- Alloodynia or dysesthesia with hair brushing / light touch
- Trigger points and / or tenderness over affected nerve branches
Occipital Neuralgia
- MRI
- Local occipital nerve block

Tolosa-Hunt Syndrome
- Unilateral orbital pain
- Paresis of III, IV, and/or VI
- Granulomatous inflammation
  - Cavernous sinus
  - Superior orbital fissure
  - Orbit

Raeder Syndrome
- Paratrigeminal Oculosympathetic Syndrome
  - “Painful Horner’s syndrome”
  - Constant, unilateral headache
    - Burning along V1
    - Aggravated by eye movement
  - Decreased sensation
  - Ptosis and miosis
  - No anhidrosis
  - MCF mass lesion, trauma, syphilis, ? sinusitis

Persistent idiopathic facial pain
- ‘Atypical facial pain’
- Persistent oral / facial pain in absence of neurologic deficit
- Minor surgery / mild injury to face, teeth, gums may precede onset
- Nasolabial fold or side of chin most common
- Daily, at least 2 hours, 3 months
- Poorly localized / not along nerve
- Dull, aching, nagging
- TCAs, gabapentin, pregabalin

Giant Cell Arteritis
- Chronic vasculitis
- Medium and large vessels
- Temporal pain
  - Frontal, occipital also possible
  - Mild or severe, variable course; present in 2/3rds
- Jaw Claudication (4/2)
  - Fatigue or trismus-sensation
  - Transient visual loss
  - Fever, fatigue, weight loss
  - Almost never before age 50

Trigeminal Neuralgia
- Paroxysmal, Intense, Stabbing or electric-shock-like pain
- Brief but repetitive
  - Refractory period
  - ‘tic douloureux’
- Most common along V2 and / or V3
  - Autonomic symptoms along V1
- Trigger zones and triggers
  - Light touch along nerve can trigger
  - Chewing, talking, brushing teeth, cold air, smiling
Trigeminal Neuralgia

- Carbamazepine
- Surgical therapy
  - MVD
    - Ectatic superior cerebellar artery
    - Effective in 90% initially
  - Ablative procedures
    - Rhizotomy with RFA
      - Risk of anesthesia dolorosa (2%)  
      - Gamma knife
      - Facial sensory impairment but no anesthesia dolorosa
      - Avoid peripheral neuroectomy
      - Incision, RFA, injection

Medication overuse HA

- Usually preceded by primary HA disorder  
- Use more than 2-3 days per weeks for 3 months
- Quality varies, but often on awakening
- Risk
  - Highest with opioids, butalbital, ASA-acetaminophen-caffeine
  - Intermediate with triptans
  - Possible with NSAIDs

Migraine

- Throbbing / pulsatile
- Often unilateral
- n/v/light sound sensitivity
- Exertional worsening
- Triggers
  - Weather changes, stress, menstruation, wine, fasting, sleep disturbance, aspartame

Chronic tension-type headache

- Bilateral
- Non-throbbing
  - ‘featureless’
- Gradual onset
- Mild to moderate
- May have muscle tenderness to palpation

Trigeminal Autonomic Cephalgias

Cluster HA

- Severe, unilateral, orbital / temporal pain
- Autonomic phenomena
  - Ptosis, miosis, lacrimation, injection, rhinorrhea, nasal congestion
- Response to O2
  - Triptans
### SUNCT or SUNA
- Short-lasting, Unilateral, Neuralgiform HA
  - With conjunctival injection and lacrimation
  - With autonomic symptoms
    - Injection OR lacrimation
    - Unilateral nasal congestion, rhinorrhea, eyelid edema, ptosis, miosis, facial flushing / sweating
  - Lack of response to indomethacin or oxygen
  - Positive response to IV lidocaine
  - MRI

### Hemicrania Continua
- Strictly unilateral
- Continuous
- Autonomic features
- Occasionally with migrainous features
- Response to indomethacin
7. Physical Exam
- Normal appearing female with normal voice
- No facial tenderness on palpation
- Nasal cavity with deviated septum and septal spur to the left
- Bilateral inferior turbinate hypertrophy
- Mucostraining
- Enlarged middle turbinate

8. Nasal endoscopy
(Insert video)

9. CT sinus

10. Additional studies?

11. Recurrent Acute Rhinosinusitis
- Defined as 4 or more acute episodes of acute bacterial rhinosinusitis without persistent symptoms between episodes (Rosenfeld et al, 2009 and updated 2011)
- Clinical consensus statement by AAOHNS discouraged CT imaging for uncomplicated acute episodes of rhinosinusitis, but supported CT imaging for suspected recurrent acute sinusitis and prior to sinus surgery (2012)
- Recent Clinical Consensus Statement on balloon sinuplasty: Balloon dilation is NOT appropriate for patients with sinonasal symptoms and a CT that does not show evidence of sinonasal disease (2017)
13. Management of Primary Chronic Rhinosinusitis

14. 56 yo male presents with >10 years of moderate to severe allergy and sinus symptoms that progressed to loss of sense of smell over the last 5 years and worsening SOB for the last several months.

15. Additional pertinent history:
- Fever normally tested for AR
- SCD and wheezing now affecting his ability to sleep. Recently started on rescue inhaler.
- Occasional sneezing and RINH use without significant worsening of symptoms.
- No aspirin sensitivity.
- Sense of smell improves with medical dose PDE4.
- Has been treated with multiple courses of augmentin without long lasting improvement.
- Occupation: stroll.

16. Physical exam:
- Normal appearing male with hyponasal speech
- Nasal exam
  - Nasal polyps visible in nasal cavity on the left.
  - Septum deviated to the right with relatively large septal perforation.
  - Unable to visualize right middle meatus.
  - Oral cavity:
    - Normal dentition.

17. Nasal endoscopy

18. CT sinus scans
His labs

- CBC w/ diff: Serum eosinophils 0.5 K/cmm (8.1%)
  Lymphocytes normal
- Elevated serum IgE along with several antigens including fungi
- Vitamin D levels normal

Referrals

Pulmonology?
  - pulmonary function test
Facial Plastics?
  - Evaluation of septal perforation repair
Allergist?
  - Evaluation of allergic rhinitis and treatment
55 yo male with asthma and aspirin sensitivity presents with 5 year history of moderate-to-severe bilateral nasal congestion and anosmia.

- Asthma diagnosed in his 40’s managed with Singular and Quir, but recently needing rescue inhaler more frequently
- He was recommended septoplasty and balloon sinuplasty 5 years ago, his ENT at the time informed him that polyps developed after this procedure
- Subsequently underwent polyectomy with benefit for only 1 month

Other pertinent history
- e/p immunotherapy with some improvement of symptoms
- Non-smoker with occasional EOH use, but unable to tolerate red wine
- Otherwise healthy
- Occupation: business consultant

Physical Exam
- Normal appearing face with hyponasal voice
- No facial tenderness on palpation
- Nasal cavity with polyps filling bilateral nasal polypos

CT sinus

Nasal endoscopy

[insert video]
Chronic Rhinosinusitis
Pathophysiology & Clinical Implications

Amber Luong, MD, PhD
Associate Professor and
Director of Research

Disclosures
Advisory Board
- 480 Biomedical
- ENTvantage Dx
Consultant
- AER Medical
- Medtronic

Departmental Research Funding
- Allakos
- ENTvantage Dx
- Intersect ENT

Objectives
- Review the updated understanding of pathophysiology of CRS with and without nasal polyps
- Discuss the clinical implications of these understanding

Pathophysiology of CRS

CRS is clinically classified based on presence of nasal polyps - Phenotypes

CRS without NP
- Anatomical obstruction
- Defect in innate immunity
- Odontogenic

CRS with NP
- AFRS/eosinophilic mucin rhinosinusitis
- Cystic fibrosis
- Aspirin exacerbated rhinosinusitis
47 yo female with asthma and sensitivity to aspirin presents with recurrent nasal polyps

24 yo male with history of allergic rhinitis and several years of nasal congestion

CRS Phenotypes to Endotypes -> Important in Advancing CRS Treatment

Phenotype characterization
• Based on clinical characterizations such as with and without nasal polyps

Endotype characterization
• Based on molecular or cellular pathophysiology such as normal and elevated local sinus mucosal levels of eosinophils or increased levels of specific cytokines

2012 – Polymorphisms of bitter taste receptor T2R38 associated with susceptibility to gram negative bacterial infections

People with homozygote dysfunctional T2R38 are more susceptible to CRS

CRSsNP with homozygote functional T2R38 had long-term improved outcomes after FESS based on SNOT-22

2009 - Bitter taste receptors were reported for the first time on respiratory epithelial cells in the lower airway

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Sinonasal Microbiome

Understanding of the Pathophysiology of CRSwNP

Eosinophilic versus Neutrophilic CRSwNP
Epithelial cell barrier function

Tight junctions
- Regulate transport of solutes and ions across epithelia

Adherens junctions
- Mediate cell-to-cell adhesions and promote formation of tight junctions

Disruption of tight junctions increase permeability and reduces transepithelial resistance

Epithelial cell barrier defective in CRSwNP

Disruption of tight junctions increase permeability and reduces transepithelial resistance

Epithelial cells have active role in pathophysiology of CRS

- Barrier function
- Housed cilia important in mucus circulation
- Active participant in the immune response
  - Release antimicrobials
  - Release cytokines important in initiating the Type 2 inflammatory response (IL-25, IL-33 and TSLP)

Epithelial cells play active immunologic role

Increased percentage of ILC2s in inflamed sinonasal mucosa from CRSwNP patients

Elevated expression of ST2 in inflamed sinonasal mucosa from CRSwNP patients
**Increased IL-13 production from Lineage-CD127+ ILC2s from CRSwNP patients in response to IL-33**

Shaw et al., J of Allergy Clin Immunol, 2013

**Goals of endoscopic sinus surgery**

1. Remove polyps
   - IL-5 ectomy
   - To improve nasal breathing
2. Provide access to sinuses for topical delivery of medications
3. Remove trapped mucus/mucin that may harbor triggers of inflammation

**Non-curative treatment option**

**Current Medical Treatment Options for CRS**

**Biologics**

A preparation, such as a drug, a vaccine, or an antitoxin, that is synthesized from living organisms or their products and used as a diagnostic, preventive, or therapeutic agent.
Amber Luong, MD, PhD  
McGovern Medical School at UT Health  
Science Center

Omalizumab for CRS  
A randomized, double blind, placebo-controlled trial of anti-IgE for chronic rhinosinusitis  
• N=7 omalizumab, N=7 placebo  
• Omalizumab reduced inflammation on imaging  
• No significant improvement in other measures  
Omalizumab is effective for allergic and non-allergic patients with nasal polyps and asthma  
• N=16 omalizumab, N=8 placebo  
• Omalizumab improved nasal polyp score, CT score, and QOL score

Anti-IL-5 (Mepolizumab and Reslizumab)  
➢ Binds and inhibits function of IL-5  
➢ Recent FDA approval for mepolizumab and reslizumab use in severe asthma  
➢ Two proof of concept study in CRS with nasal polyps – mepolizumab and reslizumab

Reslizumab in CRSwNP  
Reslizumab 1mg/kg (N=8)  
Reslizumab 3mg/kg (N=8)  
Placebo (N=8)  
1 dose IV  
Reslizumab nasal polyp score reduced in ha  
Gevaert et al. JACI 2006;118:1133

Change in Total Polyp Score  
• Responders had elevated nasal IL-5 (>40 pg/ml)  
• TPS reduced in half of patients treated with anti-IL5

Anti-IL-4R (Dupilumab)  
➢ Fully-human monoclonal antibody directed against IL-4Rα subunit which inhibits signaling of both IL-4 and IL-13  
➢ Recently completed RCT in 60 CRSwNP patients showed that dupilumab showed significant reduction in nasal polyp size and sinonasal symptoms over the 16 weeks while on medication (600 mg loading followed by 300 mg weekly shots).  
• TPS reduction from baseline and week 16 showed -1.9 (-2.5 to 1.2) reduction in dupilumab group and only -0.3 (-1.0 to 0.4) in placebo group  
Bachert et al. JAMA 2016;315:469

Summary  
➢ New appreciation for pathophysiology of CRS with and without nasal polyps  
➢ Trend from phenotyping CRS patients to endotyping CRS patients  
➢ Endotyping and better understanding of pathophysiology of CRS moving us to personalized treatment of CRS
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William Yao, MD

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Li-Xing Man, MD
Five Landmarks to Make You a Better Sinus Surgeon
Lone Star Rhinology & Rhinoplasty
November 3, 2017

RALPH METSON, MD
MASSACHUSETTS EYE & EAR INFIRMARY
HARVARD MEDICAL SCHOOL
BOSTON, MA

Disclosures
I have no conflicts of interest to disclose.

Five Landmarks
 Anatomy
 Surgical technique
 Philosophy

Five Landmarks
 Maxillary Line
 Turbinate Pump
 Maxillary-Ethmoid Plate
 Sphenoid Line
 El Toro Sign

Maxillary Line

Maxillary Line
Maxillary Line

Convergence of neurovascular networks

Jackson, Chevalier: Diseases of the Nose, Throat, and Ear. 1945
Turbinate pump: pre-injection

Maxillary-Ethmoid Plate

Turbinate pump: injection

Turbinate pump: post-injection

Turbinate Pump
Convergence of neurovascular networks along lateral nasal wall
Efficient site of injection at start of sinus surgery

Sinus X-ray: Caldwell View
Sinus X-ray: Caldwell View

Maxillary-Ethmoid Plate
Junction of maxillary and ethmoid sinuses

Maxillary-Ethmoid Plate

Trans-antral ethmoidectomy

Maxillary-Ethmoid Plate

Maxillary-Ethmoid Plate
Maxillary-Ethmoid Plate
Junction of maxillary and ethmoid sinuses

The key to the sphenoid sinus is the superior turbinate.

Trans-nasal Approach

Trans-ethmoid Approach

Sphenoid Line
Sphenoid Line
Provides vertical location of the sphenoid ostium in the surgical field.

Ting’s Triangle
Provides horizontal location of the sphenoid ostium in the surgical field.

El Toro Sign

El Toro Sign: Intra-op

Agger Nasi Punch Out Procedure: “POP”

www.SinusVideos.com

Five Landmarks

- Maxillary Line
- Turbinate Pump
- Maxillary-Ethmoid Plate
- Sphenoid Line
- El Toro Sign
Septum and Turbinate Surgery

Ashleigh Halderman, MD
Associate Professor
Rhinology and Skull Base Surgery
Department of Otolaryngology Head and Neck Surgery

SEPTOPLASTY

Disclosures

• None

Indications

Symptoms
• Nasal obstruction
• Epistaxis
• Improve comfort and compliance with CPAP/BiPAP

Adjunct to Endoscopic Sinus Surgery (ESS)
• Improve surgical access
• Improve overall drainage pathway of paranasal sinuses
• Better delivery of topical medication

Rule #1: Don’t Struggle
Approaches

- Open
  - Substantial caudal deviation
  - Dorsal septal deviation involving L strut
  - Valve collapse/stenosis
- Endonasal
- Endoscopic Endonasal

Endoscopic Endonasal Septoplasty

- Excellent visualization
- Posterior septal deviations
- Certain small technical maneuvers that make a big difference
- Some “Pearls”

Steps

- Injection
  - Endoscopic
  - Bilateral
  - Hydodissection
- Incision
  - Overhead light
  - Short speculum
  - #15 Scalpel
  - Killian’s Dissection
    - Less tearing
    - Less in the way for ESS
- Flap Elevation-Some Pearls

Dissection

- Identify plane with cottle
  - Overhead light
  - Short speculum
- Broad sweeps up and down
  - Develop enough room for your scope
- Continue dissection under endoscopic view
- Wide sweeps up and down before introducing endoscope
- Smallest caliber suction
- Finger off the hole when under the flap
- Lift the flap up with the cottle when going in and out of flap
  - The suction just doesn’t work as well
- Leave an instrument or the scope under the flap at all times
Incision/Separate BC Junction

- BC junction-around where a straight instrument “falls off the horizon”
- Separate at the junction or just anterior to it
  - Knife
  - Cottle

Instruments

- Elevation
- Gorney

Cartilage/Bone Removal

- Middleton
- Acufex

Closure

- 5-0 Fast Interrupteds for hemitransfixion
- 4-0 Plain Gut on Keith Needle for Quilting
- Evidence that quilting stitch obviates need for packing
  - Less pain, headache
  - No increased rate of complications

MT S MM
TURBINATE SURGERY

Indications

• Nasal obstruction secondary to turbinate hypertrophy not responsive to medical management
• Improve comfort/compliance with CPAP/BiPAP

Technique Selection

• Degree of turbinate hypertrophy
• Cost
• Efficacy
• Candidacy for general anesthesia
• Concomitant procedures
• Minimize complications
• Maintain normal nasal physiology

Techniques

• Outfracture/lateralization
• Extramural resection
  – Partial turbinectomy
• Turbinoplasty
  – Submucosal tissue destruction & fibrosis
  – Office based options
• Submucosal resection/reduction
  – With or without bone resection

So Many Options!!

Turbinoplasty
• Monopolar
• Bioploar
• Radiofrequency
• Coblation

Submucosal Resection
• Microdebrider
• Biopolar equipped microdebrider
• Ultrasonic aspiration

Which is the best???

Some Considerations

• Several techniques improve nasal obstruction
• Outfracture alone ➔ long term benefit?
• Surface sparing techniques ➔ less crusting, scarring, pain
• Extramural turbinate resection ➔ morbidity
• Techniques can be combined to maximize effectiveness
Submucosal Resection

Outfracture
The Evolution of Endoscopic Sinus Surgery: Lessons Learned in the First 30 Years

Lone Star Rhinology & Rhinoplasty
November 3, 2017

RALPH METSON, MD
MASSACHUSETTS EYE & EAR INFIRMARY
HARVARD MEDICAL SCHOOL
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Pre-ESS: Nasal Polyps

Intra-nasal ethmoidectomy  External ethmoidectomy

World Tour: 1985 UCLA

Dr. Heinz Stammberger

“Endoscopic Surgery for Headaches”

World Tour: 1985 UCLA

Dr. Walter Messerklinger

ENT University Hospital, Graz, Austria

New theory of the pathophysiology of sinusitis

OMC & mucociliary clearance
Lesson #1

**SURGERY IS A DYNAMIC PROCESS**

First 50 ESS cases were not that fun or easy

- Too much bleeding to see well
- Often reverted to headlight and nasal speculum
- Didn’t know how much tissue to take or leave

Lesson #2

When it comes to new surgical technology, don’t believe everything you hear or read.

- REPS
- KOLS
- PUBS

The Sinus Surgery Learning Curve

# OF CASES

- Frontal Sinus
- Sphenoid Sinus
- Case 25 – Maxillary Sinus
- Case 40 – Ethmoid Sinus
Pioneers are also on a learning curve

- MESSERKLINGER
- WIGAND
- DRAF
- STAMMBERGER
- KENNEDY

All FESS should be performed under local anesthesia
Never manipulate the middle turbinate
Treat maxillary sinus disease with a canine fossa puncture
The sphenoid sinus should be opened through its anterior wall
All patients debrided on POD 1 & 4

Pioneers

- ARE ALSO ON THE LEARNING CURVE
- HAVE THEIR OWN BIASES
- DON'T TAKE EVERYTHING THEY SAY AS DOGMA

Petrus apex cyst

Lesson #3

LESS IS MORE

It only takes 20 cases to learn what to take out of the sinuses; it takes 200 cases to know what to leave behind.
Lesson #4
LASERS ARE GOOD
CYSTS ARE BAD

Lesson #5
We all make MISTAKES,
some just cost more than others

Complication rate increases for new surgical procedures

- LAPAROSCOPIC CHOLECYSTECTOMY
- ROBOT-ASSISTED PROSTATECTOMY
- ENDOSCOPIC SINUS SURGERY

Sinus Surgery Learning Curve

Lesson #6
TECHNOLOGY IS NO SUBSTITUTE FOR TECHNIQUE

1987: 29%
1989: 9.3%
2011: 3.1%

Major technological advances in ESS
- Microdebrider
- Image-Guidance

Lesson #7
LONGEVITY HAS ITS REWARDS

Image-guidance
May make surgery safer and more effective, but...
- Not meant for every patient
- Not meant for every surgeon
- Adds time and expense to each case
How long is 30 years?

- Long enough to get very good at what you do: effective & efficient surgery
- Long enough to learn from your mistakes: wise & safe surgery
- Long enough to learn what is important in life
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## Rhinology Program

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<td>Surgery Complications</td>
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<tr>
<td></td>
<td>Pete Batra, MD</td>
</tr>
<tr>
<td>1:30-1:50 PM</td>
<td>Navigation</td>
</tr>
<tr>
<td></td>
<td>Martin J. Citardi, MD</td>
</tr>
<tr>
<td>1:50-2:10 PM</td>
<td>Postop care</td>
</tr>
<tr>
<td></td>
<td>William Yao, MD</td>
</tr>
<tr>
<td>2:10-2:30 PM</td>
<td>Role of steroids</td>
</tr>
<tr>
<td></td>
<td>Bradley Marple, MD</td>
</tr>
<tr>
<td>2:30-2:50 PM</td>
<td>Implants</td>
</tr>
<tr>
<td></td>
<td>Bradley Marple, MD</td>
</tr>
<tr>
<td>2:50-3:10 PM</td>
<td>Microbiome &amp; topical antibiotics</td>
</tr>
<tr>
<td></td>
<td>Seth Isaacs, MD</td>
</tr>
<tr>
<td>3:10-3:30 PM</td>
<td>Biologics</td>
</tr>
<tr>
<td></td>
<td>Kent Lam, MD</td>
</tr>
<tr>
<td>3:30 PM</td>
<td>Break</td>
</tr>
<tr>
<td>10:20-10:45 AM</td>
<td>Five anatomic landmarks</td>
</tr>
<tr>
<td></td>
<td>Ralph Metson, MD</td>
</tr>
<tr>
<td>10:45-11:05 AM</td>
<td>Septum &amp; turbinate surgery</td>
</tr>
<tr>
<td></td>
<td>Ashleigh Halderman, MD</td>
</tr>
<tr>
<td>11:05-11:30 AM</td>
<td>My 30 years in rhinology</td>
</tr>
<tr>
<td></td>
<td>Ralph Metson, MD</td>
</tr>
<tr>
<td>11:30-11:55 AM</td>
<td>Rhinitis diagnosis and treatment</td>
</tr>
<tr>
<td></td>
<td>Matthew Ryan, MD</td>
</tr>
<tr>
<td></td>
<td><strong>Session: Frontal Sinus Surgery</strong></td>
</tr>
<tr>
<td></td>
<td>William Yao, MD (moderator)</td>
</tr>
<tr>
<td>3:55-4:15 PM</td>
<td>Primary frontal sinus surgery</td>
</tr>
<tr>
<td></td>
<td>William Yao, MD</td>
</tr>
<tr>
<td>4:15-4:35 PM</td>
<td>Revision frontal sinus surgery</td>
</tr>
<tr>
<td></td>
<td>Li-Xing Man, MD</td>
</tr>
</tbody>
</table>
Diagnosis and Management of Rhinitis

Matthew W. Ryan, MD
Associate Professor
Department of Otolaryngology

Disclosures

none

Most Chronic Rhinitis is Allergic Rhinitis

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Allergic</th>
<th>Mixed</th>
<th>Non-Allergic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mullarkey</td>
<td>142</td>
<td>48%</td>
<td>NS</td>
<td>52%</td>
</tr>
<tr>
<td>Togias</td>
<td>362</td>
<td>83%</td>
<td>NS</td>
<td>17%</td>
</tr>
<tr>
<td>ECRHS</td>
<td>1412</td>
<td>75%</td>
<td>NS</td>
<td>25%</td>
</tr>
<tr>
<td>NRCTF</td>
<td>975</td>
<td>43%</td>
<td>34%</td>
<td>23%</td>
</tr>
</tbody>
</table>

Patient History is the most powerful diagnostic tool in the diagnosis of chronic rhinitis

- Establish main symptoms: itchy, sneezy, runny, etc.
  - Total duration
  - Frequency: intermittent, persistent, acute exacerbations
  - Alleviating and exacerbating factors: e.g., smoke
  - Associated symptoms: e.g., sinuses, eyes, throat, snoring
  - History of asthma, eczema, oral allergy syndrome, food allergy
  - Allergen exposure: e.g., home, hobbies, sports, occupational
  - Family history
  - Medication use: type, duration, compliance, efficacy
  - Impact on quality of life

Allergy and Asthma Proc 24:147–154, 2003

Allergic vs. Non-Allergic Rhinitis

- Broad differential includes inflammatory, irritant, drug-induced, infectious, hormonal causes
  - The term “Idiopathic Rhinitis” is now favored for cases with no defined etiology

Non-Allergic Rhinitis

- Manifestations
  - Age at onset: <20, >20
  - Triggers: Allergen exposure, Irritant, weather
  - Pruritis: Common, Uncommon
  - Post-nasal Drip: Not prominent, Prominent
  - Other allergy symptoms: Present, absent
  - Family history: Present, absent
  - Nasal eosinophils: Present, Present in 1/3

Allergy and Asthma Proc 24:147–154, 2003
In 1975, Huggins and Brostoff described a group of patients with history consistent with dust mite allergy, negative dust mite allergy tests, but positive dust mite specific IgE in nasal secretions.


**Entopy- Local Nasal Allergy**

“A local mucosal allergic disease in the absence of positive skin tests or serum IgE to the same allergen”

Term coined in 2003 by DG Powe

**Idiopathic Rhinitis may often be occult allergic rhinitis**

Multiple studies have shown TH2 inflammation, allergen-specific IgE in nasal mucus, positive nasal allergen provocation tests in ‘idiopathic rhinitis’ cases


**Non-Allergic Rhinitis with Eosinophilia Syndrome (NARES)**

- Paroxysmal sneezing, profuse watery rhinorrhea, nasal pruritis, congestion, anosmia
- Broad age range at onset
- Nasal eosinophilia but no local or systemic IgE mediated hypersensitivity


**When Should we Perform Allergy Tests On Our Patients?**

The mainstay of diagnosis of allergic disease is the history

Testing is performed to:
- 1) confirm the diagnosis
- 2) identify clinically significant allergens
- 3) determine the degree of sensitivity

**Indications for Allergy Testing: Results of a US-based Survey of Otolaryngologists**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>For patients with symptoms of allergies to establish the diagnosis and direct avoidance measures</td>
<td>25.8%</td>
</tr>
<tr>
<td>For patients that have failed treatment with appropriate pharmacotherapy</td>
<td>45.1%</td>
</tr>
<tr>
<td>When considering immunotherapy as an additional treatment option</td>
<td>23.1%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
</tr>
</tbody>
</table>

Results presented as % of respondents.

Which Allergens should we use to Test?

- dust mites
- common molds
- pets
- insects
- major allergenic pollens
- other prevalent airborne allergens in your area and patient population

In a US based survey study, the most common number of aeroallergens tested ranged from 11 to 20.

Prick testing is the most common form of allergy skin testing

Antigen is either placed on skin or “dipped”

Skin is then “pricked” with sharp device

Interpretation:
- Wheal diameter > 3mm (larger than negative control) is considered significant
- Erythema (flare) and itching are part of a positive response

Intradermal Dilution Tests (IDT)

Allergen specific immunotherapy is the only treatment we have that alters the natural course of allergic disease

- Immunotherapy reduces the development of new sensitizations
- Immunotherapy prevents the development of asthma
- Immunotherapy induces tolerance that lasts beyond the treatment period
Indications for Immunotherapy: Allergic Rhinitis

Patients uncontrolled on optimal pharmacotherapy

Patients in whom pharmacotherapy induces undesirable side effects

Patients not willing to be on long term pharmacotherapy

Pharmacotherapy for allergic rhinitis

The selection of pharmacotherapy for a patient depends on multiple factors:

- Symptom profile
- Cost/availability
- Patient compliance/ease of administration
- Response to previous treatment
- Pathophysiology of disease
- Associated medical conditions
- Side effect profile

Topical Decongestants

- Oxymetazoline, phenylephrine
- May be superior to INS for nasal congestion
- Local stinging or burning, sneezing, dryness
- Prolonged use not recommended; rebound and dependence may be lessened by use with nasal steroid

Oral Decongestants

- Pseudoephedrine, Phenylephrine
- Effective at relieving nasal congestion
- Side effects = insomnia, irritability, palpitations
- Phenylephrine appears less effective than pseudoephedrine
- Use with caution in patients with hypertension, bladder neck obstruction, closed angle glaucoma, hyperthyroidism, cerebrovascular or cardiovascular disease
- Use in infants and young children has been associated with agitated psychosis, ataxia, hallucinations, death. Therefore use in children under 6 with caution.

Oral Antihistamines

- Fexofenadine, cetirizine, levocetirizine, desloratadine, loratadine
- Can be used for episodic symptoms
- Effective for control of rhinorrhea, sneeze, and itch
- Often the first line treatment for allergic rhinitis
- Little effect on nasal congestion

Oral Antihistamines

- Less effective than INS; equivalent to INS for ocular symptoms
- Generally ineffective for non-allergic rhinitis; therefore other options better for mixed rhinitis
- Among the 2nd gen agents, no one agent has conclusively demonstrated superior efficacy
Oral Antihistamines

- 2nd generation antihistamines preferred over 1st generation agents because less:
  - sedation
  - performance impairment
  - anticholinergic effects

- Less effective for nasal congestion than other options

Topical Intranasal Antihistamines

- Azelastine, Olopatadine
- Efficacy ≥ oral 2nd generation antihistamines
- Efficacy for congestion symptoms
- Combination with intranasal corticosteroid shows added benefit

Topical Intranasal Antihistamines

- Rapid onset of action = episodic or PRN use
- Efficacy compared to INS not established
- Appropriate option for mixed rhinitis
- Bitter taste and/or sedation

Nasal antihistamines and steroids may have equivalent efficacy

Olopatadine vs. Fluticasone for SAR


Anticholinergics

Ipratropium bromide
- Decreases watery rhinorrhea
  - Does not reduce:
    - Congestion
    - Irritation
    - Itching
    - Sneezing
- 0.03% and 0.06% strengths

Leukotriene Receptor Antagonists

- Effective for SAR and PAR
- Comparable efficacy to antihistamines; use with antihistamines may be additive
- Montelukast approved down to 6 mos.
- Approved for both rhinitis and asthma; May be useful in patients with both conditions

NOT RECOMMENDED AS FIRST LINE TREATMENT FOR ALLERGIC RHINITIS

**Systemic Corticosteroids**

- A short course may be appropriate for severe symptoms, especially if nasal polyposis present
- Can be administered parenterally, or injected intranasally
- Recurrent administration of systemic corticosteroids has potential for long term corticosteroid side effects

**Intranasal Corticosteroids**

- Very effective medications for AR
- Effective for all symptoms of SAR and PAR, including congestion
- Appropriate choice for mixed rhinitis
- Clinical response about equal for all currently available INS
- May benefit ocular allergy symptoms; similar to oral antihistamine

**Intranasal Corticosteroids**

- More effective than oral antihistamine ± LT antagonist
- Onset of action b/w 3-12 hrs. More effective with continuous use
- Not generally associated with systemic side effects
- Older agents associated with growth suppression in children
- May cause bleeding, irritation, septal perforation

**Topical antihistamine + Topical steroid is better than either alone**

**Treatment of Non-Allergic Rhinitis**

- Avoid triggers
- Nasal saline
- Nasal steroids
- Intranasal antihistamines
- Intranasal ipratropium
- Oral decongestants

**Summary**

- The HISTORY is the most powerful diagnostic tool in managing chronic rhinitis
- Allergy Testing can confirm the diagnosis of allergic disease and allows for allergen specific immunotherapy as a treatment approach
- A wide variety of effect medications are available for the treatment of allergic and non-allergic rhinitis
Anaphylaxis

Mohamad R. Chaaban, M.D, MSCR, MBA, FACS, FAAOA
Assistant Professor
University of Texas Medical Branch
November 3rd, 2017

Outline
• Introduction: Definition, pathophysiology and differential diagnosis of anaphylaxis
• Allergen Immunotherapy: Systemic reactions
• Prevention of anaphylaxis
• Management of anaphylaxis

Anaphylaxis – Definition
• Coined by Paul Portier and Charles Richert in 1901
  ➢ Experimenting with venom extracts from sea anemone in the intention to “immunize” dogs
  ➢ Dogs received initial dose
  ➢ Mortalities occurred with second dose
  ➢ Dose independent
  ➢ Coined term “aphylaxis” from Greek: a = against phylaxis = protection

“Something that can be treated if properly recognized”

Anaphylaxis

Disclosures
• No financial disclosures
• Off-label use of sublingual immunotherapy

Allergic Emergencies
How could it affect me?
“I just took my shot and left the office and started developing hives and wheezing, already injected Epipen, what shall I do next?”

Anaphylaxis Definition

<table>
<thead>
<tr>
<th>EAACI</th>
<th>WAO</th>
<th>NIAID</th>
<th>AAAAI/ACAAAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A severe life-threatening generalized or systemic hypersensitivity reaction</td>
<td>A serious life-threatening generalized or systemic hypersensitivity reaction</td>
<td>Serious allergic reaction that involves more than one organ system (e.g., skin, respiratory tract and/or gastrointestinal tract). It can begin very rapidly, and symptoms may be severe or life-threatening</td>
<td>An acute life-threatening systemic reaction with varied mechanisms, clinical presentations, and severity that results from the sudden release of mediators from mast cells and basophils</td>
</tr>
</tbody>
</table>

EAACI: European Academy of Allergy and Clinical Immunology
WAO: World Allergy Organization
NIAID: National Institute of Allergy and Infectious Disease
AAAAI/ACAAI: American Academy of Allergy, Asthma, and Immunology

Panesar et al. Allergy 2013
Simons et al. World Allergy Organ. 2011
Anaphylaxis Epidemic?

- Canada 2007-2013: 35%
- USA 1999-2009: 2.2% yr
- Australia 1997-2013: 15%
- UK 1992-2012: 8%

USA 1999-2009: 2.2% yr

Anaphylaxis Fatalities

- Canada 2007-2013: No increase
- USA 1999-2009: No increase
- Australia 1997-2013: No increase
- Canada 2007-2013: No increase

0.064-0.099 deaths per 100,000 population per annum

Anaphylaxis – Etiology

- Food
- Venom
- Medications
- Idiopathic
- Other

Fatal Anaphylaxis Etiology

- N=2,458 Anaphylaxis deaths
- 1999-2010
- U.S National Mortality Database

Anaphylaxis vs Anaphylactoid

- Sensitization: Required, Not required
- Occurs on first exposure: No, Yes
- Antigen/Allergen load: Very little, Usually more than Anaphylaxis

Clinically similar
IgE-Mediated
Non-IgE-Mediated
Mast cell
Preformed
Histamine
Eosinophil chemotactic factor
Neutrophil chemotactic factor
Kallikreins
Others (proteases, etc)
Newly synthesized
Leukotrienes
Prostaglandins
Platelet-activating factor
Lipoxygenase products
Others

Medications: Radiocontrast agents
Physical factors: Temperature, pressure, exercise
Psychogenic: Anxiety, stress, etc.

Anaphylaxis vs Anaphylactoid

Anaphylaxis – Signs and Symptoms

<table>
<thead>
<tr>
<th>System</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutaneous (Urticaria, angioedema, flushing, itching without rash)</td>
<td>&gt; 90 %</td>
</tr>
<tr>
<td>Respiratory (Dyspnea, wheezing, upper airway angioedema, rhinitis)</td>
<td>60%</td>
</tr>
<tr>
<td>Abdominal (Nausea, vomiting, abdominal cramps, and diarrhea)</td>
<td>30%</td>
</tr>
<tr>
<td>Cardiovascular (Tachycardia, hypotension, dizziness, syncope)</td>
<td>30%</td>
</tr>
<tr>
<td>Other (Headache, substernal pain, seizure)</td>
<td>1-8%</td>
</tr>
</tbody>
</table>

Anaphylaxis—Diagnostic Criteria

Acute onset of:
Likely Allergen Known allergen
Infants/children: low SBP (age specific) or > 30% reduction in SBP
Adults: SBP <90 mmHg or >30% decrease from baseline

Differential Diagnosis

Respiratory
- Severe asthma, foreign body aspiration, pulmonary embolism
Loss of consciousness
- Vasovagal reaction, seizure disorder, myocardial infarction, arrhythmias
Flushing syndromes
- Carcinoid, vasointestinal polypeptide tumors, systemic mastocytosis, medullary carcinoma of the thyroid
Restaurant syndromes
- Non organic
  - Hyperventilation syndrome, panic attacks, vocal cord dysfunction, Munchausen’s syndrome
  - Capillary leak syndrome, red man syndrome (vancomycin), hereditary angioedema with rash, pheochromocytoma

Vasovagal Reaction vs Anaphylaxis

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Vasovagal reaction</th>
<th>Anaphylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>Pulse: Slow</td>
<td>Pulse: Rapid</td>
</tr>
<tr>
<td></td>
<td>Blood pressure</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>(recumbent)</td>
<td>Low</td>
</tr>
<tr>
<td>Skin</td>
<td>Color: Pale</td>
<td>Color: Red</td>
</tr>
<tr>
<td>Rash</td>
<td>No rash</td>
<td>Urticaria</td>
</tr>
<tr>
<td>Temperature</td>
<td>Cool</td>
<td>Warm</td>
</tr>
<tr>
<td>Perspiration</td>
<td>Profuse</td>
<td>Little</td>
</tr>
</tbody>
</table>
**Anaphylaxis Time Course**

- **Initial symptoms**
- **Up to 20%:** Biphasic anaphylaxis
- **Up to 72 hrs**
- **Time to presentation:** Depends on allergen route

**Biphasic Anaphylaxis**

- Recurrence of symptoms meeting NIAID criteria, occurring AFTER resolution of initial symptoms and WITHOUT re-exposure to the trigger
- **Rate:**
  - Adults: 0.4-3.9%
  - Children: up to 14.7%
- **Time to presentation of the second reaction**
  - Adults: Median time 3-17 hrs
  - Reported as late as 72 hrs
  - Children: 75% present prior to ED discharge (within 6 hours)
  - Median time of 18.5 hrs
  - As late as 29 hours

**Systemic Reactions to Immunotherapy**

- Prevalence of systemic reactions (SRs) ranges from < 1% in patients with conventional subcutaneous immunotherapy (SCIT) and up to 34% with rush immunotherapy
- **Delayed SRs**
  - Occur after 30 minutes
  - Reported in 14-50% of SRs
- **Biphasic reactions reported in 1-23%**
  - Scantlon et al 2009, prospective study 60 SR, 23 % biphasic
  - NIAID criteria not used
  - Biphasic reactions were more common in women, older people, and those requiring more than one dose of epinephrine
  - No difference with asthma diagnosis, or steroid use

**WAO SCIT Systemic Reaction Grading System**

<table>
<thead>
<tr>
<th>Grade</th>
<th>One organ system involvement</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st sx/sign</td>
<td>Time of onset of first symptom (Grade 2a,b,initial:10 minutes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Immunotherapy Related Anaphylaxis Risk Factors**

- Patient factors: Controlled asthma
- Children
- Peak season
- Degree of sensitivity
- Medication: β-blockers, ACE inhibitors
- Build up
- New vial
- Vial error
- Previous SR
Uncontrolled Asthma

- Amin et al. 2006 (AAAAI 1990-2001 survey)
  - Asthma present in 46% of near fatal reactions (NFRs)
  - Most severe NFRs occurred exclusively in asthmatics
  - FEV1 < 70% increased the risk of SRs

- Epstein et al. 2016 (AAAAI 2008-2013 survey)
  - No significant association between avoiding SCIT based on FEV1 and the risk of SRs of any severity
  - Among 429 practices that utilize Asthma Control Test (ACT)
    → Significant reduction of grade 3 and 4 SRs if SCIT is avoided in ACT <20

Children at Higher Risk?

- N=270
- Incidence SR ~0.2%
- Overall: Unadj IRR=1.83
- Adj IRR=1.58
- G1/2: Unadj IRR = 2.25
- Adj IRR= 1.89

Dosing Errors

- Amin et al. 2006 (AAAAI 1990-2001 survey)
  - 15/68 (~22%) of NFRs were due to dosing errors

- Aaronson et al. 2004 (survey-5 yrs of allergy practice)
  - 74% reported at least one incorrect dose administered
  - 58% reported at least one event when patient given an injection from the wrong vial
  - Effects ranged from local reactions to one fatality

Degree of Sensitivity/Peak Season

- Daveiga et al. 2011 Retrospective review of 16,375 SCIT injections
  - SR 6x higher when >33% (13/38) of skin tests were 3-4+
  - SR increased 17% for each additional 4+ skin test

- Epstein et al. 2016 (AAAAI 2008-2013 survey)
  - doses during pollen season for patients with highly positive skin tests (pseudopods or positive tests > 50% of aeroallergens)
    → Significantly reduced risk of SRs of all severity.

Medications

- Potential problems with β-blockers
  - SRs more frequent (enhance mediator release)
  - Severe (intensify the effects of mediators)
  - Refractory to treatment (epinephrine less efficacious)

- Studies still controversial for β-blockers – grade C recommendation to withhold IT

- ACE inhibitors
  - Insufficient evidence to indicate withholding ACE inhibitors (except for venom immunotherapy)
Are Systemic Reactions to SCIT Decreasing?

AAAAl national survey on allergen immunotherapy (2008-2013)

28.9 million injections

Overall stable SR rate per 10,000 injections

Are SCIT Fatalities Decreasing?

- Bernstein et al. 2004 (AAAAI 1990-2001 survey)
  - Near fatal reaction in every 1 million injection
  - 17 fatalities
  - Fatal reactions 1 in 2.5 million injections

- Epstein et al. 2016 (AAAAI 2008-2013 survey)
  - 4 in 28.9 million injections

Immunotherapy Safety

Fatalities

Epstein et al. 2016 (AAAAI 2008-2013 survey)

- 4 confirmed fatalities from SCIT
  - 2009 under care of allergist/immunologist
    - Buildup phase with advancement during peak weed season
    - Epinephrine initially utilized subcutaneous instead of intramuscular
  - 2012-2013 under care of otolaryngologist
    - Patient did not comply with 20-30 min wait and collapsed outside the office
    - History of asthma
    - Epinephrine reportedly NOT available and not administered
  - 2014 under care of allergist/immunologist
    - Correct vial and dose, unknown if maintenance or buildup
    - No risk factors identified
    - Under care of family practice physician
  - No details provided

Are SCIT Anaphylactic Events Avoidable?

Mattos et al. IFAR. 2015

0/8948 0/6874

SR: 0.02% Per year

Are IT-Related Anaphylactic Events Avoidable?

- 9 patients with severe systemic reactions (all at least grade II), no grade IV or V
- 2 patients with identification error
- 1 compounding error (0.5 ml instead of 0.15ml)
- 2 advancement during pollen season
- 1 no clear reason, but asthma as risk factor

Quality Measures

- Standardization of allergy training and delivery of care
  - Internet based modules
  - Bi-weekly educational conferences
  - Vial testing
  - 2 person vial verification
  - Yearly training with written certification
  - Centralization of serum compounding
- Quarterly mock anaphylaxis drill
- Checklists for audits of allergy satellite clinics
  - Availability of epinephrine and proper equipment
  - Adherence to protocols for safe delivery of allergen immunotherapy
Is SLIT Safer?

SCIT vs SLIT:
Grade 1 SRs equivalent
Grade 2&3 > SCIT
No Grade 4 or 5 in SLIT!

Management of Anaphylaxis:

Management – Immediate Measures

AT ALL TIMES

Airway

Breathing

Circulation

Inject IM Epinephrine

Get help, Delegate 911 call

Management – Epinephrine

• Aqueous epinephrine 1:1000 (1mg)
• Adult Dose: 0.3-0.5 ml IM
• Child dose 33-66 pounds:
  0.01 mg/kg, max 0.3mg
• Lateral thigh (vastus lateralis)
• Repeat every 5-15 min
• Epinephrine infusion: 1 mg (1ml of 1:1000) to 1,000 ml of 0.9% normal saline at 2 microg/cm (2ml/min=120ml/hr) increase up to 10 ug/min(10ml/min=600 ml/hr.)

Medication: Autoinjectable Epinephrine

Position

Oxygen, Reduce allergen & Repeat Epi

IV Access & Fluids

Management – Immediate Measures

Airway:

Ambu-bag and mask, intubation, emergency airway

Breathing:

Stethoscope, pulse oximeter, oxygen (mask/cannula)

Circulation:

Sphygmomanometer, IV access supplies, IV fluids

Medications:

– Epinephrine 1:1000 wt/vol
– Corticosteroids (IM or IV)
– Antihistamines (H1, H2 blockers)
– Inhalers: Albuterol, Ipratropium bromide
– Glucagon kit
– Other: Dopamine

Lieberman 2010. Practice Parameter Update. JACI
Management – Additional Measures

**Bronchodilators**
- Inhaled short acting bronchodilator (Albuterol)
  - MDI: 2 puffs repeat as necessary
  - Nebulizer: 2.5-5 mg in 3 ml saline repeat every 15 min
- Inhaled ipratropium (anticholinergic)
  - MDI: 2 puffs every 4 hours, 12 years and above
  - Nebulizer: 250 ug in 1 ml saline

**Glucagon**

**Epinephrine Infusion /Dopamine**

Management – Bronchodilators

Management – Optional Measures

**Antihistamines**
- H1 blockers (Diphenhydramine)
  - Adult: 100 mg IV or IM
  - Pediatric: 1 mg/kg IV push
- H2 blockers (Ranitidine)
  - Adult: 50 mg IM or IV
  - Pediatric: 2 mg/kg max 50

**Corticosteroids**

**Other – Vaspressors, Magnesium**

Management – Antihistamines

Management – Corticosteroids

Unclear benefit for biphasic reaction
- Dexamethasone
  - 10-20 mg IV/IM once
- Methylprednisone
  - 125 mg IV/IM once
- Hydrocortisone
  - 250-500 mg IV/IM once

Anaphylaxis – Aftermath

- Observe patient for biphasic reaction
- Debrief and review why incident occurred
- Make sure patient fills Rx for autoinjectable epinephrine
- Replenish supplies
- Identify factors to reduce re-occurrence
- Educate patient and staff
Summary

• Recognize signs and symptoms of anaphylaxis
• Administer epinephrine ASAP
• Follow anaphylaxis treatment protocol
• Educate staff and patients
• Prevention is key!

Thank You!
Eustachian Tube Dysfunction
Diagnosis and Treatment
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No financial disclosures or conflicts of interest

Agenda
• ETD in the adult population
• Diagnosis of ETD
• ETD and CRS
• Management of ETD

ETD in Adults
• >2 million clinic visits annually for ETD/OME/TMR
• Demographics
  • Females more commonly affected (OR 2.18)
  • No regional differences
  • No seasonal differences
  • Lower prevalence in adults compared to those <20 years of age
  • Visit ratio 0.77

ETD in Adults
• Limited data in adult population
• Most studies have included children and adults
Diagnosis of ETD
- Dilatory dysfunction
- Barometric dysfunction
- Patulous dysfunction
- Exist on a continuum

Dilatory Dysfunction
- Functional obstruction
- Dynamic dysfunction (muscular)
- Anatomical obstruction

Baro-challenge-induced Dysfunction
- Symptoms with changes in environmental pressure
- Frequent fliers
- Scuba divers
- Symptoms typically resolve with return to ground level, although may persist temporarily

Patulous Dysfunction
- Aural fullness
- Autophony
- Habitual sniffing
- Abnormally patent eustachian tube

Objective Tests
- Otoscopy/Otomicroscopy
- Tympanometry
- Audiometry/Tuning Forks
- Nasopharyngoscopy
- No perfect test, used in combination with clinical history

Signs
- Tympanic membrane retraction
- Temporal bone imaging, excluding temporal bone fractures
- Nasopharyngoscopy

Diagnosis
- Scores ETM
- Chronic ETM
- Patulous ETM
Understanding ETD Symptoms

**ETDQ-7**
- Discriminant Validity
  - Mean item score >2.1, 100% sensitive and specific
- Internal Consistency
  - Cronbach $\alpha = 0.77$
- Test-Rest Reliability
  - Spearman correlation = 0.78
- Concurrent Validity (SNOT-22)
  - Spearman correlation = 0.63

**ETDQ-7 and Patulous Dysfunction**
- ETDQ-7 does not discriminate patulous dysfunction from other types of ETD
- Cronbach $\alpha = 0.765$ in patients with patulous dysfunction
- Mean item score 3.2

**ETD and CRS**
- 213/492 (43.3%) of patients with primary rhinologic complaint with ETDQ-7 score >2.1
- Total SNOT-22 and subdomains correlated with ETDQ-7

<table>
<thead>
<tr>
<th>SNOT-22 Score</th>
<th>Pearson</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Total SNOT-22</td>
<td>0.679</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Otologic SNOT-22</td>
<td>0.847</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Rhinologic SNOT-22</td>
<td>0.486</td>
<td>&lt;0.001</td>
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</tbody>
</table>

**Management of ETD**
- Medical
  - Antihistamines
  - Topical nasal steroids
  - Oral steroids
- Autoinsufflation
- Surgical
  - Myringotomy/Pressure Equalization Tube
  - Eustachian tube balloon dilation
Eustachian Tube Balloon Dilation

- **Indications**
  - Adults ≥22 years of age
  - Persistent dilatory or barometric ETD
  - Type B/C tympanogram
  - ETDQ-7 mean item score >2.1

- **Contraindications**
  - Dehiscent internal carotid artery (CT required)
  - Patulous ETD

Data for ET Balloon Dilation


Data for ET Balloon Dilation


Summary

- **Types of ETD**
  - Dilatory
  - Barometric
  - Patulous

- ETD symptoms are common in adult patients
- ETD symptoms are common in patients with sinonasal complaints

Summary

- Traditional management for ETD
  - Medical
  - Myringotomy/PE tube

- Eustachian tube balloon dilation as an alternative
  - Appropriately selected patients
FRIDAY, NOVEMBER 3

7:00 AM  Registration/Breakfast

7:45 AM  Welcome
Martin J. Citardi, MD

Session: Rhinology Fundamentals
Amber Luong, MD, PhD (moderator)

8:00-8:20 AM  Endoscopic anatomy & CT correlates
Philip Chen, MD

8:20-8:40 AM  Chronic rhinosinusitis diagnosis
K. Christopher McMains, MD

8:40-9:00 AM  Headache
Drew Plonk, MD

9:00-9:25 AM  Chronic rhinosinusitis pathophysiology & clinical implications
Amber Luong, MD, PhD

9:25-9:50 AM  Primary CRS management panel
Amber Luong, MD, PhD (moderator); Mohamad Chaaban, MD; Philip Chen, MD; Drew Plonk, MD; Matthew Ryan, MD

9:50 AM  Break

Session: Primary Nasal & Sinus Surgery
William Yao, MD (moderator)

10:20-10:45 AM  Five anatomic landmarks
Ralph Metson, MD

10:45-11:05 AM  Septum & turbinate surgery
Ashleigh Halderman, MD

11:05-11:30 AM  My 30 years in rhinology
Ralph Metson, MD

Session: Rhinitis & Eustacian Tube
Matthew Ryan, MD (moderator)

11:30-11:55 AM  Rhinitis diagnosis and treatment
Matthew Ryan, MD

11:55 AM-12:15 PM  Anaphylaxis
Mohamad Chaaban, MD

12:15-12:35 PM  Eustachian tube dysfunction diagnosis and treatment
Michael Marino, MD

12:35 PM  Lunch

Session: Optimizing Chronic Rhinosinusitis Outcomes
Martin J. Citardi, MD (moderator)

1:00-1:30 PM  Surgery Complications
Pete Batra, MD

1:30-1:50 PM  Navigation
Martin J. Citardi, MD

1:50-2:10 PM  Postop care
William Yao, MD

2:10-2:30 PM  Role of steroids
Bradley Marple, MD

2:30-2:50 PM  Implants
Bradley Marple, MD

2:50-3:10 PM  Microbiome & topical antibiotics
Seth Isaacs, MD

3:10-3:30 PM  Biologics
Kent Lam, MD

3:30 PM  Break

Session: Frontal Sinus Surgery
William Yao, MD (moderator)

3:55-4:15 PM  Primary frontal sinus surgery
William Yao, MD

4:15-4:35 PM  Revision frontal sinus surgery
Li-Xing Man, MD
Objectives:
1. To understand the spectrum and major and minor complications in sinus surgery
2. To review the causes and management of adhesions
3. To discuss the management of orbital complications during FESS
4. To outline the management strategy for iatrogenic CSF leaks
Complications of Sinus Surgery

Pete S. Batra, MD, FACS
Stanton A. Friedberg, MD, Chair in Otolaryngology
Professor and Chairman
Co-Director, Rush Center for Skull Base and Pituitary Surgery
Dept. of Otorhinolaryngology – Head and Neck Surgery
Rush University Medical Center
Chicago, Illinois

PSB Disclosures
- Advisory Board: Optinose, Regeneron
- Research Grant: Medtronic
- Royalties: Springer

Background

"If it were placed in any other part of the body, [the ethmoid] would be an insignificant and harmless collection of bony cells. In the place where nature has put it...diseases and surgery of the labyrinth often lead to tragedy. Any surgery in this region should be simple, but it has proven to be one of the easiest ways to kill a patient."

Mosher HP. Transactions of the 34th Annual Meeting of the American Academy of Ophthalmology and Otolaryngology. 1929.

Sinus Surgery and Medical Malpractice

- LexisNexis Jury Verdicts and Settlements database
- 85 cases 42 decided by jury and 43 adjudicated out of court
- Endoscopic sinus surgery most commonly litigated
- Plaintiff favored for eye injury (p = 0.0196)
- Defendant favored for neurologic injury (p = 0.0137)
- Payments significant for both out-of-court settlements ($1.3 million) and jury verdicts ($2 million)


ESS Complications

Major Complications | Percent  
--- | ---  
Intracranial | 0.47%  
Orbital | 0.05%  
Hemorrhage | 0.19%  
Lacrimal | 0.14%  
Overall | 0.85%

Minor Complications | Percent  
--- | ---  
Orbital | 1.7%  
Epistaxis | 0.6%  
Bronchospasm | 1.8%  
Adhesions | 1.7%  
Other | 6.9%  
Overall | 6.9%

ESS Complications: Incidence


Potential Risk Factors

- 997 patients
- Overall rate 7.8%, major 0.5%, minor 7.3%
- Major: CSF leak (2), MR injury (1), orbital hematoma (2)
- Minor: Excessive intraop bleeding (32), lamina breach (26), postop bleeding (13)
- Multivariate analysis showed complication rate linked to:
  - Advanced Lund-Mackay score
  - Mesenteric type of anterior ethmoid artery
  - Inexperienced surgeon

Adhesions

- **Avoid mucosal stripping!!!**
- Setup for prolonged healing phase
- Risk of neo-osteogenesis
- Ultrastructural studies show:
  - Loss of cilia
  - Submucosal gland loss
  - Basal lamina and lamina propria fibrosis

Bleeding

- Ranges from mild postoperative epistaxis to intraoperative ICA injury
- Average blood loss
  - ≤120 cc for bilateral ethmoidectomy
  - ≥200+ cc for polyposis/revision surgery
- Most common complication reported by Stankiewicz et al. (3402 patients)
  - 41 (1.2%) total cases:
    - Intraoperative (4)
    - Postoperative (37)

Adhesions: Management

- Metabolic surgical technique
- Use thru-cutting forceps
- Judicious use of shavers
- Commitment to postop care
- Middle turbinate pexy suture
- Middle meatal spacer

Adhesions: Preventive Measures

1. Preoperative medical therapy (antibiotics, steroids) to control sinonasal inflammation
2. Beware anticoagulants and herbals
3. Head of bed position (reverse Trendelenburg)
4. Anesthetic technique (TIVA)
5. Topical vasoconstrictors (1:1,000 epinephrine)
Postop Bleeding: Endoscopic SPA Ligation

- Overall success rate 87%
- SPA ligation associated with:
  - Shorter hospital stay (p = .02)
  - Treatment cost (p = .03)


Bleeding: Risk of Carotid Injury

- Assess ICA position and bony integrity during all sphenoid surgery!!!
- ICA bulge in sphenoid: 98%¹
- Bony thickness <0.5 mm: 88%¹
- Bony dehiscence: 19.5%²
- Direct septal insertions 37.5%²


Risk of Carotid Injury

- 25 articles with 50 cases
- Inflammatory disease in 16 cases
- Skull base procedures in 34 cases
- Most commonly injured ICA segment was cavernous in 34 cases (mean EBL 1.7 L)
- Initial hemostasis was achieved with packing (35), endoscopic clip sacrifice (4), bipolar coagulation (4)
- Persistent neurologic deficits in 5 cases
- 15 died from ICA injury


Spectrum of Orbital Injuries

1. Nasolacrimal duct injury
2. Orbital fat exposure
3. Orbital hematoma
4. Extraocular muscle injury
5. Optic nerve injury
6. Enucleation

Nasolacrimal Duct Injury

- Epiphora reported 0.3 – 1.7% cases
- Lacrimal drainage injury in FESS*
  - 46 LDS (24 patients) irrigated with fluorescein dye
  - Dye in middle meatus 7 sides (15%) intraop
  - Dye in middle meatus in 2 sides postop
  - Spontaneous healing in 3 sides postop

  *Occult damage to the NLD would appear to be a common event...the complication of postoperative epiphora is rare.”

Nasolacrimal Duct Injury: Prevention

- NLD 1 to 8 mm anterior to root of uncinate process
- Mean thickness of lacrimal bone < 100 µm
- Bone absent in 20%
- Utilize 30°, 45° and 70° scopes
- Careful retrograde dissection
- Avoid bone anterior to UP


Nasolacrimal Duct Injury: Management

- Prompt recognition!!!
- Meticulous debridement
- Antibiotics +/- steroids
- Monitor closely for symptoms
- Late DCR if symptomatic epiphora


Orbital Injury: Beware Dehiscence!!!

Etiology:
1. Inflammatory disease
2. Tumors
3. Previous surgical manipulation
4. Orbital trauma
5. Natural dehiscence (6.5%)


Orbital Injury: Prevention

- Leave eyes uncovered....
- Lubricating eye ointment and thin steristrip
- Palpate eyes preop
- Routinely inspect eyes intraop for edema and ecchymosis

Orbital Fat Exposure

- Confirm by globe palpation
- DO NOT manipulate or resect fat!!!
- Monitor for signs of orbital hematoma
- May still complete procedure
- No nasal packing
- No nose blowing


Consequences of Orbital Fat Exposure....

- 1600 ESS cases
- 33 cases of orbital entry
- 15 with functionally insignificant periorbital ecchymosis
- 1 orbital hemorrhage
- 4285 ESS cases
- 28 cases with orbital fat exposure
- No orbital issues

Orbital Hematoma

- From venous oozing or AEA (rarely PEA) injury
- Venous: arterial bleed ratio of 17:3 (Stankiewicz 2011)
- Increased intra-orbital pressure
- Venous outflow obstruction
- Central retinal artery vasospasm
- Stretch injury from proptosis?
- Blindness reported within 60 to 90 minutes

Orbital Hematoma: Management

- Intervention: IOP > 40 mm Hg, afferent pupillary defect, poor or worsening visual acuity, or severe retro-orbital pain
- Lateral canthotomy and inferior cantholysis: relieves 14-30 mm Hg
- Medial orbital decompression: relieves 10 mm Hg

Rapid hematoma

- Usually arterial (AEA/PEA)
- Remove packing
- Emergent canthotomy/cantholysis
- Ophtho evaluation
- Medical tx: mannitol, steroids, acetazolamide
- Canthotomy/ cantholysis if worsens

Case: Orbital Hematoma

- Slow hematoma

- Usually venous
- Remove packing
- Vision/EOM check
- Ophtho evaluation
- Medical tx: mannitol, steroids, acetazolamide
- Canthotomy/ cantholysis if worsens

Extraocular Muscle Injury

- Incidence: 1 per 735 FESS procedures\(^1\)
- Diplopia 2° muscle contusion, transection, or fibrosis
- Medial rectus most commonly injured
- 11 of 14 reported cases\(^2\)
- Presents with diplopia on medial gaze

Extraocular Muscle Injury: Treatment

- Surgical goal: reestablishment of a binocular single visual field
- Immediate exploration for entrapment only
- Exploration in 3-4 weeks to minimize scar contracture

Intraoperative

- Re-approximate muscle
- Tag ends with suture

Postoperative

- Primary or muscle-to-muscle anastomosis
- Botulinum toxin, prisms, strabismus surgery
Case: Medial Rectus Injury

Immediate postop

3-month postop

Skull Base Injury

- CSF leak
- Pneumocephalus
- Meningitis
- Intracranial hemorrhage/stroke
- Frontal lobe injury

Danger areas:
- Low lying skull base
- Asymmetric skull base
- All 50 sides asymmetric (right lower in 28 cases)\(^1\)
- Median height of LLCP was 2.4 mm\(^1\)
- Ethmoidal sulcus thickness (0.05 mm)\(^2\)

Posterior Ethmoid Height Relative to Maxillary Sinus

- Significant maxillary pneumatization results in a relatively smaller posterior ethmoid
- Less room to operate
- Dissection closer to skull base

Skull Base Injury: CSK Leak

- Intraoperative CSF leak in 0.2 – 1.1% of cases
- Clear drainage from superior nasal cavity washes away blood
- "Excessive bleeding near skull base*

- Location: Cribriform plate adjacent to AEA, posterior ethmoid
- 10%/year risk of developing meningitis*

Skull Base Injury: CSK Leak

- 32 iatrogenic leaks in 6908 cases (0.46%)
- Right side: 56.3%
- Delay in diagnosis: 31.3%
- Most common location: anterior ethmoid at MT attachment (43.7%)
- Initial repair successful in 87.5%

Potential risk factors:
- Compared 7 intraop CSF leaks with 100 uneventful cases
- ESS performed by resident or junior staff in 6 of 7 cases
- Skull base asymmetry in 4/7 cases (57%) vs. 18/100 (18%) (p=.032)

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CSK Leak: Management

- Small defects 1-3 mm (overlay graft suffices)
- Large defects >5 mm (multilayer closure)
- Lumbar drain selected cases only
- Prophylactic antibiotics?
- Treated 2.5% vs. untreated 10% (p=0.006)¹
- Meta-analysis: did not prevent meningitis (OR = 1.15, p = 0.678)²

- Recognize and repair intraop!!!
- 1st reorient (correlate endoscopy with CT)


Case: Posterior Ethmoid CSF Leak

- Intimate knowledge of anatomy
- Thorough understanding and comfort in preventing and managing complications
- “An ounce of prevention is a pound of care”

Case: Iatrogenic Encephalocele

Conclusions

- Intimate knowledge of anatomy
- Thorough understanding and comfort in preventing and managing complications
- “An ounce of prevention is a pound of care”

Thanks!

Questions?
Surgical Navigation 2017

Ideal Scenario

- Small footprint
- Workflow (moving CTs, exporting data)
- Easy set-up in multiple environments
- Robust tracking (no line-of-sight, no EM interference)
- Fast & accurate registration

Ideal Navigation System

- Good tools
- Data presentation (PIP, image quality)
- Data export (stills and video)
- Image segmentation
- Augmented reality
- Advanced applications (drill, CT-MR fusion)

Surgical Navigation in Practice

- TRE > 1.5 mm
- TRE has wide standard deviation
- TRE deteriorates posteriorly in the sinonasal space
- Disjointed presentation of data (multiple screens, etc)
- Additional surgical targets undetected in 25% cases

Disclosure

- Acclarent (consultant)
- Arrinex (consultant)
- Biosense Webster (consultant)
- Factory CRO (consultant)
- Hemostasis, LLC (consultant)
- Medical Metrics (consultant)
- Medtronic (consultant)
- Optinose (consultant)
IG-FESS
Olson, Citardi. Oto-HNS, 2000

Revision sinus surgery
Distorted sinus anatomy of development, postoperative, or traumatic origin
Extensive sino-nasal polyposis
Pathology involving the frontal, posterior ethmoid and sphenoid sinuses
Disease abutting the skull base, orbit, optic nerve or carotid artery
CSF rhinorrhea or conditions where there is a skull base defect
Benign and malignant sino-nasal neoplasms

Reported TRE
Citardi, Batra (Curr Opin Otolaryngol, 2007)

1. Fried, et al. (Laryngoscope, 1997)
5. Carollo, et al. (Eur Arch Otorhinolaryngol, 2001)

TRE Distribution
Actual vs. Expected

Impact on Complication Rates
Dalgorf, et al. (Oto-HNS, 2014)
ICAR 2016 on Surgical Navigation
IFAR, 2016

- Aggregate Grade of Evidence: D (Level 2a: 1 study; Level 3b: 6 studies; Level 4: 33 studies; Table X-11)
- Benefit: Potential for reduction of complications and more complete surgery
- Harm: None identified.
- Cost: Moderate. Cost is due to additional equipment, time for setup.
- Benefits-Harm Assessment: Benefits outweigh risks, potentially outweigh costs.
- Value Judgments: Benefit is likely achieved in more difficult cases, with a higher risk of complication. Achievement of high levels of evidence are complicated by the need for very large sample sizes and possible ethical issues involving clinical equipoise.
- Policy Level: Option
- Intervention: Image guidance is an option for ESS for CRSnHP and CRSwNP.

Impact on Surgical Strategy
Straub, et al. (Laryngoscope, 2006)

- Evaluation trial of Navibase
- 89 ESS procedures performed by inexperienced (<50 cases) and experienced surgeons (>50 cases)
- Protocol for Level of Quality (LOQ) and Change of Surgical Strategy (COS)
- 47.9% of applications resulted in COS

NAVIGATION PEARLS

Tracking Technology
Options
- Electromechanical
- Optical
- Acoustic
- Electromagnetic

Dynamic Reference Frame
Surgical navigation requires:
- Skull as rigid box
- Track position of box
Fiducials, Fiducials, Fiducials

Surgical Navigation Accuracy
Target Registration Error
• TRE: How close to target?
• During surgery, TRE is a visual estimate
• Always check against known landmarks
• Accuracy may vary in different parts of the surgical volume

Practical Approach for Assessing Navigation Accuracy
Assess each xyz component separately:
X-axis:
• orbital wall
Y-axis:
• ethmoid roof
Z-axis:
• sphenoid face

Practical Approach for Determining TRE
Another Alternative
• Posterior maxillary wall gives xyz positional information
• Warning: Bent instruments
• Warning: Tracked part of instrument tip

Resolution
• Smallest measurable change detected
• In series of events, weakest link sets maximal resolution

Practical limitations
• Image pixel count
• CT slice thickness
• Tracking technology

NAVIGATION INNOVATION
Integrated Platform with Smaller Form Factor

Optical Tracking

EM Tracking Optimization

EM Tracking Optimization

EM Tracking Optimization

Tracking Volume
Microsensors

Fiagon Guide Wire

Acclarent NavWire

Distal Sensors & Rigid Balloons

Medtronic NuVent

- Rigidity problematic, especially under local anesthesia
- Rigid device placement may fracture anatomy during placement (almost like a curette)
Augmented Reality
Citardi, et al. (IFAR 2016)

Target Guided Surgery
(Courtesy Prof. Oliver Kaschke)

Conclusion
• Widespread acceptance
• Well-recognized problems
• Clinical data supports usage
• Common misconceptions
• Registration process
• Error theory
• Practical implications for troubleshooting
Postoperative Management

Introduction

• Postop management begins immediately following the completion of case
• Geared to improving outcome
• Transition to chronic medical management

Post-Operative Management

• Basic post-operative precautions
• Saline irrigation
• Oral steroids
• Antibiotics
• Pain medication
• Implants/Spacers
• Postoperative visits

Postoperative instructions

• No heavy lifting greater than 10lbs for 2 weeks
• Light activity
• No nose blowing x 2 weeks
• Cough and sneeze with mouth open
• Normal diet

Disclosure

• None

Saline irrigations

### Saline irrigations
- **Irrigations on POD 1 – BID**
- **Benefit:** well tolerated, improved postop endoscopic score and appearance
- **Harm:** Local irritation, fluid in middle ear
- **Cost:** minimal
- **Level of evidence:** B

---

### Oral Steroids
- **No significant evidence**
- **Benefit:** improved endoscopic score at followup
- **Risks:** gastritis, mood changes, increased IOP, avascular necrosis
- **Consider avoiding steroid use with concurrent use of steroid eluting stent**
- **Level of evidence:** N/A - Option
  - **Consider for polyp and AFRS case**

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### Topical Steroids
- **Benefit:** Improved symptoms and endoscopic scores
  - Significant improvement at 6 and 12 mos
  - Lengthen time to polyp recurrence
  - Risks: Headache, epistaxis, cough
  - Consider off label steroid irrigation only after failure with spray or recurrent polyposis
- **Level of evidence:** A

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### Topical decongestant
- **Benefit:** potentially decrease bleeding and swelling
- **Risk:** rhinitis medicamentosa
- **Level of evidence:** N/A - Option

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### Antibiotics
- **Benefit:** may decrease crusting
- **Use with presence of active infection**
- **Use should be tailored to type of disease**
  - CRSwNP vs CRSsNP vs AFRS
- **Recommend staph coverage with use of packing (eg Doyle splint, merocel)**
  - Cephalexin BID
  - Itraconazole an option for postoperative management of AFRS
- **Level of evidence:** B

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### Pain Medication
- **Opioid addiction has become an epidemic**
- **Push to minimize prescription**
  - 1997-2007: prescription increased 700%
  - 2016: MD wrote opioid for 66.5 per 100 pts
- **Tramadol**
  - Low potential for dependence
  - Diclofenac – 50mg q6hr
  - Alternative to opioids
  - Avoid in patient with gastric ulcers, gastritis

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**References:**
- CDC Surveillance report of drug related outcomes. 2017
**Postoperative Management**

**Spacers and Implants**

- **Benefit:** Promote healing and prevent persistent and recurrent disease
- One RCT showed decreased adhesions with debridement
- Improved Lund-Kennedy score (1.5 vs 2.9)
- Another RCT: No difference with adhesions
- All patient had middle meatus spacer and long term oral steroids
- Level of evidence: B


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**What I do**

- Middle meatus spacer – Nasopore vs PosiSep
- +/- Propel
- Gloved Merocel
- Doyle with vents if turbinate reduction performed
- Antibiotic for staph coverage
  - Eg Augmentin, Clindamycin, Bactrim DS, Keflex
- No PO steroids
- Irrigations start at POD 1
- Diclofenac, tramadol or norco for pain control

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**Postoperative debridement**

- Debridement at 1 wk- 7 Fr suction and gentle curved 8 Fr suction
- 3mm- 30 deg endoscope facing down for middle meatus
- Remove steroid eluting implants at 3 wks.
- If synchieae then will perform lysis
- Place gelfoam as a spacer to prevent resynchieae
- Resume intranasal steroid at first POV
- Tailor to the patient
Summary

- Packing – Grade B - Option
- Irrigation – Grade B - Option
- Antibiotics – Grade B - Option
- Topical steroids – Grade A - High recommendation
- Systemic steroids - Option
- Debridement – Grade B - Option
- Tailor implant/spacer to surgeon preference
- Care must be tailored to the individual patient!

Questions?
The impact of corticosteroids on surgical outcomes
Bradley F. Marple MD
Professor and Chair
Department of Otolaryngology – Head and Neck Surgery
University of Texas Southwestern Medical Center

Objectives

- Understand
  - Impact of surgery on CRSwNP
  - Which sub-populations respond favorably to steroids
  - Do ENTs use steroids?
  - How to use steroids
  - Risks of steroids

Disclosures

- None

Prevalence of Polyp Recurrence After Endoscopic Sinus Surgery for Chronic Rhinosinusitis With Nasal Polyposis
Aden A. DeCristo, MD; Jussi C. Mann, BPHR; CCRP; Andrea H. Loye, MD; MPH; Luke Reddick, MD, MSc; Annamaria A. Ail, MD, PhD; Timothy L. Smith, MD, MPH

- Obj – prevalence of NP recurrence
- Design – prospective multi-institutional cohort
  - Baseline L-M and endo scores
- Results – 363 pts followed for 18 months

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- Results – 363 pts followed for 18 months
  - Recurrence rate
    - 6 mo – 35%
    - 12 mo – 38%
    - 18 mo – 40%
- Risk factors
  - Prior surgery
  - Severity of polyposis


Objective – National Audit of ESS

Design – Prospective Cohort

Subjects – consecutive patients undergoing ESS

Outcomes – Primary – Snot-22
  – Lower scores = better health


Results

– 3128 pts followed for 36 months
– Patients with nasal polyposis constituted – 69.6%
– CRSwNP
  • Greater perceived improvement
  • Greater use of medications
  • Greater risk of revision surgery


Recurrence

– Group 1 – 25%
– Group 2 – 81%

Conclusion – eosinophils are a predictor of polyp recurrence.

The importance of local eosinophilia in the surgical outcome of chronic rhinosinusitis: A 3-year prospective observational study

Stephan Vielstein, M.D.,1 Yun Vastokas, M.D.,1 Peter M. Hjalte, M.D., Ph.D.,1,7 Mark Jennings, M.D., Phil,2 Frederick Ache, M.D.,2 Paul Van Cauwenberghe, M.D., Ph.D.2
Claire Rached, M.D., Phil,7 and Philippe Garrié, M.D., Ph.D.7

- Obj – risk stratification based upon eosinophils
- Methods – prospective
  - 221 patients
  - Tissue examined for eos, EM, FH
  - Followed for 3 years


EFFECTS OF CORTICOSTEROIDS ON EOSINOPHILS

Perioperative Corticosteroids

Corticosteroid Treatment Regulates Mucosal Remodeling in Chronic Rhinosinusitis With Nasal Polyps

- Obj – investigate oral steroids on nasal polyp remodeling
- Methods – prospective
  - Tissue samples from 18 patients with CRSwNP
  - 2 wks prednisone then transitioned to budesonide
  - IHC for MMPs
- Conclusion
  - Tissue remodeling via
    - Eosinophil infiltration
    - Decrease in collagen content
    - Regulation of tissue remodeling markers
    - MMPs


Systemic prednisone administration selectively alters granulocyte populations in nasal polyps from aspirin-exacerbated respiratory disease and chronic rhinosinusitis patients

Justin A. Edward, M.S., Minyoung Song, Ph.D.,1 Eager R. Neminath, M.D., Yoon Lee, M.D., Alan L. Nguyen, B.K., Todd E. Kingerly, M.D., Pierre H. Hwang, M.D. and Jayadev V. Nagpal, M.D., Ph.D.

- Obj – steroid impact on granulocyte populations
- Methods – controlled prospective
  - NP and adjacent ethmoid tissue sampled at time of surgery
  - 5 cohorts
    - CRSwNP w/o pred (6 each)
    - AERD w/o pred (6 each)
    - Pred (9)
- Conclusion – prednisone decreases tissue eosinophils


HOW DO ENTS USE STEROIDS?
Oral corticosteroid prescribing habits for rhinosinusitis: The American Rhinologic Society membership

John R. Scott, MD, J. Kasibhatla, M. J. Jones, Jr., MD, F.R.C.S., and Leigh J. Sowerby, MD

• Background - OCS are commonly used in Otolaryngology
• Obj – To understand the current use of OCS
• ARS Survey
• Results
  – 93 respondents
  – Most common use – CRSwNP
  – Prednisone most commonly used
  – Median starting dose – 60mg
  – Median duration – 8 days

Scott Jr., et al. Am J Rhinol Allergy 31, 22–26, 2017

Dosing of Systemic Corticosteroids

Table 3: Initial OCS dosing for rhinosinusitis subtypes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Starting Dose, median (range), mg</th>
<th>Starting Dose Duration, mean (range), days</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRSwNP-AERD</td>
<td>60 (40-80)</td>
<td>8 (2-28)</td>
</tr>
<tr>
<td>CRSwNP-AFS</td>
<td>50 (20-60)</td>
<td>6 (2-37)</td>
</tr>
<tr>
<td>CRSwNP-NOS</td>
<td>50 (20-80)</td>
<td>5 (2-11)</td>
</tr>
<tr>
<td>CRSwP</td>
<td>30 (40-60)</td>
<td>5 (1-28)</td>
</tr>
<tr>
<td>AERD</td>
<td>20 (40-60)</td>
<td>5 (1-28)</td>
</tr>
</tbody>
</table>

DOSING OF SYSTEMIC CORTICOSTEROIDS

Scott Jr., et al. Am J Rhinol Allergy 31, 22–26, 2017

Duration of Systemic Corticosteroids

Oral corticosteroid therapy in chronic rhinosinusitis without polyposis: a systematic review

Deonarine, K., and Peter H. Huang, MD

Perioperative Corticosteroids

CRS PHENOTYPES AND THE ROLE OF CORTICOSTEROIDS

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Perioperative Corticosteroids

CRS PHENOTYPES AND THE ROLE OF CORTICOSTEROIDS
Potential Benefits of Steroids

- **Preoperative**
  - Decrease in bleeding
  - Ease of operative procedure
  - Visualization
  - Decrease edema

- **Post-operative**
  - Control of inflammation
  - Epithelial remodeling
• Relatively strong literature support
• Similar findings amongst essentially all studies
  – Improved outcomes in this population of patients in several domains
    • QOL
    • Olfaction
    • Recurrence of polyps
• Dosing
  – Intermediate dose (20-40mg)
  – Longer duration (>2 weeks)

Potential Benefits of Steroids

• Preoperative
  – Decrease in bleeding
  – Ease of operative procedure
  – Visualization
  – Decrease edema
• Post-operative
  – Control of inflammation
  – Epithelial remodeling
National survey on the use of preoperative systemic steroids in endoscopic sinus surgery


**RISKS OF CORTICOSTEROIDS**

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**Preoperative Corticosteroid Oral Therapy and Intraoperative Bleeding During Functional Endoscopic Sinus Surgery in Patients With Severe Nasal Polyposis: A Preliminary Investigation**


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National survey on the use of preoperative systemic steroids in endoscopic sinus surgery

• ObJ – Pt recall of risk  
• Design – DBRCT  
• Methods  
  – 25 patients  
  – Informed consent for prednisone prescriptions  
  • Group 1 – verbal discussion  
  • Group 2 – hand-out  
  – Telephone f/u at 2-4 wks

• Hand-out  
  – Broken hip or injury to your hip  
  – Changes in your mood  
  – Elevation in blood sugar  
  – Weight gain  
  – Cosmetic changes, for example swelling of your legs or face  
  – Acid reflux or heartburn  
  – Osteoporosis or brittle bones  
  – Early formation of cataracts  
  – Glaucoma or increased eye pressure  
  – Sore or achy muscles

Conclusions: Patients in general did not remember discussing adverse prednisone risks with their physician even a short time after the discussion took place. Although the patient handout resulted in improved recall of risks following the prescription of prednisone, its importance in the informed medication consent process remains an open question.

Summary  
• Surgery, in and of itself, fails to adequately treat CRSwNP  
• CRSwNP benefits from the use of perioperative steroids, while CRSsNP lacks strong data or rationale for routine use  
• Preoperative steroids are commonly employed for CRSwNP. Data are limited  
• Dosing – empiric data.  
  – Duration – 1 – 4 weeks  
  – Dosing – approximately 0.5mg/kg/day
Treatment of CRS: examining the role of packing/stents/implants

Bradley F. Marple, MD
Chair Otolaryngology Head & Neck Surgery
Associate Dean Graduate Medical Education
University of Texas Southwestern Medical Center

Disclosures
• None

Optimal Treatment of CRS

Goals of CRS management
• Symptom relief
• Control of inflammation
• Maintenance of mucociliary function
• Minimize pharmacotherapy
• Limit use of potentially harmful medications

Goals of Surgery
• Acceptable functional outcome
  – Rapid healing
  – Control of scarring
  – Medialized middle turbinates
  – Restoration of functional status of sinuses
• Hemostasis
• Minimal discomfort

Packing Options
• Non-absorbable
• Absorbable
• Drug Eluting
• No packing

Historical Rationale for Packing
• Pro
  – Bleeding
  – Adhesions
  – Lateralization of Middle Turbinate

Rationale for Packing
• Pro
  – Bleeding
  – Adhesions
  – Lateralization of Middle Turbinate

• Con
  – Discomfort
  • Pain
  • Obstruction
  – Bleeding upon removal
  – Aspiration
  – OSA
  – Toxic Shock Syndrome
  – Scarring
  – Biofilm

Valentine R, Wormald PJ, Sindwani R.
Introductory question:

Is Nasal Packing Necessary Following Endoscopic Sinus Surgery?

Orlandi RR, Lanza DC. Laryngoscope 114: September 2004

Rationale for Packing

- Pro
  - Bleeding
  - Adhesions
  - Lateralization of Middle Turbinate

- Hypothesis:
  - Packing decreases postoperative bleeding?

Post-op bleeding

- Effect of FloSeal on post-op bleeding
- Design – RDBC
  - FloSeal vs no packing
- Subjects - ESS
  - N = 45
- Outcome measure
  - Bleeding after surgery

Rationale for Packing

• Pro
  – Bleeding
  – Adhesions
  – Lateralization of Middle Turbinate

• Hypothesis:
  – Packing decreases postoperative bleeding?
  • Infrequent need for uncontrolled bleeding
  • No difference in postoperative oozing in days following surgery
  • Slight decrease in oozing in the recovery room

Post-op Wound Healing


CONCLUSION

“In a randomized, controlled prospective clinical study, we found no significant difference between the CMC-packed side and the unpacked side with regard to several endoscopically observed parameters of wound healing. Thus, CMC packing was not found to have an appreciable effect on wound healing.”


Rationale for Packing

• Pro
  – Bleeding
  – Adhesions
  – Lateralization of Middle Turbinate

• Hypothesis:
  – Drug Delivery?

Rationale for Packing

• Pro
  – Bleeding
  – Adhesions
  – Lateralization of Middle Turbinate

• Hypothesis:
  – Packing decreases postoperative scarring?

• Con
  – Discomfort
  • Pain
  – Obstruction
  – Bleeding upon removal
  – Aspiration
  – OSA
  – Toxic Shock Syndrome
  – Scarring
  – Biofilm

Novel Concept: Use of spacer as drug delivery platform

- Steroids are effective in postoperative period following surgery in reduction of inflammation and recurrence of polyps
- Spacers or packing provide a potential platform for topical delivery
  - Lower systemic exposure
  - Higher tissue delivery of medication

Triamcinolone-Impregnated Nasal Dressing Following Endoscopic Sinus Surgery: A Randomized, Double-Blind, Placebo-Controlled Study

- Obj – impact of steroid-impregnated absorbable dressing
- Design – PRDBPC
  - 19 pts with CRSwNP ESS
    - Nasopore + Triamcinolone
    - Nasopore

Laryngoscope, 120:1269-1273, 2010

Steroid-Releasing Sinus Implant

- Maintains sinus patency mechanically and medically
  - Spring-like implant
  - Props sinus open without obstruction
  - Local, sustained delivery of mometasone furoate over 30 days
  - Bioabsorbable polymer

**Study Design**

- **PRDB Phase II trial**
- **N=105**
- **Controls – side of surgery randomized**
- **Primary outcome**
  - Polyp grading
  - Inflammation
- **Secondary outcome**
  - Safety

---

**Results**

- Seven studies met the inclusion criteria from T17 initial articles identified.
- Six studies demonstrated SEBID efficacy with statistical significance (P < 0.05).

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**Endoscopic photos**

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**Objectives/Hypothesis:** The primary aim of this systematic review is to evaluate the efficacy and safety of SEBIDs. The secondary aim is to inform clinical recommendations and to introduce clinicians to this novel technology.

**Study Design:** Systematic Review and Meta-analyses guidelines.

**Methods:** Original articles assessing the efficacy of SEBIDs inserted after endoscopic sinus surgery. For each study, we recorded the efficacy endpoints and safety outcomes.

**Results:** Steroid-eluting bioabsorbable intranasal devices were effective in reducing adhesion formation, polyp formation, inflammation, Lund-Kennedy scores, and perioperative sinus endoscopy scores. The devices improved patient-reported outcomes and reduced postoperative interventions. There is limited data available on SEBIDs; further studies are required to determine whether they are safe and effective adjuncts post-endoscopic sinus surgery. Future studies are needed to optimize the dosing regimen, compare devices, and provide long-term outcomes. Steroid-eluting bioabsorbable intranasal devices may tentatively be incorporated into future evidence-based practice.
Main results
We identified no RCTs that met our inclusion criteria. Among the 159 records retrieved using our search strategy, 21 trials had the potential to be included given that they had tested sinus stents, spacers and packing materials for patients with CRS undergoing FESS. However, we excluded these trials from the review because they met some but not all of the inclusion criteria.

Effect of a dexamethasone Sinu-Foam™ middle meatal spacer on endoscopic sinus surgery outcomes: A randomized, double-blind, placebo-controlled trial

- **Obj** – do steroids in sinu-foam impact healing in CRSsNP?
- **Design** – DBRCT
  - 36 pts
    - Sinu-foam
    - Sinu-Foam + Dexamethasone
- **Outcome measure**
  - Endo scores at 1, 4, 12 wks

Int Forum Allergy Rhinol, 2012;2:248-251

Effect of a dexamethasone Sinu-Foam™ middle meatal spacer on endoscopic sinus surgery outcomes: A randomized, double-blind, placebo-controlled trial

Int Forum Allergy Rhinol, 2012;2:248-251

Steroid-eluting sinus stents for improving symptoms in chronic rhinosinusitis patients undergoing functional endoscopic sinus surgery

Mainly 2012 was also a prospective, randomised study that enrolled 105 patients with CRS undergoing FESS and compared the effect of steroid-eluting sinus stents to non-steroid-eluting sinus stents, again using an intra-patient control design. Postoperative interventions, polypysis and adhesions were assessed 30 days postoperatively. This study showed that steroid-eluting sinus stents, providing sustained release of corticosteroid, improve surgical outcomes by reducing polyp formation, sinus adhesions, middle turbinate lateralisation and the need for further surgical intervention and oral steroid treatment. As with Huyer 2011, the authors also failed to report our primary outcome, subjective measurement of sinonasal symptoms.

Int Forum Allergy Rhinol, 2012;2:248-251

Object – in-office use for post-op patients

- **Design** – Prospective cohort, multi-center
  - Same basic design as prior company sponsored studies
  - 12 patients with recurrence of polyps after ESS
  - New implant design
    - 1350 ug over 90 days = 15.1 μg/day

**Conclusion**

- Routine use of nasal packing is not necessary
- Matching product to patient needs
  - Coagulopathy: Hemostasis
  - Risk of Scarring: Mechanical
  - Concha Bullosa
  - Excessive mucosal trauma
- Modulation of inflammation: Drug eluting
Sinus Microbiome and Topical Antimicrobials
November 3, 2017
Seth Isaacs, M.D.
Cincinnati Sinus Institute
Trihealth

Historical Concept
• Single pathogen and host interaction
  • Quantity and type of bacteria

Bacteria
• Acute Bacterial Rhinosinusitis
  – Strep. pneumonia
  – Haem. influenza
  – M. catarrhalis
• Chronic Rhinosinusitis2
  • Coag neg. Staph. 51%
  • Staph. aureus 20%
  • Pseud. aeruginosa 5%
  • Anaerobes 3%
  • Multiple 16%

Bacterial Detection
• Collection Method
  • Swab
  • Aspiration
  • Lavage and aspiration
• Collection Location
  • Direct Sinus
  • Middle Meatus

Bacterial Detection
• Culture
  • Identification
  • Antibiotic sensitivity
  • Bias towards easily cultured
• Microscopy
  • Multiple stains
  • Cost
  • Molecular methods

CRS Predisposing Factors
Environmental
Genetic/Physiologic
Nucleic Acid Detection
- Multiple pathogen detection
- Rapid
- Determine genetic resistance
- Extraction
- Amplification by PCR
- Microarray analysis
- DNA sequencing

Feazel 2011

Microbiome
- “a community of microorganisms that inhabit a particular environment and especially a collection of microorganisms living in or on the human body”

Merriam Webster

Microbiome Balance
- Native microbial balance leads to health
  - Stability
  - Diversity
  - Individuality
- Imbalance may lead to disease

Sinonasal Health
- Stable microbiome
  - Epithelial barrier
  - Immune response
  - Mucus blanket
- Competition between native microbes and pathogens

Bacterial Communities in Health
- Propionibacterium acnes
- Staph epidermidis
- Staph aureus
- Corynebacterium

Feazel 2012
Ramakrishnan 2013

Microbiome and CRS
- Decreased species diversity
- Shift in bacterial community versus increase in microbial pathogens
- S. aureus and anaerobes

Stephenson 2010
Boase 2013
Host and Environmental Factors
• Asthma
• Purulence
• Smoking

- Topical saline and steroids do not influence the microbiome

Antimicrobial Treatment
• Eliminate infection
• Reduce inflammation
• Normalize mucus
• Promote OMC patency

Topical Antimicrobial Treatment
• Direct mucosal action
• Higher concentration at target
• Low side effect profile

- Requires a postoperative cavity

Delivery
• Nasal spray
  • Poor deposition
  • Relies on mucociliary clearance
• Nasal irrigation
• Nasal nebulization

Nebulizer vs. Sinus Rinse

- Requires a postoperative cavity

Uncommon Delivery Methods
• MAD Atomizer
  • Maxillary, ethmoid, sphenoid

• Vertex to Floor
  • Maxillary, ethmoid, frontal recess
  • More effective at 5 minutes than 1 minute

Gelfand 2010

Citardi 2005
Delivery

- Abadie 2011
- Complete cadaveric dissections (including Draf III)
- Trephination through ACF, GWS, and canine fossa
- Endoscopic visualization of penetration
- Sinus Rinse > NetiPot > nebulizer = nasal sprays
- Sinus Rinse
- 100% penetration after 4 squeezes
- 33% frontal failure until 4th squeeze

Common Topical Antibiotics

- Mupirocin
- Levaquin
- Tobramycin
- Ceftazidime
- Vancomycin

Evidence for Topical Antibiotics

- Improvement 1-3
  - QOL Scores
  - Endoscopy
- Surgical outcomes 4
  - Longer disease/infection free interval

Conclusion

- Paradigm shift on the role of bacteria in the sinus cavities
- Advances in bacterial culture and quantitative analysis
- Bacterial identification is important for treatment
- Moderate level evidence supporting use of topical antibiotics

References

BILOGICS: APPLICATIONS IN CHRONIC RHINOSINUSITIS

Kent Lam, MD
Assistant Professor
Department of Otolaryngology – Head & Neck Surgery
Eastern Virginia Medical School
Norfolk, Virginia

Objectives

- Review potential endotypic classifications of chronic rhinosinusitis (CRS)
- Highlight emerging biologic therapies for various atopic diseases
- Present available evidence regarding efficacy and safety of biologic agents for CRS

Disclosures

- No personal conflicts of interests
- Eastern Virginia Medical School has served as a clinical site for a Phase III clinical study for dupilumab (Dupixent) in chronic rhinosinusitis

Inflammatory cascade in CRS

Contributing etiologies

- ENVIRONMENTAL VARIABLES
  - Fungi
  - Bacterial superantigens
  - Biofilms
  - Allergens/tobacco smoke

- HOST VARIABLES
  - Defects in mechanical, innate, and adaptive immune systems

Clinical manifestations:

- Nasal congestion
- Nasal discharge
- Facial pressure or pain
- Altered sense of smell

Traditional CRS phenotypes

- Use of observable clinical characteristics
  - Presence or absence of nasal polyps
  - Recalistence to interventions
  - Associated comorbidities

Evolving CRS Endotypes

- Use of underlying mechanisms and biomarkers of disease

References

- Akdis et al, JACI (2013)
CRSwNP Endotypes

- Distinct but overlapping classificatory approaches
  - Type 2 cytokine-based
  - Eosinophil-based
  - IgE-based
  - Cysteinyl leukotriene-based

Pharmacotherapeutics for CRS

- Current pharmacotherapy is diverse but nonspecific
  - Intranasal and oral corticosteroids
  - Nasal saline
  - Antibiotics in both oral and topical preparations
  - Leukotriene receptor antagonists
  - Estimated rates of success is low: 38-51%
  - Residual morbidity is substantial

What are biologics?

- “Biologics” is short for “biologic products”
  - Derived from living organisms or produced by biotechnology
  - Composed of sugars, proteins, nucleic acids, or complex combinations of these substrates of life

Pharmaceuticals versus biologics

- Interest in monoclonal antibodies (mAb) that target key inflammatory pathways in CRS pathophysiology
- Current commercially available uses for various atopic diseases – asthma, urticaria, and atopic dermatitis
  - Omalizumab
  - Mepolizumab
  - Reslizumab
  - Dupilumab

IgE in CRSwNP
Omalizumab: targeting IgE pathway
- Trade name: Xolair
- Recombinant humanized mAb to free circulating IgE
- Mechanisms of effect:
  - Inhibits IgE binding to receptors on basophils and mast cells
  - Downregulates IgE receptor on effector cells
- Approved by FDA for use in 2003

Omalizumab
- Subcutaneous administration based on patient weight and IgE levels every 2-4 weeks
- Current indications:
  - Asthma in patients (> 6 years of age) with allergic sensitization and symptoms refractory to inhaled corticosteroids
  - Chronic idiopathic urticaria in patients (> 12 years of age) with symptoms despite use of H1-receptor antagonist antihistamine
- Risks: Anaphylaxis (0.2%), malignancy, parasitic infections

Randomized placebo-controlled trial
- N = 24 subjects with comorbid asthma and CRSwNP
- Omalizumab (4-8 doses over 4 months) improved nasal poly scores, CT disease severity scores, and QoL scores after 16 weeks

Reslizumab: targeting IL-5 pathway
- Trade name: Cinqair
- Recombinant humanized mAb to human IL-5
- Mechanisms of effect:
  - Binds to directly IL-5
  - Limits IL-5 signaling, reducing eosinophil production and survival
- Approved by FDA for use in 2016

Reslizumab
- Intravenous administration based on patient weight every 4 weeks
- Current indications:
  - Asthma in patients (> 18 years of age) with eosinophilic endotype (blood eosinophil level ≥ 400 cells/μL at initiation of dosing) and symptoms refractory to inhaled steroid
- Risks: Anaphylaxis (0.3%), malignancy (0.3%), parasitic infection
**Mepolizumab: targeting IL-5 pathway**
- Trade name: Nucala
- Recombinant humanized mAb to human IL-5
- Mechanisms of effect:
  - Blocks bindings of IL-5 to receptors (alpha-chain) on eosinophils
  - Limits IL-5 signaling, reducing eosinophil production and survival
- Approved by FDA for use in 2015

---

**Mepolizumab**
- Subcutaneous administration independent of patient weight and eosinophil levels every 4 weeks
- Current indications:
  - Asthma in patients (> 12 years of age) with eosinophilic endotype (Blood eosinophil level ≥ 150 cells/µL at initiation of dosing) and symptoms refractory to inhaled steroid
- Risks: Zoster/varicella infections, parasitic infections

---

**Mepolizumab, a humanized anti-IL-5 mAb, as a treatment option for severe nasal polyposis**
- Randomized controlled trial
- N = 30 subjects with CRSwNP
- Mepolizumab (2 doses over 28 days) reduced endoscopic polyp scores and CT scores

---

**IL-4/IL-13 in CRSwNP**

---

**Dupilumab: targeting IL-4/13 pathway**
- Trade name: Dupixent
- Human mAb to alpha-subunit of IL-4 receptor
- Mechanisms of effect:
  - Inhibits binding site for both IL-4 (via Type 1 and Type 2 receptors) and IL-13 (via Type 2 receptor)
  - Targets upstream activation of B lymphocytes that result in production of IgE
- Approved by FDA for use in 2017

---

**Dupilumab**
- Subcutaneous administration independent of patient weight every 2 weeks – patient may self-inject at home
- Current indications:
  - Atopic dermatitis in patients (> 18 years of age) with symptoms refractory to topical prescription therapies
- Risks: Conjunctivitis and keratitis, parasitic infections
Effect of Subcutaneous Dupilumab on Nasal Polyp Burden in Patients With Chronic Sinusitis and Nasal Polyposis: A Randomized Clinical Trial

- Randomized placebo-controlled trial
- N = 60 subjects with CRSwNP
- Dupilumab (weekly doses over 16 weeks) improved nasal polyp scores, CT disease severity scores, and QoL scores after 16 weeks

Conclusions

- Recognition of CRS endotypes is based on various pathophysiologic mechanisms and biomarkers of disease
- Biologics, including those targeting IgE, IL-5, and IL-4/13, provide innovative strategies for CRSwNP endotypes
- Additional studies are necessary to determine efficacy, patient selection, safety, and cost-effectiveness of various biologics

References

FRIDAY, NOVEMBER 3

7:00 AM    Registration/Breakfast
7:45 AM    Welcome
           Martin J. Citardi, MD

Session: Rhinology Fundamentals
Amber Luong, MD, PhD (moderator)

8:00-8:20 AM    Endoscopic anatomy & CT correlates
                 Philip Chen, MD

8:20-8:40 AM    Chronic rhinosinusitis diagnosis
                 K. Christopher McMains, MD

8:40-9:00 AM    Headache
                 Drew Plonk, MD

9:00-9:25 AM    Chronic rhinosinusitis pathophysiology & clinical implications
                 Amber Luong, MD, PhD

9:25-9:50 AM    Primary CRS management panel
                 Amber Luong, MD, PhD (moderator); Mohamad Chaaban, MD; Philip Chen, MD; Drew Plonk, MD; Matthew Ryan, MD

9:50 AM    Break

Session: Primary Nasal & Sinus Surgery
William Yao, MD (moderator)

10:20-10:45 AM    Five anatomic landmarks
                   Ralph Metson, MD

10:45-11:05 AM    Septum & turbinate surgery
                   Ashleigh Halderman, MD

11:05-11:30 AM    My 30 years in rhinology
                   Ralph Metson, MD

Session: Rhinitis & Eustacian Tube
Matthew Ryan, MD (moderator)

11:30-11:55 AM    Rhinitis diagnosis and treatment
                   Matthew Ryan, MD

11:55 AM-12:15 PM    Anaphylaxis
                       Mohamad Chaaban, MD

12:15-12:35 PM    Eustachian tube dysfunction diagnosis and treatment
                   Michael Marino, MD

12:35 PM    Lunch

Session: Optimizing Chronic Rhinosinusitis Outcomes
Martin J. Citardi, MD (moderator)

1:00-1:30 PM    Surgery Complications
                 Pete Batra, MD

1:30-1:50 PM    Navigation
                 Martin J. Citardi, MD

1:50-2:10 PM    Postop care
                 William Yao, MD

2:10-2:30 PM    Role of steroids
                 Bradley Marple, MD

2:30-2:50 PM    Implants
                 Bradley Marple, MD

2:50-3:10 PM    Microbiome & topical antibiotics
                 Seth Isaacs, MD

3:10-3:30 PM    Biologics
                 Kent Lam, MD

3:30 PM    Break

Session: Frontal Sinus Surgery
William Yao, MD (moderator)

3:55-4:15 PM    Primary frontal sinus surgery
                 William Yao, MD

4:15-4:35 PM    Revision frontal sinus surgery
                 Li-Xing Man, MD
<table>
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<tr>
<th>Time</th>
<th>Session/Panel</th>
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<tr>
<td>4:35-5:00 PM</td>
<td>Frontal sinus panel</td>
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<td>Pete S. Batra, MD (moderator); Ashleigh Halderman, MD; Seth Isaacs, MD; Li-Xing Man, MD; William Yao, MD</td>
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<td><strong>Session: Fungal Rhinosinusitis</strong></td>
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<td><strong>Allergic fungal rhinosinusitis diagnosis and management</strong></td>
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<td>6:00 PM</td>
<td><strong>Announcements</strong></td>
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<td>William Yao, MD</td>
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<td><strong>SUNDAY, NOVEMBER 5</strong></td>
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<td>9:30-9:50 AM</td>
<td><strong>Endoscopic epistaxis management</strong></td>
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<td>K. Christopher McMains, MD</td>
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<td><strong>Endoscopic orbital surgery</strong></td>
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<td><strong>SATURDAY, NOVEMBER 4</strong></td>
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<tr>
<td>7:00 AM</td>
<td><strong>Registration/Breakfast</strong></td>
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<td>7:45 AM</td>
<td><strong>Welcome</strong></td>
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<td><strong>Rhinology innovations</strong></td>
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<td><strong>Rhinology Dissection Lab</strong></td>
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<td><strong>Travel to lab</strong></td>
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<td><strong>Lab</strong></td>
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Primary Frontal Sinus Surgery

William C Yoo, MD
Department of Otorhinolaryngology
Texas Sinus Institute
Texas Skull Base Institute
www.ut-ent.org
William.c.yoo@uth.tmc.edu

Disclosure
• None

Frontal Sinus
• Most complex of all paranasal sinuses
• Rudimentary at birth - Last sinus to develop
• Asymmetrical
• 10% - Unilateral
• 5% - Rudimentary
• 4% - Absent

Anatomy
• Highly variable
• Can distinguish monozygotic twins from one another
• Boundaries of frontal recess
• Anterior – Nasal/frontal beak, Agger Nasi
• Posterior – Posterior table, Bulla Lamella
• Medial – Middle turbinate, Uncinate
• Lateral - Orbit

History - Past
• External Approach
  • Ogston in 1884 – Trephination
  • Jansen described entry into frontal sinus via external frontoethmoid approach
  • Schonberg introduced osteoplastic flap in 1894
  • Morbidity - scarring, injury to neurovascular bundle, damage to nasolacrimal duct, diplopia, mucocele, CSF leak

History - Modern
• Endoscopic Era – introduced in early 1980s
  • Obviated need for majority of open frontal sinus surgery
  • Navigation further expanded indication
  • Facilitate localization of frontal sinus tract
• Development of minimally invasive techniques
  • Balloon Sinuplasty

References:
Ogston A. Med Chron. 1884
Besana A, Rogers TL. J Forensic Sci. 2010
Evaluation

- Trial of medical therapy
  - Intranasal Steroids
  - Saline Irrigation
  - Trial of oral corticosteroids
  - +/- antibiotics
- Imaging Studies
  - CT sinus with navigation protocol
  - Identify the pathology and possible area of disease
  - Develop understanding of frontal sinus outflow tract

Frontal Sinus Surgery

Decision to operate on the frontal sinus is based on persistent symptoms refractory to medical therapy WITH radiographic evidence of disease by CT.

Frontal Sinus Surgery

- Understand the frontal sinus outflow tract
- Surgeon required to maintain spatial orientation with angled telescopes
- Need precise control of angled instruments, including high-speed drills

Anatomy

<table>
<thead>
<tr>
<th>Kuhn Classification</th>
<th>Frontal Sinus Cells</th>
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<tbody>
<tr>
<td>Agger nasi cell</td>
<td>Squamous epithelial cells</td>
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<tr>
<td>Type 1</td>
<td>Single frontal sinus cell above agger nasi cell</td>
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<tr>
<td>Type 2</td>
<td>Two cells in frontal recess above agger nasi cell</td>
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<tr>
<td>Type 3</td>
<td>Single mucous cell pneumatizing cysticified frontal sinus</td>
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<tr>
<td>Type 4</td>
<td>Bony cell in frontal sinus</td>
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<tr>
<td>Type 5</td>
<td>Septal bulla cells</td>
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<tr>
<td>Type 6</td>
<td>Infractal sinus septal cell</td>
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Frontal Bullar Cell versus Type IV Cell
Surgical Options

- Balloon Sinuplasty
  - I: anterior ethmoidectomy, w/o instrumentation of FS
  - IIA: simple frontal sinusotomy - removal of frontoethmoidal cells and cannulating FS (eg. “uncapping the egg”)
  - IIB: removal of the frontal sinus floor between the septum and LP
  - III: (modified Lothrop): creation of a common cavity


Balloon Sinuplasty

- First introduced in 2005
- Dilation of FSOT w/o tissue remove
- Adjunct to identify frontal sinus in OR
- Can be performed in the office setting with similar outcomes to the OR
- May combine with navigation
- Contraindication:
  - Nasal polyposis, Allergic/fungal mucin
  - Neoplasm, neo-osteogenesis


Draf 1

- Removal of the axillae and inferior aspect of agger nasi cells
- Improves visualization of the frontal recess
- May destabilize MT if performed too medial


Draf 1

- In-office setting
- 4% lidocaine or 2% tetracaine
- Topical oxymetazoline or adrenaline have been described.
- 1% lidocaine with 1:1,00,000 epi
- +/- NuCalm
Primary Frontal Sinus Surgery

Draf 2a

Centrifugal dissection

- Entering a large anterior or posteriorly based frontoethmoidal aircell with navigation
- Minimize damage to the posterior table of the frontal sinus
- Useful when FSOT is narrow and less than 1mm

Draf 2b

- More aggressive than 2a
- Removal of the frontal beak and partial MT resection

Draf 3

- Generally reserved for previously failed frontal sinus surgery
- Tumor

Draf 3


Yao WC, Bleier BS. Int Forum Allergy Rhinol. 2015

Improving Outcomes

- Recurrence of disease/ restenosis
- 14-19% failure rate
- 8% require revision surgery
- Minimize mucosal damage
- Circumferential injury leads to increased stenosis
- Identification of anterior ethmoid artery and posterior table
- Remove free bony fragments
- Pro-inflammatory
- Avoid injuring the frontal beak
- Osteoneogenesis

Implants

- Spacers
  - Absorbable packing (eg Posisep, Nasopore)
  - Decrease lateralization of middle turbinate and synechiae formation
- May add steroids
- Kenalog
- Implants
  - Silastic sheeting – surrounding exposed bony surfaces
  - Steroid eluting stents (eg Propel)
  - Decreases immediate postoperative inflammation

Conclusions

- Following trial of medical therapy, obtain a CT sinus with navigation protocol
- Study anatomy and frontal outflow pattern
- Use image guidance to verify that true frontal sinus was cannulated
- Tailor surgical intervention to the disease present
- Preserve mucosa on the frontal beak
- Minimize osteoneogenesis and frontal sinus stenosis
- Consider implants
- Routine postoperative care

Questions?
Local causes of recalcitrant frontal sinus disease

- Mucosal disease of the frontal sinus outflow tract
  - Microbial infection
  - Eosinophilic inflammation
- Patient anatomy
  - Anteroposterior dimension of the frontal recess
  - Intercanthal distance

Disclosures
- No disclosures
- No relevant financial interests

Outcomes of primary frontal sinus surgery

- Short-term (≤1 year) patency
  - 81% to 92%
- Longer-term (>3 year) patency
  - 68% to 88%
  - Associated with creating a frontal sinus ostium ≥ 5 mm

Local causes of recalcitrant frontal sinus disease

- Mucosal disease of the frontal sinus outflow tract
- Patient anatomy
- Incomplete surgical dissection during primary frontal sinusotomy
- Inattentive postoperative care
Incomplete surgical dissection

- Study of 109 frontal sinuses in 66 patients undergoing revision frontal sinusotomy
  - Retained agger nasi cell 73%
  - Residual (non-agger nasi) ethmoid cells 32%
  - Residual frontal cells 25%
  - Most often: Combination

Lack of meticulous postoperative care

- Neo-osteogenesis 46%
- Middle turbinate lateralization 30% to 48%
Frontal sinus rescue

Draf III (modified endoscopic Lothrop)
- “Frontal sinus drillout”
- Endoscopic approach to Lothrop procedure

Lothrop procedure
- Open approach described in 1914
- Removal of:
  - The floor of the frontal sinus
  - Inter-sinus septum
  - Superior nasal septum

Draf III (modified endoscopic Lothrop)
- Removal of the:
  - Midline septum
  - 80% middle turbinate attachments to the floor of the frontal sinus
  - All of the frontal sinus floor from orbital wall to orbital wall

Lothrop procedure

Draf III – Indications
- Failed prior frontal sinus surgery
- Frontal sinus unobliteration
- Mucocele
- Need for surgical access
  - Type 3 or 4 Kuhn frontal cells
  - Benign or malignant tumor
  - Repair of cerebrospinal fluid leak or encephalocele
Draf III – Indications
Extensive frontal sinus tumor

Draf III – Preoperative endoscopy
Failed previous frontal sinus surgery

Draf III – Indications
Frontal sinus osteoma and headaches

Radiologic considerations

- Software with the ability to perform multiplanar reconstructions (MPR) aids in creating a three-dimensional understanding of the anatomy
- Study the anterior-to-posterior dimension of the frontal recess in the axial and sagittal planes
- Assess the thickness of the nasofrontal beak, as this may be drilled out early in the procedure to increase the anterior-to-posterior dimension
- Locate the anterior ethmoid artery, as it often courses along the posterior boundary of the frontal recess

Draf III – Indications
Failed previous frontal sinus surgery
Equipment and instrumentation

- 45- and 70-degree endoscopes ("reverse-post")
  - Angled punches
    - 65-degree circular Stammberger mushroom punches
    - 70-degree Hosemann punches
  - Angled irrigating drills (esp. 70-degree diamond bur)
  - Image guidance system

Draf III – Postoperative debridement
Failed previous frontal sinus surgery

1 week post-op
2 weeks post-op

3.5 mm and 5.5 mm Hosemann punches

Draf III – Postoperative endoscopy
Failed previous frontal sinus surgery

30,000 rpm 70-degree 4 mm diamond bur
References


Lone Star Rhinology and Rhinoplasty: Frontal Sinus Panel

Moderator: Pete S. Batra, MD, FACS
Panelists: Ashleigh Halderman, MD
Seth Isaacs, MD
Li-Xing Man, MD
William Yao, MD


The Treatment of Frontal Sinusitis
By Dr. MAXWELL TELEIS (London)

"...its treatment has always been difficult, often unsatisfactory and sometimes disastrous. The frequency with which we discuss the problem of treating it, and the diverse methods which have been proposed, are clear expressions of our uncertainty, and perhaps of our failure."


History of Frontal Sinus Surgery

- 1884 – Ogston published 1st account external frontal surgery for infection
- Trephination“drainage tube”
- 1898 – Riedel reported on radical obliterative surgery
- 1903 – Hajek introduced the concept of osteoplastic frontal operation

Sir Alexander Ogston

Hajek M. Pathology and treatment of the inflammatory diseases of the nasal accessory sinuses. St. Louis: CV Mosby, 1903.

The Early Frontal Sinus Procedures

- 1914 – Lothrop proposed a wide nasofrontal opening
- Resection of frontal sinus floor, intersinus septum, and upper nasal septum
- 1921 – Lynch advocated a medial periorbital incision
- Address ethmoids and frontal sinus
- ~30% failure rate!!!
- Scar tissue, orbital prolapse


Transition to Osteoplastic Flaps

- 1958 – Goodale and Montgomery perform 1st OPF
- Workhorse from 1960-80s
- Indications: 76% - chronic infection
- 10% (each) - osteoma and trauma
- 93% symptom improvement
- 6% moderate to severe frontal pain
- 1% persistent neuralgia

The Advent of Endoscopic Approaches

1. Introduction of the FESS paradigm
2. Improved understanding of frontal recess anatomy and physiology
3. Advances in CT imaging
4. Refinement of frontal instrumentation

Complication
Frontal wound (hematoma/abscess)
Abdominal wound (infection/hematoma)
Bone cuts outside sinus confines
Dural lacerations

Complication
No. Pts
Frontal wound (hematoma/abscess) 14
Abdominal wound (infection/hematoma) 13
Bone cuts outside sinus confines 8
Dural lacerations 7

Outcomes in Frontal Sinus Surgery:

- 130 frontal sinuses in 66 patients\(^1\)
- Stenosis rate of 14.6\% after initial surgery
- Mean follow-up ranged 8.3 months for successes and 10.7 months for failures
- 294 frontal sinuses in 161 patients\(^2\)
- Overall patency rate 88\%
- One or more revision frontal sinusotomies performed on 101 frontal sinuses (34.4\%)
- Average follow-up 45.9 months

---

Frontal Sinus Surgery: Options

- Most Invasive
- Obliteration
- Unoblation
- Modified Lothrop
- Frontal trephination
- Frontal sinus rescue
- Endo. frontal sinusotomy

- Least Invasive
- Balloon catheters

---

Rhinology Program

4:35-5:00 PM  **Frontal sinus panel**  
Pete S. Batra, MD  
(moderator); Ashleigh  
Halderman, MD; Seth  
Isaacs, MD; Li-Xing Man,  
MD; William Yao, MD

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**Session: Fungal Rhinosinusitis**  
Bradley Marple, MD (moderator)
5:00-5:20 PM  **Fungal rhinosinusitis diagnosis**  
Martin J. Citardi, MD
5:20-5:40 PM  **Allergic fungal rhinosinusitis diagnosis and management**  
Amber Luong, MD, PhD
5:40-6:00 PM  **Fungal rhinosinusitis panel**  
Bradley Marple, MD  
(moderator); Philip Chen,  
MD; Martin J. Citardi, MD,  
Amber Luong, MD, PhD;  
Matthew Ryan, MD

6:00 PM  **Announcements**  
William Yao, MD

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**SATURDAY, NOVEMBER 4**
7:00 AM  **Registration/Breakfast**
7:45 AM  **Welcome**  
Amber Luong, MD, PhD

**Session: Office-based Rhinology Procedures**  
Amber Luong, MD, PhD (moderator)
8:00-8:20 AM  **Patient selection & preparation**  
Amber Luong, MD, PhD
8:20-8:40 AM  **Office technology**  
Martin J. Citardi, MD
8:40-9:10 AM  **Office procedures panel**  
Martin J. Citardi, MD,  
(moderator); Pete S. Batra,  
MD; Amber Luong, MD,  
PhD; Michael Marino, MD

**Session: Extended Indications for ESS**  
William Yao, MD (moderator)
9:10-9:30 AM  **Inverted papilloma**  
William Yao, MD

9:30-9:50 AM  **Endoscopic epistaxis management**  
K. Christopher McMains, MD
9:50-10:15 AM  **Endoscopic orbital surgery**  
William Yao, MD
10:15-10:40 AM  **Endoscopic CSF leak repair**  
Pete S. Batra, MD
10:40 AM  **Break**

**Session: Rhinology: Past, Present & Future**  
Matthew Ryan, MD (moderator)
11:10-11:35 AM  **Defining indications for FESS**  
Martin J. Citardi, MD,  
(moderator); Pete S. Batra,  
MD; Bradley Marple, MD
11:35 AM-12:00 PM  **Recalcitrant rhinosinusitis**  
William Yao, MD,  
(moderator); Martin J.  
Citardi, MD; Seth Isaacs,  
MD; Kent Lam, MD;  
Bradley Marple, MD
12:00-12:30 PM  **Rhinology innovations**  
Amber Luong, MD, PhD,  
(moderator); Kent Lam, MD;  
Li-Xing Man, MD;  
K. Christopher McMains,  
MD; Matthew Ryan, MD
12:30-1:00 PM  **Endoscopic skull base surgery**  
Pete S. Batra, MD
1:00 PM  **Announcements**  
Amber Luong, MD, PhD

**Rhinology Dissection Lab**  
(paid participants only)
1:10 PM  **Travel to lab**  
(lab participants only)
1:30 PM  **Lunch**  
(lab participants only)
2:00-5:00 PM  **Lab**
Fungal Rhinosinusitis Classification

Martin J. Citardi, MD, FACS
Department of Otorhinolaryngology
Texas Sinus Institute
www.ut-ent.org

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Disclosure
- Acclarent (consultant)
- Arinex (consultant)
- Biosense Webster (consultant)
- Factory CRO (consultant)
- Hemostasis, LLC (consultant)
- Medical Metrics (consultant)
- Medtronic (consultant)
- Optinose (consultant)

Challenges
- Inconsistent terminology
- Inconsistent pathology interpretation
- Difficult to culture fungi for identification
- Regional differences

Classification

Noninvasive fungal sinusitis
- Fungus ball
- Allergic fungal sinusitis (AFS)

Invasive fungal sinusitis
- Granulomatous fungal sinusitis
- Acute fulminant fungal sinusitis
- Chronic invasive fungal sinusitis

Fungus Ball
Clinical Presentation
- Nasal obstruction
- Thick posterior rhinorrhea (bacterial superinfection)
- Facial pain/pressure
- Typically isolated maxillary involvement
- Fungal elements mostly nonviable
Fungus Ball

**Clinical Presentation**
- Aspergillus fumigatus most common
- Some bone resorption/remodeling
- Immunocompetent, nonatopic host

**Treatment**
- Surgical removal (FESS)
- Antibiotics for bacterial superinfection
- Recurrence rare

---

**Classification**

*International Society for Human and Animal Mycology*

**Noninvasive**
- Fungus ball
- Allergic fungal rhinosinusitis
- Saprophytic fungal infection

**Invasive**
- Acute invasive fungal rhinosinusitis
- Chronic invasive fungal rhinosinusitis
- Granulomatous rhinosinusitis

---

**AFRS Diagnostic Criteria**

**Bent & Kuhn Criteria**
- Type I hypersensitivity for fungal antigens (history, skin tests, mRAST)
- Nasal polyposis
- Characteristic CT scan
- Eosinophilic mucus without fungal invasion
- Positive fungal stain of sinus contents

---

**Eosinophilic Mucin**

- Eosinophil degradation products: eosinophil cationic protein (ECP), eosinophil peroxidase (EPO), major basic protein
- Classically described as peanut butter
- May expand sinuses and erode bone with orbital and intracranial extension
- AFRS must have fungal elements
AFRS Pathology

- Rubber, tenacious mucus
- Peanut-butter like debris
- H&E: amorphous layers of mucus, mixed with sheets of eosinophils
- H&E: Charcot-Leyden crystals (breakdown product of eosinophils)
- KOH, silver stain: extramucosal fungal hyphae, relatively rare

AFRS Mycology

Dematiaceous Fungi
- Alternaria
- Bipolaris
- Cladosporium
- Curvularia

Others
- Aspergillus species

AFRS Pathophysiology

Plonk & Luong (Curr Opin Otolaryngol, 2014)
- Fungus
- Staphylococcus
- Epithelial cell-derived cytokines
- Adaptive immune response

AFRS Clinical Presentation

- Usually adolescents, young adults
- ASA sensitivity rare
- Immunocompetent host
- Regional differences in prevalence

AFRS Associated Features

- Unilateral predominance
- Proptosis, hypertelorism
- Intracranial expansion, but not invasion
- Elevated total IgE (marked)
- Serum eosinophilia (absent or minimal)
- Asthma (not all patients, not severe)
- Diplopia, loss of vision, etc. due to compression from sinus contents (rare)

Allergic Fungal Rhinosinusitis
Fungal Rhinosinusitis Classification

MRI Findings

- Increased signal
- Decreased signal
- No signal

Allergic Fungal Sinusitis

Treatment

- FESS, especially IG-FESS
- Serial postop debridement
- Endoscopic monitoring
- Systemic corticosteroids
- Topical corticosteroids
- Steroid-releasing implants
- Nasal irrigations
- Culture-directed antibiotics

Classification

International Society for Human and Animal Mycology

Noninvasive
- Fungus ball
- Allergic fungal rhinosinusitis
- Saprophytic fungal infection

Invasive
- Acute invasive fungal rhinosinusitis
- Chronic invasive fungal rhinosinusitis
- Granulomatous rhinosinusitis

Saprophytic Fungal Infection

- Superficial mycosis
- Saprotrophs obtain nutrients from dead organic matter
- Immunocompetent host
- Typically appears on crust
- Often secondary to another issue (such as retained secretions)
- Does not cause symptoms directly
- Treatment: removal

Invasive Fungal Sinusitis

Diagnostic Criteria

Gold Standard:
- Histopathological evidence of hyphae within mucosa, submucosa, blood vessels, etc.

Other factors:
- Endoscopy
- CT & MRI
- Cultures

Histological criteria:
- Granulomatous inflammation
- Inflammatory cells: monocytes, lymphocytes, plasma cells, eosinophils, fibrosis
- Hyphae or mycelia
- Fungi: Aspergillus, Fusarium, Alternaria, Mucor

Pathogenesis:
- Fungal inoculation
- Aspiration
- Augmented colonization
- Hypersensitivity reaction
Acute Invasive Fungal Rhinosinusitis

- AKA rhinocerebral mucormycosis
- Destructive rhinosinusitis with extension to palate, orbit, and skull base
- Diabetes, immunosuppression

**Pathology**

- Hyphal invasion of vessels, including ICA, cavernous sinus
- Nonseptate hyphae
- Vasculitis, thrombosis
- Hemorrhage
- Tissue infarction
- Variable inflammatory infiltrate (minimal due to neutropenia)

**Mycology**

Order: Mucorales
- Rhizopus
- Rhizomucor
- Absidia
- Mucor
- Cunninghamella
- Mortierella
- Sakshanee
- Apophysomyces
- Zygomycyes

**Treatment**

- Critically ill patient
- Reverse immunodeficiency
- Low threshold for urgent surgery
- Ophthalmology and Neurosurgery consultations
- Infectious disease consultation
- Sequential debridement/revision
- Sequential imaging, especially MRI

**Classification**

International Society for Human and Animal Mycology

Noninvasive
- Fungus ball
- Allergic fungal rhinosinusitis
- Saprophytic fungal infection

Invasive
- Acute invasive fungal rhinosinusitis
- Chronic invasive fungal rhinosinusitis
- Granulomatous rhinosinusitis

Chronic Invasive Fungal Rhinosinusitis

- Chronic course
- Dense accumulation of fungal debris (like mycetoma)
- Associated with diabetes and corticosteroid use
Chronic Invasive Fungal Rhinosinusitis

- Tissue invasion
- Minimal chronic inflammatory cells

Chronic Invasive Fungal Sinusitis

Treatment

- Reverse immunodeficiency
- Low threshold for urgent surgery
- Ophthalmology and Neurosurgery consultations
- Infectious disease consultation
- Sequential debridement/revision
- Sequential imaging, especially MRI
- Anticipate indolent course, after initial stabilization

Classification

International Society for Human and Animal Mycology

Noninvasive
- Fungus ball
- Allergic fungal rhinosinusitis
- Saprophytic fungal infection

Invasive
- Acute invasive fungal rhinosinusitis
- Chronic invasive fungal rhinosinusitis
- Granulomatous rhinosinusitis

Granulomatous Fungal Rhinosinusitis

- Fungal tissue invasion
- Noncaseating granuloma
- Giant cells, plasma cells

Granulomatous Fungal Sinusitis

- AKA indolent fungal sinusitis
- Sudan
- Also: India, Pakistan
- U.S.?
Granulomatous Fungal Rhinosinusitis

- Low threshold for urgent surgery
- Ophthalmology and Neurosurgery consultations
- Infectious disease consultation
- Sequential debridement/revision
- Sequential imaging, especially MRI
- Anticipate indolent course

Conclusions

- Classification
- Invasive vs. noninvasive disease: tissue invasion
- Surgery critical for diagnosis, treatment
Allergic Fungal Rhinosinusitis Diagnosis and Management

Amber Luong, MD, PhD
Associate Professor and Director of Research

Objectives

- Review diagnostic criteria for AFRS and their limitations
- Discuss best practices for the clinical management of allergic fungal rhinosinusitis

AFRS Diagnostic Criteria

Bent & Kuhn Criteria

- Presence of nasal polyps
- Type I hypersensitivity for fungal antigens (skin test or elevated serum fungal specific IgE levels)
- Characteristic CT scan
  - Sinus opacification with increased signal intensity (ferromagnetic element in fungal debris)
  - Sinus expansion with bone erosion
- Eosinophilic mucus without fungal invasion
- Positive fungal stain or culture of sinus contents

Disclosures

Advisory Board
- 480 Biomedical
- ENTvantage Dx

Consultant
- Aerin Medical
- Medronic

Departmental Research Funding
- Allakos
- ENTvantage Dx
- Intersect ENT

Issues with clinical diagnostic criteria for AFRS

Nasal polyps

In previously operated patient, presence of nasal polyps may not be obvious in AFRS

Classic Allergic Fungal Rhinosinusitis Presentation

- 16 yo AA male presents with right-sided nasal congestion and sinus pressure
- No asthma
- Labs
  - Elevated fungal IgE levels
  - Serum IgE: 835.3 IU/ml (high)
  - Eosinophils: 6%, 0.5 (normal)
Amber Luong, MD, PhD  
McGovern Medical School at UT Health  
Science Center

**Issues with clinical diagnostic criteria for AFRS**  
**Fungal sensitivity**  
Diagnosis of fungal sensitivity is dependent on the assay used to diagnose fungal sensitivity

- Serum fungal IgE level < skin prick test
- < Intradermal test < ELIspot assay

- **Chakrabarti, et al. Laryngoscope, 2009**

**Elispot assay to identify T-cells Secreting Type 2 cytokine in response to fungi stimulation**

**Issues with clinical diagnostic criteria for AFRS**  
**Eosinophilic mucin**

Typical clinical presentation

- >20 yo male presents with nasal obstruction
- Labs classic for AFRS
  - Total IgE 742
  - Multiple elevated fungal specific IgE
  - Serum eosinophils nl
- No asthma
- Significant fungal hyphae within collected mucin

**Hierarchical Cluster Analysis -> Transition to Phenotypes to Endotypes**

AFRS associated with significant upregulation of genes important in T-cell activation

**AFRS (Unique v CRSwNP)**

- CD28 signaling in T-Helper Cells
- iCOS signaling in T-Helper Cells
- NFAT signaling
- PKθ signaling in T-cells
- TCR signaling

**Typical clinical presentation**

**AFRS (Unique v CRSwNP)**

- CD28 signaling in T-Helper Cells
- iCOS signaling in T-Helper Cells
- NFAT signaling
- PKθ signaling in T-cells
- TCR signaling


Tyler et al., JACI 2017

Tyler et al., JACI 2017
Treatment – FESS is typically indicated first

Goals of surgery:
1. Clear eosinophilic mucin which also harbors fungal triggers
2. Clear nasal polyps to improve symptoms of sinus pressure and nasal congestion
3. Provide access to diseased mucosa for topical medications

Surgical considerations

Typical post-operative regimen

- Manage pain
  - Diclofenac tablets 50 mg PO q8 hrs as needed
- Address inflammation incited by surgery
  - Prednisone 30 mg PO x 9 days
- Manage post-operative infections?
  - Use when steroid-eluting implants are used
    - Duricef 500 mg PO BID x 10 days
- Manage sinus inflammation of the disease
  - Start budesonide saline irrigations about 2 weeks post-operative

Airway surface fungi important in Th2-associated airway disease

Positive fungal culture from sinus cavities associated with presence of asthma and CRSwNP

Fungus-specific PBMC IL-4 responses occur in the majority of patients with Th2-associated airway diseases.
Amber Luong, MD, PhD
McGovern Medical School at UT Health Science Center

**Fungi can stimulate release of IL-33**

![Graph showing Epithelial Cells and IL-33 levels](image)

Shaw JL and Luong A et al, 2013 AJRCC

**RCT of oral itraconazole in fungal sensitive CRSwNP**

![Diagram showing RCT process](image)

**When to consider oral itraconazole in AFRS?**

- Increasing sinus mucosal inflammation despite topical steroid irrigations
- Trial for 1 month
- Precautions
  - Rule out congestive heart disease by history
  - Evaluate liver function with baseline hepatic labs
  - Review medication list

**Anti-IgE (Omalizumab)**

- Recombinant humanized monoclonal antibody against IgE
- Trade name is Xolair
- Indicated for patient aged 12 or older with moderate to severe persistent asthma who have a positive skin test or *in vitro* reactivity to a perennial aeroallergen and whose symptoms are not controlled with inhaled corticosteroids.
- A couple case reports using anti-IgE for treatment of recalcitrant CRS with nasal polyps in patients with asthma showed reduction in nasal polyps and mucosal edema
- Active Phase III clinical trial for CRSwNP patients

**Summary**

- AFRS clinically can be difficult to diagnose especially in previously treated patients
- Treatment typically requires FESS first, taking care to minimize fungal exposure in any nondiseased sinuses
- Medical management is aimed at immediate post-operative issues and management of long-term inflammation and disease triggers
Allergic Fungal Rhinosinusitis: What have we learned?

Bradley F. Marple, MD – Moderator
Martin J. Citardi, MD
Philip Chen, MD
Amber Luong, MD, PhD
Matthew Ryan, MD

An association is recognized – the journey begins

Clinical Observations Concerning AFRS: The first 10 years

Waxman JE, Spector JG, Sale SS, Katzenstein AA.
Laryngoscope 1987;97:261-266

Radiographic Characteristics: Bone Erosion

- CT
  - Allergic mucin mucocoele
  - Associated obstructive sinusitis
  - Heterogeneous appearance
  - Charcot Fe, Mn

- Mukherji
  - Reviewed 45 AFRS CTs
  - Bone erosion - 20%

- Nussenbaum, Marple
  - Reviewed 142 AFRS CTs
  - Bone erosion - 20%
  - Histology - 0/142 demonstrated invasion

Clinical Presentation: Mucin

- Mucin is the hallmark of the disease
- Nasal discharge - brown to green, gritty

Allergic Aspergillus Sinusitis: Concepts in Diagnosis and Treatment of a New Clinical Entity

- 15 cases
- Mean age 29
- Average of 4 sinus surgeries
- 11/15 had asthma
- 80% skin test positive for Aspergillus
- 85% elevated total serum IgE
- 2 patients with expansile disease

Waxman JE, Spector JG, Sale SS, Katzenstein AA.
Laryngoscope 1987;97:261-266
Allergic Mucin

- Gross findings - indistinguishable from ABPA
- Thick viscosity
- Tan, black, green
- Histology
  - Non-invasive fungus
  - Grocott
  - Giemsa
  - PAS
  - Eosinophils
  - Charcot-Leyden Crx

Diagnostic Criteria

- Cody
- Allphin
- Lowry, Schaefer
- deShazo, Swain
- Bent and Kuhn
  - Gell & Coombs type I hypersensitivity (history, skin, or serology)
  - Polyposis
  - CT findings
  - Eosinophilic mucus: no fungal invasion

European Position Paper on Rhinosinusitis and Nasal Polyps 2012 (EPOS)

6.6. Allergic fungal rhinosinusitis

5.6.1. Introduction

There is much debate regarding the role of fungi in CRSwNP and whether the diagnostic group of AFRS truly represents a unique disease. In spite of our limited knowledge regarding the pathophysiology of CRSwNP, there is a subset of patients who identify with the classic Bent-Kuhn criteria for AFRS who demonstrate some phenotypic differences when compared to other CRSwNP patients. The original Bent-Kuhn diagnostic criteria (15) consist of the following:
1. Nasal polyposis,
2. Fungus on imaging,
3. Eosinophilic mucin without fungal invasion into sinonasal tissue,
4. Type I hypersensitivity to fungal and
5. Characteristic radiologic findings with soft tissue differential densities on CT scanning.

Bent, Kuhn, Oto-HNS 1994;111:580-88


European Position Paper on Rhinosinusitis and Nasal Polyps 2012 (EPOS)

Is AFRS Distinct from CRScP?
Questions

- The moderator will lead the panel through a series of questions with the intent of understanding current opinions related to this disease.
- The audience will be invited to ask questions of the panel.
- Given that this is a panel discussion, the discussion is intended to be dynamic and reflective of the differing opinions of the panel and audience.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Panel</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:35-5:00 PM</td>
<td>Frontal sinus panel</td>
<td>Pete S. Batra, MD (moderator); Ashleigh Halderman, MD; Seth Isaacs, MD; Li-Xing Man, MD; William Yao, MD</td>
</tr>
<tr>
<td></td>
<td><strong>Session: Fungal Rhinosinusitis</strong></td>
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<tr>
<td>5:00-5:20 PM</td>
<td>Fungal rhinosinusitis diagnosis</td>
<td>Martin J. Citardi, MD</td>
</tr>
<tr>
<td>5:20-5:40 PM</td>
<td>Allergic fungal rhinosinusitis diagnosis and management</td>
<td>Amber Luong, MD, PhD</td>
</tr>
<tr>
<td>5:40-6:00 PM</td>
<td>Fungal rhinosinusitis panel</td>
<td>Bradley Marple, MD (moderator); Philip Chen, MD; Martin J. Citardi, MD; Amber Luong, MD, PhD; Matthew Ryan, MD</td>
</tr>
<tr>
<td>6:00 PM</td>
<td>Announcements</td>
<td>William Yao, MD</td>
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<tr>
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<td><strong>SATURDAY, NOVEMBER 4</strong></td>
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<tr>
<td>7:00 AM</td>
<td>Registration/Breakfast</td>
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<tr>
<td>7:45 AM</td>
<td>Welcome</td>
<td>Amber Luong, MD, PhD</td>
</tr>
<tr>
<td></td>
<td><strong>Session: Office-based Rhinology Procedures</strong></td>
<td>Br...</td>
</tr>
<tr>
<td>8:00-8:20 AM</td>
<td>Patient selection &amp; preparation</td>
<td>Amber Luong, MD, PhD</td>
</tr>
<tr>
<td>8:20-8:40 AM</td>
<td>Office technology</td>
<td>Martin J. Citardi, MD</td>
</tr>
<tr>
<td>8:40-9:10 AM</td>
<td>Office procedures panel</td>
<td>Martin J. Citardi, MD (moderator); Pete S. Batra, MD; Amber Luong, MD, PhD; Michael Marino, MD</td>
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<tr>
<td></td>
<td><strong>Session: Extended Indications for ESS</strong></td>
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<tr>
<td>9:10-9:30 AM</td>
<td>Inverted papilloma</td>
<td>William Yao, MD</td>
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<tr>
<td>9:30-9:50 AM</td>
<td>Endoscopic epistaxis management</td>
<td>K. Christopher McMains, MD</td>
</tr>
<tr>
<td>9:50-10:15 AM</td>
<td>Endoscopic orbital surgery</td>
<td>William Yao, MD</td>
</tr>
<tr>
<td>10:15-10:40 AM</td>
<td>Endoscopic CSF leak repair</td>
<td>Pete S. Batra, MD</td>
</tr>
<tr>
<td>10:40 AM</td>
<td>Break</td>
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<tr>
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<td><strong>Session: Rhinology: Past, Present &amp; Future</strong></td>
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<tr>
<td>11:10-11:35 AM</td>
<td>Defining indications for FESS</td>
<td>Martin J. Citardi, MD (moderator); Pete S. Batra, MD; Bradley Marple, MD</td>
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<td>11:35 AM-12:00 PM</td>
<td>Recalcitrant rhinosinusitis</td>
<td>William Yao, MD, (moderator); Martin J. Citardi, MD; Seth Isaacs, MD; Kent Lam, MD; Bradley Marple, MD</td>
</tr>
<tr>
<td>12:00-12:30 PM</td>
<td>Rhinology innovations</td>
<td>Amber Luong, MD, PhD (moderator); Kent Lam, MD; Li-Xing Man, MD; K. Christopher McMains, MD; Matthew Ryan, MD</td>
</tr>
<tr>
<td>12:30-1:00 PM</td>
<td>Endoscopic skull base surgery</td>
<td>Pete S. Batra, MD</td>
</tr>
<tr>
<td>1:00 PM</td>
<td>Announcements</td>
<td>Amber Luong, MD, PhD</td>
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<td><strong>Rhinology Dissection Lab</strong></td>
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<tr>
<td>1:10 PM</td>
<td>Travel to lab</td>
<td>(lab participants only)</td>
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<tr>
<td>1:30 PM</td>
<td>Lunch</td>
<td>(lab participants only)</td>
</tr>
<tr>
<td>2:00-5:00 PM</td>
<td>Lab</td>
<td>(lab participants only)</td>
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</table>

**Rhinology Program**
Patient Selection and Preparation for In-Office Procedures

Amber Luong, MD, PhD
McGovern Medical School at UT Houston

Disclosures

Advisory Board
- 480 Biomedical
- ENTvantage Dx

Consultant
- Aerin Medical
- Medtronic

Departmental Research Funding
- Allakos
- Intersect ENT

Increasing Trend of In-office Procedures

<table>
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<tr>
<th>12 Mth Ending Q1 CY12</th>
<th>12 Mth Ending Q1 CY13</th>
<th>12 Mth Ending Q1 CY14</th>
<th>12 Mth Ending Q1 CY15</th>
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<td>7851</td>
<td>9353</td>
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<tr>
<td>Hospital Cases 65186</td>
<td>97952</td>
<td>58467.14969</td>
<td>52413.37845</td>
<td>51550.54546</td>
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<td>Total 103478.9795</td>
<td>107493.1497</td>
<td>131057.3784</td>
<td>147183.5455</td>
<td>158861.8089</td>
</tr>
</tbody>
</table>

Progression of technology for balloon localization

Advances in technology driving in-office procedures

Case presentation of recurrent nasal polyps: a common scenario

- 45 yo female with AERD s/p multiple sinus surgery presents with recurrent sinus pressure and nasal congestion
- Her asthma is currently still generally controlled
- She is on aspirin at 350 mg BID and singulair
- She is also doing budesonide irrigations daily
- She wants to avoid oral steroids
Treatment options?

1. Medical therapy
   - Topical steroids and antibiotics
   - Oral steroids and/or antibiotics
2. Revision FESS in OR
3. In-office procedure
4. Other

Considerations for in-office procedures

- Patient selection
- Case selection
- Preparation of the patient
- Set-up for the procedure
- Contingency plan to manage possible complications

Patient selection

- Demeanor
- Anxious?
- Motivation for an in-office procedure
- Candidate for general vs local anesthesia

Case selection

- Review history
  - Diagnosis
  - Confirm medication list
  - Similar pre-operative work-up as if pt going to OR
- Review CT sinus scan
  - Significant eosinophilic mucin?
  - Significant bony work necessary?
- Review nasal endoscopy
- Understand the goals of the procedure

Patient counseling

- Critical to set expectations
  - Provide patient overview of the procedure and what to anticipate – especially the challenging components of the procedure
  - Review the goals of the procedure
- Consent the patient

CT sinus scan

SNOT-22: 54
Considerations for set-up of in-office procedure room

1) Designated procedure room versus clinic room
2) Staff assistance
3) Equipment
   - Powered microdebrider
   - Navigation
   - Instrument set
   - Disposables on hand
4) Anesthesia

Be prepared to manage the most complication

Epistaxis
   - Afrin-soaked cotton/cottonoids
   - Bipolar cauterization
   - Epistaxis toolkit

Minimizing patient anxiety

- Consider pre-medication with Ativan (1 mg) about 1 hour prior to procedure
- Provide music
- Consider eye covers
- Consider NuCalm system
- Consider narrating key components of the procedure and framing the patient’s expectation of activities

NuCalm system

Neurophysiologic technology aimed at inducing a parasympathetic dominance to put a patient in a deep calm state

Anesthesia for in-office procedure

- Topical spray of 4% lidocaine and oxymetazoline
- Cotton balls moistened with 4% lidocaine gel mixed with oxymetazoline placed in the middle meatus for 20 mins
- Possible injection of 1% lidocaine and 1:10000 epinephrine at strategic sites

Summary

- Patient and case considerations are critical in identifying appropriate cases
- Protocols for local anesthesia and management of bleeding and patient anxiety important
Rationale for Procedures in the Office

- Lower cost setting
- Reserve OR for most challenging cases
- Good patient acceptance
- Low-friction logistics
- Favorable reimbursement

Decision Matrix 1.0

Option A (Office vs. OR)
- B endo balloon FS
- B endo balloon max
- B endo partial ethmoid
- B endo balloon sphenoid
- Surgical navigation

Option B (OR vs. office)
- B endo FS
- B endo max
- B endo ethmoid
- B endo sphenoid
- Surgical navigation

Decision Matrix 2.0

- Degree of symptomatic improvement disproportionate to the intervention
- Pareto Principle: roughly 80% of the effects come from 20% of the causes
- Office-procedure as an 80% solution
- 80-20 rule
- Easy salvage path

Office Preparations

- Staff Training
- Supplies
- Revenue Cycle
Outline

• Anesthesia
• Supplies
• Instrumentation
• Powered Instrumentation
• Surgical navigation

ANESTHESIA

Tetracaine

• Available as ophthalmic preparation
• Compounding pharmacy preparations

Anesthesia

Via atomizer:
• Oxymetazoline (.05%)
• Lidocaine (4%)

Via packing:
• Oxymetazoline (.05%)
• Lidocaine (4%)

Via infiltration (SPA and other sites):
• 1% lidocaine with 1:100,000 epinephrine

Local Anesthetics Pharmacology

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset</th>
<th>Max dose (78 kg)</th>
<th>Max dose (70 kg)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>Rapid</td>
<td>4.5 mg/kg</td>
<td>7 mg/kg</td>
<td>315 mg</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>Slow</td>
<td>1.5 mg/kg</td>
<td>3.5 mg/kg</td>
<td>60 mg</td>
</tr>
</tbody>
</table>

Remember
1%: 10 mg/ml
2%: 20 mg/ml
4%: 40 mg/ml

Lidocaine Options

Jelly, 2%
Cream, 3%
Non-Pharmacological Relaxation Technology

**NuCalm**

**Meditation in a Box**
- Rapid induction of parasympathetic hypnagogic dissociative state
- Sustained, steady parasympathetic dominance
- Rapid return to a functional state (motor skills, attention, and full cognition) with no lingering negative post-sedative effects

**NuCalm Cream**
- Proprietary orthomolecular formula (all-natural dietary supplements)
- Intended to block stress response
- “Generally Recognized as Safe” per FDA

**NuCalm®**
- Apply NuCalm Cream to each carotid
- Apply Cranial Electrotherapy Stimulation (CES) patches (one below each ear lobe); activate at 0.1 mA
- Cover the eyes
- Apply headset; activate neuroacoustic software

**Neuroacoustic Software**
- Designed to entrain brain wave function and lead the brain to pre-sleep alpha-theta states (4-12 Hz)
- Claim not reviewed by the FDA
- Not intended for medical treatment of specific conditions

**Cranial Electrotherapy Stimulation**
- Class II medical device
- Designed for reduction of anxiety, depression and/or insomnia
- FDA cleared
- Only available with prescription

**Light-Blocking Mask/Glasses**
- Blocks stimulation of optic nerve
- Up 30% increase in alpha waves at visual cortex
- Not intended for diagnosis/treatment

**Contraindications**
- Pregnant women
- Nursing women
- Patients with pacemakers, ventricular assist devices and brain implants
- Patients with claustrophobia

**SUPPLIES**
**Device Options**

**Balloon Sinus Dilatation**

- **Acclarent**
  - RELIEVA SPIN
  - RELIEVA SCOUT
  - RELIEVA ULTRIRA

- **Entellus**
  - XprESS Pro
  - XprESS LoProfile
  - XprESS Ultra

**Epistaxis Management**

- Resorbable materials preferable
- Cost is an issue
- Carboxymethylcellulose

**Carboxymethyl Cellulose Fibers**

**Middle Meatal Spacer**

- Stammberger SINU-FOAM® (Smith & Nephew)
- Hemostatic
- Injected as viscous hydrocolloid foam
- May serve as carrier for drugs (steroids and antibiotics)
- Well-tolerated by nasal mucosa

**Carboxymethyl Chitosan Polymer**

**Middle Meatal Sponge**

- PosiSepX® (Hemostatis LLC)
- Hemostatic properties
- Prevents adhesions
- Prevents edema
- Reported clearance time of 5-10 days

**Chitosan/Polyethylene Glycol**

**Middle Meatal Spacer**

- Xerogel® (Entellus)
- Co-polymer of chitosan and PEG
- PEG hydrogel imparts some additional integrity

**Esterified Hyaluronic Acid**

**Middle Meatal Spacer**

- Woven fleece option (MeroGel®)
  - After hydration, transforms to muco-adhesive gel
  - Dissolves over two weeks
- Dressing/stent option (MeroPack®)
  - 80% HYAFF, 20% collagen
  - Hemostatic properties
  - Dissolves over 2 weeks
  - Injectable option (MeroGel Injectable®)
  - Pre-mixed syringe
Chitosan Injectable Nasal Packing & Stent
- NovaShield® (Medtronic)
- Hemostatic effect due to platelet aggregation and tamponade
- Antibacterial effect (in vitro)
- Adhesion prevention (barrier)
- Fast & easy

Syntetic Fragmentable Foam Sponge
- NasoPore (Stryker)
- polyurethane (DL-lactide-co-e-caprolactone) foam
- Degrades to CO₂, H₂O and O₂ and poliamine
- 4 variations (“compression strength” and fragmentation time)
- May be combined with triamcinolone (40 mg/ml, 2 ml)

Synthetic Fragmentable Foam Sponge with Chitosan Middle Meatal Spacer
- HemoPore® (Stryker)
- poly (DL-lactide-co-e-caprolactone) urethane foam, chitosan derivative, violet color additive
- Fragments in 10-14 days
- Hemostatic properties due to platelet aggregation

Drug-Eluting Implant
- Propel, Propel Mini, Contour
- Mometasone implant (370 ug)

Instrument Optimization
Other Devices

- Entellus Cyclone
- Acclarent CIRCA

POWERED INSTRUMENTATION & VIDEO

Soft-Tissue Shavers

Video Equipment

Bipolar Coagulators

SURGICAL NAVIGATION
Feasibility of Balloon Sinuplasty in Patients with Chronic Rhinosinusitis: the Graz Experience
Tomazic, et al. (Rhinology, 2013)
• Aim: Assess feasibility
• Platform: Acclarent
• Patient population: consecutive patients with refractory CRS
• 45 patients; 112 sinuses (60%) planned as balloon only
• 65% failure rate in the balloon only group
• 66% failure rate in the hybrid group
• Success defined as proper cannulation and sufficient dilatation… according to the surgeon’s evaluation
• Failure categorized as insertion failure, dilatation failure and not tried.

Rationale for Navigation
• Anatomic complexity
• Perceptual distortion afforded by endoscopes
• Greater need for precision in office setting

Transillumination
• Only confirms the destination, but not the pathway
• False positives with specific anatomic configurations
• Trajectory and pathway are important, especially with moderate-to-severe inflammatory burden or complex anatomy

Device Options
Surgical Navigation
Fiagon Surgical Navigation
Medtronic Fusion

Device Innovations
Integration with Navigation
Fiagon Wire
Acclarent Spin Plus Nav
Medtronic NuVent EM Balloons
Conclusion

- Equipment can approach OR-level capabilities
- Graduated approach OK
- Cost considerations
- Foundation for office-based procedures
Exploring the Limits of Office Procedures

Panelists
- Pete S. Batra (Rush, Chicago, IL)
- Amber Luong, MD, PhD (McGovern Medical School, Houston, TX)
- Michael Marino, MD (Mayo, Scottsdale, AZ)

Rationale for Procedures in the Office
- Lower cost setting
- Reserve OR for most challenging cases
- Good patient acceptance
- Low-friction logistics
- Favorable reimbursement

Anesthesia Options

Decision Matrix 2.0
- Degree of symptomatic improvement disproportionate to the intervention
- Pareto Principle: roughly 80% of the effects come from 20% of the causes
- Office-procedure as an 80% solution
- 80-20 rule
- Easy salvage path

Disclosure
- Acclarent (consultant)
- Arrinex (consultant)
- Biosense Webster (consultant)
- Factory CRO (consultant)
- Hemostasis, LLC (consultant)
- Medical Metrics (consultant)
- Medtronic (consultant)
- Optinose (consultant)
CASES

Decision Matrix 1.0

Option A (Office vs. OR)
- B endo balloon FS
- B endo balloon max
- B endo partial ethmoid
- B endo balloon sphenoid
- Surgical navigation

Option B (OR vs. office)
- B endo FS
- B endo max
- B endo ethmoid
- B endo sphenoid
- Surgical navigation

Patient JEB
- 79 year old man
- c/o nasal obstruction and congestion
- Slowly progressive over period of months; now with QOL impact
- Established patient with known CRSwNP; on inhaled fluticasone sprays
- 2011: B rev IG-FESS for CRSwNP
- 2011 work-up: peripheral eosinophilia, high serum IgE, normal RAST
- PMH: Seizure disorder, brain injury, asthma
- Meds: Fluticasone/salmeterol, fluticasone nasal spray, fondaparinux, phenytoin
Patient JEB
For Discussion
• Anti-coagulation?
• Patient age?
• Disease burden?
• Mental status?
• Navigation?
• Shaver?
• Coblation?

Patient LEB
• 60 year old man
• c/o cough and nasal obstruction
• Reports 2 “infections” per month for past year; each characterized by discolored drainage, worsening PND and facial pain
• Symptoms worse on LT
• PMH: “cardiac arrhythmia,” DVT, GERD, hypercholesterolemia, OSA, PTSD
• Meds: Atorvastatin, dexlansoprazole, flecainide, fluticasone sprays, metoprolol, warfarin

Patient LEB
In-Office Procedures
• Anti-coagulation?
• Cardiac co-morbidity
• Navigation?
• Scope of surgery: septoplasty, B IT SMR, B endo CB, mini-FESS, FESS, and/or balloon
Patient H

Initial Presentation

- 49 year old man
- CC: nasal drainage, clear, mostly from LT side
- Also reports facial pressure/pain, nasal obstruction/congestion
- >4-6 exacerbations per year
- Drainage will drip like a faucet; no salty taste
- Sinus procedure 20 years ago (no details)
- Previous treatment (prior 12 months): azithromycin, cetirizine, INS, nasal saline
- s/p SCIT with mild improvement
- Exam: LT serous OM

Initial Treatment

- Levofloxacin 500 mg po qd X 15 days
- Mometasone 2 sprays each side daily
- Collect drainage for beta-2 transferrin
- RTC 4 weeks
- CT scan at next visit

Second Visit

- No major changes in symptoms
- Unable to collect drainage for beta-2 transferrin testing
- Exam unchanged
- Endoscopy unchanged
Patient H

Surgical Intervention

Option A (Office vs. OR)
- B endo balloon FS
- B endo balloon max
- Surgical navigation

Option B (OR vs. office)
- B endo FS
- B endo max
- Surgical navigation

Patient H

For Discussion

- Navigation?
- Scope of surgery: septoplasty, B IT SMR, B endo CB, mini-FESS, FESS, and/or balloon
- Patient counseling?

Patient M

Initial Presentation

- 31 year old woman
- CC: wheezing, cough; associated with PND for 2-3 months
- Started with viral URI
- Then developed LT>>RT nasal obstruction, thick rhinorrhea
- Baseline asthma worsening
- No recent CRS treatment
- s/p B ESS 10 years earlier
- PMH: Grave’s disease

Patient M

Initial Treatment

- Amox/clav 875-125 BID X 21 days
- Prednisone 40 mg daily X 3 days, then 30 mg daily X 3 days, then 20 mg daily X 3 days, then 10 mg daily
- Steroid counseling
- Labs: CBC with diff, RAST, Tot IgE, Vitamin D
- Endocrine consult
- Pulmonary consult
- CT at next visit

Patient M

Second Visit

- Seem worse—more congestion and drainage on LT
- Took prednisone for 30 days with some improvement
- Now on Advair from pulmonary
- RAST panel negative
- No peripheral eosinophilia
- Normal total IgE
- Vit D 25-OH at 24 ng/ml (30-100 ng/ml normal range)
For Discussion

- Navigation?
- Scope of surgery: All sinuses?
  How much dissection?
- Steroids: implants, topical or systemic?
- Patient counseling?
### Session: Fungal Rhinosinusitis
Bradley Marple, MD (moderator)

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00-5:20 PM</td>
<td>Fungal rhinosinusitis diagnosis</td>
<td>Martin J. Citardi, MD</td>
</tr>
<tr>
<td>5:20-5:40 PM</td>
<td>Allergic fungal rhinosinusitis diagnosis and management</td>
<td>Amber Luong, MD, PhD</td>
</tr>
<tr>
<td>5:40-6:00 PM</td>
<td>Fungal rhinosinusitis panel</td>
<td>Bradley Marple, MD (moderator); Philip Chen, MD; Martin J. Citardi, MD; Amber Luong, MD, PhD; Matthew Ryan, MD</td>
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### Session: Office-based Rhinology Procedures
Amber Luong, MD, PhD (moderator)

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<thead>
<tr>
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<th>Topic</th>
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<tbody>
<tr>
<td>8:00-8:20 AM</td>
<td>Patient selection &amp; preparation</td>
<td>Amber Luong, MD, PhD</td>
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<tr>
<td>8:20-8:40 AM</td>
<td>Office technology</td>
<td>Martin J. Citardi, MD</td>
</tr>
<tr>
<td>8:40-9:10 AM</td>
<td>Office procedures panel</td>
<td>Martin J. Citardi, MD (moderator); Pete S. Batra, MD; Amber Luong, MD, PhD; Michael Marino, MD</td>
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</table>

### Session: Extended Indications for ESS
William Yao, MD (moderator)

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:10-9:30 AM</td>
<td>Inverted papilloma</td>
<td>William Yao, MD</td>
</tr>
</tbody>
</table>
4:35-5:00 PM  Frontal sinus panel
Pete S. Batra, MD (moderator); Ashleigh Halderman, MD; Seth Isaacs, MD; Li-Xing Man, MD; William Yao, MD

Session: Fungal Rhinosinusitis
Bradley Marple, MD (moderator)
5:00-5:20 PM  Fungal rhinosinusitis diagnosis
Martin J. Citardi, MD

5:20-5:40 PM  Allergic fungal rhinosinusitis diagnosis and management
Amber Luong, MD, PhD

5:40-6:00 PM  Fungal rhinosinusitis panel
Bradley Marple, MD (moderator); Philip Chen, MD; Martin J. Citardi, MD, Amber Luong, MD, PhD, Matthew Ryan, MD

6:00 PM  Announcements
William Yao, MD

SATURDAY, NOVEMBER 4
7:00 AM  Registration/Breakfast
7:45 AM  Welcome
Amber Luong, MD, PhD

Session: Office-based Rhinology Procedures
Amber Luong, MD, PhD (moderator)
8:00-8:20 AM  Patient selection & preparation
Amber Luong, MD, PhD

8:20-8:40 AM  Office technology
Martin J. Citardi, MD

8:40-9:10 AM  Office procedures panel
Martin J. Citardi, MD, (moderator); Pete S. Batra, MD; Amber Luong, MD, PhD; Michael Marino, MD

Session: Extended Indications for ESS
William Yao, MD (moderator)
9:10-9:30 AM  Inverted papilloma
William Yao, MD

9:30-9:50 AM  Endoscopic epistaxis management
K. Christopher McMains, MD

9:50-10:15 AM  Endoscopic orbital surgery
William Yao, MD

10:15-10:40 AM  Endoscopic CSF leak repair
Pete S. Batra, MD

10:40 AM  Break

Session: Rhinology: Past, Present & Future
Matthew Ryan, MD (moderator)
11:10-11:35 AM  Definining indications for FESS
Martin J. Citardi, MD, (moderator); Pete S. Batra, MD; Bradley Marple, MD

11:35 AM-12:00 PM  Recalcitrant rhinosinusitis
William Yao, MD, (moderator); Martin J. Citardi, MD; Seth Isaacs, MD; Kent Lam, MD; Bradley Marple, MD

12:00-12:30 PM  Rhinology innovations
Amber Luong, MD, PhD, (moderator); Kent Lam, MD; Li-Xing Man, MD; K. Christopher McMains, MD; Matthew Ryan, MD

12:30-1:00 PM  Endoscopic skull base surgery
Pete S. Batra, MD

1:00 PM  Announcements
Amber Luong, MD, PhD

Rhinology Dissection Lab (paid participants only)
1:10 PM  Travel to lab (lab participants only)
1:30 PM  Lunch (lab participants only)
2:00-5:00 PM  Lab
Endoscopic Management of Inverted Papilloma

William C Yao, MD
Department of Otorhinolaryngology
Texas Sinus Institute
Texas Skull Base Institute
www.ut-ent.org
William.c.yao@uth.tmc.edu

Inverted Papilloma

Disclosure
• None

Inverted Papilloma

Case Presentation

48 year old male presents to the ENT clinic after being found to have an unilateral nasal mass. His congestion gradually worsened over the past several years.

Inverted Papilloma

• Benign epithelial tumor of the nasal cavity
• Subtype of Schneiderian papilloma
• 0.5-4% of all nasal tumors
• Locally destructive
• Most common in white males age 50-70
• Rates of Carcinoma Transformation
  • Synchronous: 7.1%
  • Metachronous: 3.6%

Pathology

• Schneiderian Papilloma
• Inverted growth of nonkeratinizing transitional cells
• Distinct BM

Radiographic Findings

- CT
  - 56% with osteitic changes at attachment site
  - Difficult to tell apart trapped secretions versus tumor
- MRI
  - Better definitions of the margins of IP

Case Presentation

Sites of Attachment

- Papilloma on lateral nasal wall more likely IP or cylindrical
- Odds ratio 43.4

Staging

Original Research

Endoscopic Resection of Sinonasal Inverted Papilloma: A Meta-analysis
Jose M. Barquet, MD, and Peter H. Hing, MD, Portland, Oregon
How do we decrease recurrence?

Minimizing recurrence

• Retrospective review of 127 patients
• Average time to recurrence: 27 months

Postoperatively

2 months
Conclusion

- IP has an approximate 10% chance of malignant transformation
- Most common site of an IP is the maxillary sinus
- There is a focal osteitic changes that occur at the base
- Base should be removed, drilled or cauterized to decrease recurrence
- Recurrence rate is 12%
Epistaxis: Endoscopic Management

K. Christopher McMains, MD
Associate Professor
Department of Surgery
USUHS

Disclosures

- No disclosures
- These represent my views and not the views of VA, USUHS, or DoD.

Penalties for Bad Teaching Practice...

Blood Supply

Underlying anatomy
Considerations
- PMH:
  - HTN*
  - Coagulopathies
  - CAD/PVD/CHF
- Meds:
  - Anti-coagulants
- FH:
  - "Free bleeders"
- PE:
  - Special cases

Treatment Options
- Topicals
- AgNO3
- Anterior Packing*
- Posterior Packing*
- Anterior
- Monitored setting
- Surgery
- Cautery
- SPA ligation
- Embolization

Getting Ready: Protect Yourself

Getting Ready: Bag o’ Tricks...

Getting Ready: Bag o’ Tricks...
Embolization vs. SPA Ligation?

- Embolization
  - Higher Success Rate
  - More expensive
  - Availability?
- SPA Ligation
  - Lower Success Rate (slight)
  - Less Expensive
  - Surgeon Ability?

Rudmik L, Smith V, 2012
Rudmik L, Leung R, 2014
HHT Considerations

- Imaging:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epistaxis</td>
<td>90-98%</td>
</tr>
<tr>
<td>GI Telangiectas</td>
<td>19%</td>
</tr>
<tr>
<td>Hepatic AVMs</td>
<td>0.1-0.9%</td>
</tr>
<tr>
<td>Pulmonary AVMs</td>
<td>0.6-3.1%</td>
</tr>
<tr>
<td>Central Nervous System AVMs</td>
<td>0.1-0.9%</td>
</tr>
<tr>
<td>Optic AVMs</td>
<td>1%</td>
</tr>
</tbody>
</table>

- Medications:
  - Bevacizumab (Avastin)
  - Estrogens
  - Propanolol
  - Thalidomide

Special Cases

Endoscopic Epistaxis: Summary

- Every case is endoscopic!
- Protect yourself
- Ounce of preparation vs. a pound of flail
Orbital Surgery in the Endoscopic Age

Disclosure

• None
“The specialties of otolaryngology and ophthalmology are separated by no more than the width of the lamina papyracea”

R. Metson

Outline

- Dacryocystorhinostomy
- Orbital Decompression
- Expanded Endoscopic Orbital Surgery

Dacryocystorhinostomy

- Indication
  - Nasolacrimal duct obstruction (NLDO)
  - Epiphora
  - Chronic dacryocystitis

Surgical Approach

External

- Success rate 80-95%
- Skin incision
- Allows for direct visualization of lacrimal sac

Endoscopic

- Success rate 80-95%
- No skin incision
- Preservation of orbicularis pump mechanism
- Improved patient satisfaction

Surgical Approach

- Recommend endoscopic DCR
- Endoscopic lasers show poor results
- ~25% with nasal pathology

DCR
**Dacryocystorhinostomy**
- Mucosal flaps decrease crusting
- No change in success rate
- Stents does not improve success
- Stents for 6 weeks

**Orbital Decompression**

**Goal of Decompression**
- Optic Neuropathy
  - Decrease tension on optic nerve
- Diplopia
  - Minimize new onset diplopia
- Exposure Keratopathy
- Cosmesis
  - Decrease proptosis
  - Prolapse of orbital contents into adjacent space

Note: Surgery can be used to treat proptosis of non-Graves’ etiology

**Radiographic Findings**
- CT
  - Hypertrophied extraocular muscle
    - Inferior rectus > medial rectus > superior rectus > lateral rectus
  - Spindle shaped
  - Increase in retro-orbital fat volume
  - Stretched optic nerve

**Transantral Decompression**
- Threatened vision loss
- Gingivobuccal incision
- Proptosis reduction
  - 4.0-5.5mm
- Complications
  - 40-64% new onset diplopia
  - Ocular dystopia
  - “Setting sun syndrome” – 4.5%
  - Maxillary sinusitis
  - Oroantral fistula – 3%

**Endoscopic Decompression**
- ESS
  - Middle turbinate removal
  - Removal of lamina papyracea
  - Spheno-ethmoid junction to maxillary line
  - Medial and inferior
  - Incision of periorbita
  - NO PACKING!!!!
Endoscopic Orbital Surgery

**Advantages**
- Avoid external scar
- Intact inferior oblique and medial canthal attachment
- Avoid nasolacrimal duct and infraorbital nerve

**Disadvantage**
- Asymmetric decompression
- Retrograde movement of globe medially and inferiorly

Mean reduction proptosis: 3.0 - 4.7mm
New onset diplopia: 19-32%

Infraorbital Strut
- Bony thickening at jx of multiple orbital wall
- Gives support for orbit
- 5-7mm width anteriorly
- Decreases ocular dystopia
- New-onset diplopia - 18%

- Orbital floor anterior to the equator of the globe is critical
- Cadaveric study (2002)
  - Anterior IOS with more robust support
  - Structural support from maxillary face
  - Globe supporting "ligaments"
  - Base of posterior lacrimal crest
  - Extension of Lockwood ligament
  - Posterior IOS may be site of further decompression

Infraorbital Strut

Pre-op

Post-op
Endoscopic Orbital Surgery

**Orbital Sling**
- Metson et al 2002
  - Removal of infraorbital strut
  - Preserve a sling of periorbita
  - Stabilize medial rectus and prevent prolapse

**Balanced Decompression**
- Medial and lateral wall decompression
- Increased area for decompression
  - Medial (3.2mm) vs Bal (5.6mm)
  - Lateral (4.0mm) vs Bal (5.7mm)
- May reduce postop strabismus
  - New onset diplopia rate lower than medial

**Surgical technique**
- Balanced orbital decompression
- Endoscopic approach
- Modified inferomedial orbital strut
  - Posterior 1/2 removed
  - New onset diplopia 17%
  - +/- orbital sling
  - w/ sling, 57% resolution of diplopia
  - 5.0mm decompression

**Orbital Tumor**
- Classically performed by orbital and neurosurgeons
  - External
  - Difficult to access tumors in the posterior-medial aspect of the orbit
  - Poor visualization
  - Area prime for endoscopic surgeons
  - Low incidence: 3-5 tumors/million
  - 17% vasculogenic

**Endoscopic Management of Orbital Tumor**
### Anatomy

- Several neurovascular structures in the medial orbit
- MRI with contrast and CT sinus for preop planning

### Surgical Approach

- Bimanual endoscopic
- Trans-septal 4-hand technique
- Retract MR, fat retraction
- Periorbital incision made anterior to the mass
- Blunt dissection with saline soaked patty
- Divert blood
- Hemostasis with warm saline
- Consider bipolar cautery in the extraconal compartment

### Reconstruction

![Reconstruction Image]

Questions?
Endoscopic CSF Leak Repair

Pete S. Batra, MD, FACS
Stanton A. Friedberg, MD Chair in Otolaryngology
Professor and Chairman
Co-Director, Rush Center for Skull Base and Pituitary Surgery
Co-Director, Rush Sinus Program
Head, Section of Rhinology, Sinus Surgery, and Skull Base Surgery
Dept. of Otorhinolaryngology – Head and Neck Surgery
Rush University Medical Center
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Office: 312-942-6100
Fax: 312-942-6653
Email: pete_batra@rush.edu

Objectives:
1. To review the etiology of CSF rhinorrhea
2. To understand the diagnostic workup, including role of endoscopy and imaging
3. To discuss the role of lumbar drains and intrathecal fluorescein
4. To outline the surgical strategy for management of CSF leaks
5. To appraise outcomes based on the available peer-review literature
Endoscopic CSF Leak Repair

Pete S. Batra, MD, FACS
Stanton A. Friedberg, MD, Chair in Otolaryngology
Professor and Chairman
Co-Director, Rush Center of Skull Base and Pituitary Surgery
Dept. of Otorhinolaryngology – Head and Neck Surgery
Rush University Medical Center
Chicago, Illinois

CSF Leak Surgery: History

- 1926: Dandy performed 1st CSF leak repair via frontal craniotomy
- 1952: Hirsch performed 1st transnasal repair of 2 sphenoid CSF leaks
- 1981: Wigand reported 1st successful endoscopic repair during sinus surgery

CSF Leaks: Etiology

- Traumatic
- Blunt
- Penetrating
- Iatrogenic
- Neurosurgery (craniotomy, pituitary)
- Rhinology (FESS, septoplasty)
- Others
- Neoplasms, congenital, hydrocephalus, spontaneous

CSF Leaks: Location

<table>
<thead>
<tr>
<th>Site</th>
<th>No.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphenoid</td>
<td>62</td>
<td>32.5%</td>
</tr>
<tr>
<td>Ethmoid</td>
<td>60</td>
<td>31.4%</td>
</tr>
<tr>
<td>Cribriform plate</td>
<td>28</td>
<td>14.7%</td>
</tr>
<tr>
<td>Frontal</td>
<td>22</td>
<td>11.5%</td>
</tr>
<tr>
<td>Unknown</td>
<td>12</td>
<td>6.3%</td>
</tr>
<tr>
<td>Multiple</td>
<td>9</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

Diagnostic Evaluation

- Nasal exam (watery rhinorrhea when lean forward)
- Neurologic exam
- Ocular exam
- Ophthalmology to rule out papilledema

*Don’t forget otologic exam!!!*
- Middle ear effusion
- Temporal bone leak via Eustachian tube
Endoscopic Evaluation

- Critical for accurate diagnosis...
- Pooling of clear secretions in the nasal cavity (rapidly fills with suctioning)
- Glistening pulsatile mass in the olfactory cleft

Laboratory Studies: $\beta_2$-transferrin

- Found in CSF, perilymph, and aqueous humor
- Highly specific and non-invasive test
- Collection issues: minimal volume (0.5 cc), degradation, delayed result
- Glucose test unreliable (high false positive rate due to reducing substances in tears and nasal mucus)

CT Imaging

- Study of choice....
- High-resolution axial/coronal CT (1-mm cuts) is initial study of choice
- Bony skull base defect (possible A-F level)\(^1\)
- Skull base disruption in trauma/iatrogenic leaks
- Localization of defect\(^2\)
  - Accuracy 93%
  - Sensitivity 92%

CT in Spontaneous CSF Leaks

- Soft tissue lesion of olfactory cleft, ethmoid, or sphenoid
- Anterior skull base often broadly attenuated
- Arachnoid pits
- Beware multiple defects!

MR Imaging

- Selected cases only...
- Assess contents of meningoencephalocele sac
- Evaluate for presence of empty sella in spontaneous leaks
  - 82-92% with partial or totally empty sella

MRI Imaging

- 24 y/o with severe NAO and hyposmia with recurrent sinus infections
### Diagnostic Studies

**CT cisternography:**
- Useful in patients with active leak
- Sensitivity 92% in active leaks and 40% in inactive leaks<sup>1</sup>

**MR cisternography:**
- T2-weighted fast-spin echo sequence with fat suppression
- Sensitivity 87% and accuracy 89%<sup>1</sup>

**Radionuclide cisternography (pledget study):**
- Sensitivity 62-76% and false-positive 33%<sup>2</sup>
- Precise localization often not possible...


### General Management Principles

**Key dictums:**
1. Precise identification of leak site
2. Determine best surgical corridor for repair
3. Address adjacent sinuses (avoid postop mucoceles)
4. Meticulous preparation of graft bed
5. Multi-layered reconstruction of defect

> Tailor approach and technique based on etiology and site of leak

### Surgical Approaches

**Endoscopic:**
- Transnasal
- Trans-ethmoid
- Trans-sphenoid
- Transpterygoid
- Extended

**Open:**
- Supraorbital
- Bilateral craniotomy

### Intrathecal Fluorescein

- Facilitate encephalocele identification
- Ensure watertight closure
- Identify multiple sites
- 0.1cc of 10% fluorescein in 10cc CSF (10-15 min)
- Informed consent imperative

Not FDA approved for intrathecal usage!!!

### Reconstruction Principles

- Careful fulguration of meningoencephalocele
- *Use bipolar cautery*
- Meticulous preparation of the graft bed
- Circumferential removal of mucosa (2-3 mm)
- Gentle drilling may stimulate new bone formation

### Intrathecal Fluorescein

- Review of 420 fluorescein applications in 305 pts
- Overall 0.1% risk of adverse events from 1969-98
- Serious complications at doses 100-700 mg (grand mal seizures, pulmonary edema, death)

<table>
<thead>
<tr>
<th>Amount of Fluorescein</th>
<th>Headache (%)</th>
<th>Nausea/Vomiting (%)</th>
<th>Dizziness (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-50 mg (52)</td>
<td>5 (9.6%)</td>
<td>3 (5.8%)</td>
<td>2 (3.8%)</td>
</tr>
<tr>
<td>50-100 mg (317)</td>
<td>30 (9.5%)</td>
<td>9 (2.8%)</td>
<td>6 (1.9%)</td>
</tr>
</tbody>
</table>

Skull Base Reconstruction

- Multi-layer reconstruction
  1. Fascia/acellular dermis (underlay)
  2. Bone graft (+/-)
  3. Fascia/acellular dermis (overlay)
  4. Mucosa (free or pedicled)
  5. DuraSeal™
  6. Fibrillar Surgicel
  7. Sponges (+/-)

---

Free Grafts: Options

- www.integra-ls.com
- www.medscape.com

Pedicled Grafts: Options

- Nasoseptal flap
- Pedicled on posterior septal artery
- Reconstruct large dural defects
- Success rate 94.3%
- Middle turbinate flap
- Inferior turbinate flap
- Pericranial flap

---

Lumbar Drains: Routine Placement Unnecessary!!

- 65 lumbar drains
- LD complications in 8 (12.3%) - 6 blood patches, 3 head CTs, 1 retained catheter fragments, 3 readmissions and 10 additional hospital days attributable to LD complications

---

Case 1: Spontaneous CSF Leak

- 64 y/o female with right CP and sphenoid LPR
- CSF leaks

---

Spontaneous Leaks: Pathophysiology

- Impaired CSF resorption (Low conductance at arachnoid villi)
- Development of elevated ICP
- Hydrostatic forces at areas of least resistance (Pneumatized sphenoid, elongated CP, optic nerve)
- Formation of CSF leak/encephaloceles
- Papilledema/visual loss

---

Pathophysiology: Role of OSA and Obesity


30% with diagnosis of OSA with spontaneous leaks

Long-Term Management

- Acetazolamide
  - Decreases CSF production by 48%\(^1\)
  - Mean reduction of ICP by 10 cm H\(_2\)O\(^2\)
- VP shunting in select cases only
- Repeat LP to monitor ICP
- Ophthalmology to rule out papilledema


Traumatic CSF Leaks

- 2-4% of all closed head injuries
- 80% begin within 48 hours
- 95% manifest within 3 months of injury
- 70% close with conservative measures
- Associated with significant risk of ascending meningitis (18%)
- May only heal by thin layer of mucosa or fibrous tissue


Spontaneous Leaks: Clinical Characteristics

- Distinct clinical entity...
- Mean age: 57.7 years
- Gender: 33 females (85%)
- Average BMI: 38.5 kg/m\(^2\)
- Sites: cribriform plate (51%), sphenoid LPR (31%)
- Mean ICP: 24.0 cm H\(_2\)O
- Empty or partially empty sella: 77.4%
- Meningocele or encephalocele: 84.6%


Case 2: Traumatic CSF Leak

24 y/o male with planum leak after fall from roof


Traumatic CSF Leaks: Management

- Conservative measures
- Bed rest, stool softeners +/- LD
- Consider exploration:
  - Persistent leak
  - Significant skull base disruption
  - Associated intracranial injury
- Highly individualized approach....
Case 3: Misdiagnosis of Encephalocele

52 y/o female S/P polypectomy and septoplasty – final path with “glial tissue”

CSF Leaks: Outcomes

- ARS survey of 197 respondents
- 522 CSF leaks
- 128 encephaloceles

<table>
<thead>
<tr>
<th>Variable</th>
<th>CSF Leaks</th>
<th>Encephaloceles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Success</td>
<td>90%</td>
<td>93%</td>
</tr>
<tr>
<td>Secondary Success</td>
<td>86%</td>
<td>97%</td>
</tr>
<tr>
<td>Complication Rate</td>
<td>2.5%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Seizures</td>
<td>0.2%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Meningitis</td>
<td>1.1%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Deaths</td>
<td>0.2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Outcomes: Systematic Review

- 55 studies with 1778 repairs
- Spontaneous leaks most prevalent
- Overall success rate:
  - Primary repair: 90.6%
  - Secondary repair: 96.6%
- Sphenoid (48%) most common site of failure
- Low complication rate: <0.03% (meningitis most common)

Outcomes: Systematic Review

- 22 studies with 673 patients (surgically created defects)
- Success for low-flow leaks:
  - Multilayered: 92%, pedicled flap: 100%
- Success for high-flow leaks:
  - Multilayered: 82%, pedicled flap: 94%
- Success by location:
  - Anterior cranial base: 92%, sellar: 93%, clival: 80%

Conclusions

- Endoscopic approach suffices in majority of CSF rhinorrhea cases
- High success rate >90%
- Low rate of major complications <1%
- Do not forget the key steps:
  - Careful identification of leak site
  - Selection of appropriate surgical approach
  - Meticulous reconstruction technique
Thanks!

Questions?
4:35-5:00 PM  Frontal sinus panel  
Pete S. Batra, MD  
(moderator); Ashleigh  
Halderman, MD; Seth  
Isaacs, MD; Li-Xing Man,  
MD; William Yao, MD

Session: Fungal Rhinosinusitis  
Bradley Marple, MD (moderator)
5:00-5:20 PM  Fungal rhinosinusitis diagnosis  
Martin J. Citardi, MD
5:20-5:40 PM  Allergic fungal rhinosinusitis diagnosis and management  
Amber Luong, MD, PhD
5:40-6:00 PM  Fungal rhinosinusitis panel  
Bradley Marple, MD  
(moderator); Philip Chen,  
MD; Martin J. Citardi, MD,  
Amber Luong, MD, PhD,  
Matthew Ryan, MD

6:00 PM  Announcements  
William Yao, MD

SATURDAY, NOVEMBER 4
7:00 AM  Registration/Breakfast
7:45 AM  Welcome  
Amber Luong, MD, PhD

Session: Office-based Rhinology Procedures  
Amber Luong, MD, PhD (moderator)
8:00-8:20 AM  Patient selection & preparation  
Amber Luong, MD, PhD
8:20-8:40 AM  Office technology  
Martin J. Citardi, MD
8:40-9:10 AM  Office procedures panel  
Martin J. Citardi, MD,  
(moderator); Pete S. Batra,  
MD; Amber Luong, MD,  
PhD; Michael Marino, MD

Session: Extended Indications for ESS  
William Yao, MD (moderator)
9:10-9:30 AM  Inverted papilloma  
William Yao, MD

9:30-9:50 AM  Endoscopic epistaxis management  
K. Christopher McMains, MD
9:50-10:15 AM  Endoscopic orbital surgery  
William Yao, MD
10:15-10:40 AM  Endoscopic CSF leak repair  
Pete S. Batra, MD
10:40 AM  Break

Session: Rhinology: Past, Present & Future  
Matthew Ryan, MD (moderator)
11:10-11:35 AM  Defining indications for FESS  
Martin J. Citardi, MD,  
(moderator); Pete S. Batra,  
MD; Bradley Marple, MD
11:35 AM-12:00 PM  Recalcitrant rhinosinusitis  
William Yao, MD,  
(moderator); Martin J.  
Citardi, MD; Seth Isaacs,  
MD; Kent Lam, MD;  
Bradley Marple, MD
12:00-12:30 PM  Rhinology innovations  
Amber Luong, MD, PhD,  
(moderator); Kent Lam, MD;  
Li-Xing Man, MD;  
K. Christopher McMains,  
MD; Matthew Ryan, MD
12:30-1:00 PM  Endoscopic skull base surgery  
Pete S. Batra, MD
1:00 PM  Announcements  
Amber Luong, MD, PhD

Rhinology Dissection Lab  
(paid participants only)
1:10 PM  Travel to lab  
(lab participants only)
1:30 PM  Lunch  
(lab participants only)
2:00-5:00 PM  Lab
Defining Indications for FESS

Martin J. Citardi, MD, FACS
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Texas Sinus Institute
Texas Skull Base Institute
www.ut-ent.org
martin.j.citardi@uth.tmc.edu

Disclosure
- Acclarent (consultant)
- Arrinex (consultant)
- Biosense Webster (consultant)
- Factory CRO (consultant)
- Hemostatis LLC (consultant)
- Medical Metrics (consultant)
- Medtronic (consultant)
- Optinose (consultant)

Objective
- Playing field: FESS for inflammatory conditions of the sinuses
- Benefit of early intervention?
- Operational definition of threshold for surgery
- Define minimal disease burden for surgery
- Does a CT need to be abnormal before surgery?
- Does the timing of the CT matter?
- What about endoscopy?

Panelists

Pete S. Batra, MD
Bradley Marple, MD

Does Time to Endoscopic Sinus Surgery Impact Patient Outcomes?
Hopkins, Rimmer, Lund
Rhinology, 2015
Patient CB
- 34 year old woman
- CC: “frequent sinus infections”
- Congestion, PND, ear fullness (associated with flying)
- 3 episodes over 3 mon
- Baseline of 1-2 episodes per year
- Received azithromycin once; now on amox/clav
- No imaging
- No trauma
- No procedures
- Remote h/o asthma; no symptoms now
- PMH otherwise unremarkable
Patient CB

Treatment
• Complete amox/clav
• Add fluticasone sprays
• RTC 3 weeks
• CT scan if no resolution or rapid relapse

Patient CB

• 3 weeks later
• No symptoms at all

One month later…
Patient CB
One month later...

- Improved, but still has residual congestion
- Active lifestyle, but feels some wheezing with exercise

At what point is medical optimization achieved?
- Role of surgery?
- Role of observation?

---

Patient CB

- No symptoms at all
- Active lifestyle

At what point is medical optimization achieved?
- Role of surgery?
- Role of observation?

---

Patient CB

- No symptoms at all
- Active lifestyle
- Relapse 2 months later

At what point is medical optimization achieved?
- Role of surgery?
- Role of observation?

---

Patient CB

- No symptoms at all
- Active lifestyle

At what point is medical optimization achieved?
- Role of surgery?
- Role of observation?

---

Patient MS

- 24 year old woman

What symptom gives you the most trouble (chronic fatigue, depression, sleep difficulties, etc.)?...
Patient MS

- Abx: azithromycin, levofloxacin; however, none for past 6 months
- INS: triamcinolone; however, no improvement
- OTC: guaifenesin, oral decongestants, non-sedating antihistamines
- s/p turbinate procedure (probably cautery), tonsillectomy, and polyps (2014)
- s/p in-office BSD (2012)

Patient MS

- Additional testing?
- Additional treatments?

- At what point is medical optimization achieved?
Patient MS
October, 2014

• Additional testing?
• Additional treatments?

Patient MS
March, 2014

• Additional testing?
• Additional treatments?

Patient MS
March, 2014

• Additional testing?
• Additional treatments?

Patient MS
March, 2014

• Additional testing?
• Additional treatments?

Patient MS
March, 2014

• At what point is medical optimization achieved?

Patient MS
March, 2014

• At what point is medical optimization achieved?
Patient MS
- Additional testing?
- Additional treatments?
- At what point is medical optimization achieved?

Patient MLP
- 33 year old woman
- c/o “sinus problems”
- Reports frequent “infections”—approximately 6 over 12 mon; each characterized by facial pressure, nasal congestion and drainage; receives abx each time
- Has RT retro-orbital headache
- Currently uses fluticasone sprays and cetirizine
- h/o migraine as a teenager
- Saw another ENT, who recommended BSP for “narrowing”
- PMH: Hashimoto’s thyroiditis

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Patient MLP
- Patient counseling
- Continue fluticasone sprays
- Add saline washes
- RTC at time of exacerbation
- Requested CT scans; took 2 months to track them down

Patient MLP
- Patient counseling
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Patient MLP
CT at Time of Maximal Symptoms

Patient MLP
CT at Time of Maximal Symptoms
Patient MLP

At next contact: no nasal symptoms, ascribed to "no-dairy" diet, prescribed by holistic doctor
3 months later: ER visit for 9/10 headache; sent to neurology and received migraine diagnosis after negative vasculitis work-up

8 Months Later

- c/o exacerbation
- First exacerbation since initial visit
- 1-2 weeks of sore throat, congestion and drainage
- Now improving

2 Months Later

- c/o exacerbation
- First exacerbation since initial visit
- 1-2 weeks of sore throat, congestion and drainage
- Now improving
- MRI (ordered by another physician): normal sinuses
Recalcitrant Rhinosinusitis Panel

William C Yao, MD  
Department of Otorhinolaryngology  
Texas Sinus Institute  
Texas Skull Base Institute  
www.ut-ent.org  
William.c.yao@uth.tmc.edu

Disclosure

• None

Panelists

Kent Lam, MD  
Bradley Marple, MD  
Martin Citardi, MD  
Seth Isaacs, MD

Case 1

• 63yo female with recurrent sinusitis since 1980s treated with several variety of antibiotics.
• History of ESS in 1997, 1999 with presumed AFRS
• Since 2009, the patient had been complaining of recurrent forehead pressure with thick buildup of mucin. Her pressure is relieved after blowing out “chunks of mucin”
• She has been using oral voriconazole to improve her symptoms
• No immune deficiency
• Allergy to Alternaria (dematacieous fungi)

CT - 2010
Case 1

- What would you do?
  - Cultures?
  - Oral antibiotics?
  - Topical therapy?
- Revision Surgery?
  - What approach?

Cultures revealed
- 2009 - MRSA, Stenotrophomonas
- 2010 - Pseudomonas
- 2011 - Acinetobacter

Per patient, her left forehead symptoms improve with voriconazole
  - Doctor shops to obtain voriconazole

CT - 2015

2016 - Patient has recurrent forehead pressure
  - Budesonide rinses

However...
- Recurrent forehead pain

CT 2016

What would you do?
  - Cultures?
  - Oral antibiotics?
  - Topical therapy?
- Revision Surgery?
  - What approach?
**Case 1**
- In-office procedure: Balloon sinuplasty – L Frontal; revision of right frontal sinus
- Patient did not want OR procedure

**Case 1**
- Pt returns with recurrent HA and sinus pressure
- Patient cannot tolerate budesonide

**Case 1**
- Remains on topical nasal steroid spray
- Oral itraconazole

**Case 2**
- 41yo female with a 1 month history of worsening rhinorrhea and purulent drainage
- Purulent drainage from bilateral nares
- Tried multiple antibiotics, oral steroids and decongestants with no improvement in symptoms

**Case 2**
- What would you do?
  - Imaging?
  - Lab?

**Case 2**
- WBC - 4.4
- Eos – 23%, Absolute count 1.0
- ANA, ANCA negative
- CRP – 15.5
- CT Sinus
Case 2

- To OR for debridement 7/2017
  - Necrotic septum, lateral nasal wall and nasal floor
  - Edematous tissue in nasal cavity
  - No frank nasal polyposis
  - Path – negative for NK/T cell lymphoma
    - Necrotic tissue, inflammatory debris
      - No definite granuloma, giant cells, lymphoepithelial lesions
    - Culture – propionibacteria

Case 2

- Patient with persistent crusting and pain
- Patient maintained on topical mupirocin and Augmentin
- Repeat culture – negative
- What should we do?

Case 2

- Repeat labs
  - Eos – 0.6%
  - CRP = 2.9
  - IgG levels normal
- Patient taken for repeat debridement in OR
  - Rheumatology and infectious disease consult
  - Path – Fite stain positive for rods

Case 3

- 49yo female with asthma and chronic sinusitis with recurrent nasal drainage and frequent asthma exacerbation
- Previous ESS
- Allergy to dermatophytes
- Nasal polyposis
Case 3

- Revision ESS
- Path – chronic inflammation with eosinophilic mucin
- Patient did well postoperatively; however, continues to have frequent exacerbation
  - Budesonide rinses BID
  - Patient frequently requires prednisone due to asthma exacerbation
  - What should we do?

Case 3

- Labs
  - Eosinophilia – 7%
  - ANA – 1:40
  - CRP – normal
  - ESR – 43mm/hr
  - IgE – 512
  - Further questioning revealed hx of eosinophilic esophagitis

Case 3

- What should we do now?
  - Consults?
  - Possible diagnosis?
Balloon sinuplasty

How important is the data? How good is the data?
What is the most significant con associated with balloon sinuplasty?
What is the greatest pro associated with balloon sinuplasty?
If you use it, when, where and how?

Biologics

Are you impressed with reported effects?
Is this the end of the era for surgery?
Objectives:
1. To appreciate the history of technological innovation in rhinology
2. To review lessons learned in management of benign sinonasal and skull base neoplasms
3. To understand the diagnostic workup of sinonasal and skull base malignancy
4. To comprehend the endoscopic paradigm for skull base surgery
Endoscopic Skull Base Surgery: Lessons Learned in Over 500 Cases

- Howard Hopkins patented the rod-lens system in 1967
- Interspersed “air lenses” between the rods
- Wider viewing angle, improved color and resolution, and greater light transmission (9X)
- Concept of mucociliary flow (coordinated and directional)
- Mucosal contact in critical locations could lead to obstruction

Key Innovations in Rhinology
1. Introduction of HD rigid endoscopes
2. Refinement of surgical instrumentation
3. Introduction of microdebriders and drills
4. Enhancement of endoscopic cautery devices
5. Development of surgical navigation

History of Rhinology….

- Concept of FESS
  
  - Functional endoscopic sinus surgery codified in 1985
  - Reestablish ventilation and mucociliary clearance of sinuses
  - Endoscopic removal of diseased tissue from key areas
  - Excellent visualization with minimal morbidity and bleeding

Graduated Surgical Experience

More Advanced

- Cavernous Sinus, Petrous Apex, & Clival Pathology
- Anterior Skull Base Malignancy
- Benign Sinonasal Neoplasms
- CSF Leak Repair
- Orbital Techniques
- Advanced Frontal Surgery
- Primary and Revision FESS

Less Advanced
Expertise in Managing CSF Leaks

- Broad experience for various etiologies
- Traumatic
- Iatrogenic
- Spontaneous
- High success rate
  - 90% for 1st repair
  - 97% for 2nd repair
  - Low complication rate at 0.03%


Comfort with Orbital Techniques

- DCR
- Orbital decompression
- Optic nerve decompression
- Endoscopic orbital exenteration
- Endoscopic orbital tumor removal


Expertise: Benign Neoplasms

- IP
- Fibro-osseous lesions
- JNA
- Pituitary adenomas


Inverted Papilloma


IP: Outcomes by Stage

- **Group A:** IP limited to nasal cavity, ethmoid sinuses, medial maxillary wall
- **Group B:** IP with maxillary sinus involvement (other than medial wall), frontal sinus, sphenoid sinus
- **Group C:** IP with extension beyond paranasal sinuses


IP: Lessons Learned

- Complete surgical resection with negative margins imperative!
- Recurrent/residual IP with higher risk of recurrence
- Judicious use of ancillary open techniques (gingivobuccal approach, osteoplastic flap)
- Consider staging for extensive tumors
- IP with SCC treated like 1st sinonasal malignancy
- Long-term endoscopic surveillance is an absolute requisite

Fibro-Osseous Lesions

- Osteoma
- Fibrous Dysplasia
- Ossifying Fibroma
- Ecchordosis Physaliphora
- Osteoradionecrosis

**FOL: When is Biopsy Indicated?**

- Retrospective analysis of 60 FO lesions
- Correlate preop imaging with biopsy or resection
- Positive predictive value of radiology:
  - 100% for osteoma
  - 85.7% for fibrous dysplasia
  - 33.3% for ossifying fibroma
- **Most patients can be observed!!!**
- Surgery reserved for ossifying fibroma or osteoma/FD with significant symptoms

**FOL: Surgical Management Required in Select Cases Only**

20 months
36 months

**Juvenile Nasopharyngeal Angiofibroma**

Radkowski Stage IIA

23 months

**JNA: Lessons Learned**

- Intimate knowledge of pattern of spread
- Close collaboration with IR for effective embolization
- Compartmentalize tumor for complete resection
- NC/NP → Sphenoid → PMF/ITF → Pterygoid → Skull Base
- Drilling of vidian canal to decrease recurrence

**Non-Functioning Pituitary Adenoma**

16 months
Outcomes: Endoscopic Vs. Sublabial

<table>
<thead>
<tr>
<th></th>
<th>Endoscopic</th>
<th>Sublabial</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Studies</td>
<td>21</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>2,335</td>
<td>2,565</td>
<td></td>
</tr>
<tr>
<td>Gross total resection</td>
<td>79%</td>
<td>69%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CSF leak rate</td>
<td>5%</td>
<td>7%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Septal perforation</td>
<td>0%</td>
<td>5%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Postop epistaxis</td>
<td>1%</td>
<td>4%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

- No difference between techniques in incidence of DI, meningitis, or resolution of hormonal abnormality
- Hospital stay (p = .01) shorter for endoscopic group
- No difference in terms of length of operation


Pituitary Surgery: Lessons Learned

1. Careful review of preop imaging
   - (carotid/optic nerve dehiscence or septal insertions, intersphenoid septum location, Onodi cell)
2. Topical epinephrine for hemostasis
3. Transition to neurosurgery after exposure of sellar dura
4. Formal reconstruction in select cases only
   - Surgicel and tissue glue in most cases
   - Nasoseptal flap for repair of high flow leaks
   - Lumbar drains rarely needed

Minimally Invasive Resection of Skull Base Malignancy…

- Transnasal endoscopic approach
  - Paranasal sinuses
  - Skull base (cribriform plate, dura, olfactory bulbs)
  - Orbit (lacrimal system to optic nerve)
  - +/- Bifrontal craniotomy

Sinonasal Malignancy: Challenges…

1. Often extensive at presentation
2. Difficult access
3. Proximity to critical structures
   - Brain
   - Orbit
   - Internal carotid artery
   - Cranial nerves

T4BNO0M0 poorly differentiated SCC

Patient Evaluation

- Careful history and physical examination
- Endoscopy +/- biopsy
- CT scanning
- MR imaging
- PET scan for metastatic workup
- Consultations (neurosurgery, medical oncology, radiation oncology)

Minimally Invasive Resection of Skull Base Malignancy…

- Transnasal endoscopic approach
  - Paranasal sinuses
  - Skull base (cribriform plate, dura, olfactory bulbs)
  - Orbit (lacrimal system to optic nerve)
  - +/- Bifrontal craniotomy

Patient Evaluation

- All cases presented at tumor board
- Consensus developed for optimal management strategy...
  - Individualized plan based on tumor histology, stage of disease, tumor location, and patient preference
  - Consultation for open approach obtained if deemed necessary
  - No defined treatment protocols

**Multidisciplinary Approach**

1. Rhinology
2. Neurosurgery
3. Head & neck surgery
4. Facial plastic surgery
5. Ophthalmology
6. Medical oncology
7. Radiation oncology
8. Surgical pathology
9. Neuroradiology
10. Interventional radiology

**Oncologic Goals Remain Paramount!**

1. Complete tumor extirpation with negative margins
2. Maximize patient quality of life
3. Preserve neurologic function
4. Preserve vision, swallowing, voice, and normal physical appearance
5. Minimize intra- and postop complications

**Surgical Techniques**

- Frontal Drillout
- MI ER
- Clival Drillout
- Endo. Craniectomy
- Septectomy
- Sphenoid Drillout
- ASB Resection
- Orbital Decompression
- DCR
- Nasopharyngectomy

**Key Surgical Principles**

1. Identify the site of tumor attachment/insertion
2. *En bloc* resection of the area of attachment (if technically feasible)
3. Intraoperative frozen section control
4. Minimally invasive approach but maximally invasive resection!!!

**Role of Neurosurgery**

- Co-surgeons
- *Equal partners in the surgical endeavor....*
- 3-handed (or 4-handed) technique for most skull base cases
- Lumbar drain in select cases only
- +/- Bifrontal craniotomy
- Guide vertical cuts via endoscopy

**Skull Base Reconstruction**

- CSF leak expected sequela
- Array of options for reconstruction
- Multilayered with free grafts
- Nasoseptal flap
- Middle or inferior turbinate flap
- Pericranial flap
Frequency of Flap Usage

- 330 flaps for endoscopic skull base surgery
- Nasoseptal flap (90%), secondary flaps (10%)

<table>
<thead>
<tr>
<th>Flap</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasoseptal flap</td>
<td>296</td>
</tr>
<tr>
<td>Endoscopic-assisted pericranial flap</td>
<td>16</td>
</tr>
<tr>
<td>Temporoparietal fascia flap</td>
<td>7</td>
</tr>
<tr>
<td>Inferior turbinate flap</td>
<td>3</td>
</tr>
<tr>
<td>Middle turbinate flap</td>
<td>2</td>
</tr>
<tr>
<td>Anterior lateral nasal wall flap</td>
<td>2</td>
</tr>
<tr>
<td>Palatal flap</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
</tr>
</tbody>
</table>

T3N0M0 Ethmoid Clear Cell Carcinoma

T4BN0M0 Olfactory Neuroblastoma

Clival Chordoma

International Collaborative Study Data

- 1307 patients from 17 institutions
- Tumors involving anterior cranial fossa: 87%
- Squamous cell ca: 29%
- Adenocarcinoma: 16%
- Olfactory neuroblastoma: 12%
- Positive or close margins: 32%
- Complications: 33%
- Mortality: 4%

Histopathology

<table>
<thead>
<tr>
<th>Histopathology</th>
<th>No.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamous cell carcinoma</td>
<td>6</td>
<td>32%</td>
</tr>
<tr>
<td>Mucosal melanoma</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>5% each</td>
</tr>
</tbody>
</table>

Outcomes: Early US Data

- Study population: 19 patients
- Location: Cleveland Clinic
- Mean age: 56.9 years
- M:F ratio: 10:9
- Mean follow-up: 26.4 months (3 – 74)
Outcomes: Early US Data

- No peri- or postoperative deaths
- CSF leaks repaired intraoperatively
- Pneumocephalus with mental status changes (1 case)
- Disease-free survival: 13 / 19 (68.4%) (33.1 months)

Parameter | No. patients (Percent) | MIER | CFR | P-value*
---|---|---|---|---
Local Recurrence | 5 / 19 (26.3%) | 3 / 9 (33.3%) | | 0.99
Distant metastasis | 3 / 19 (15.8%) | 2 / 16 (75%) | | 0.26
Overall survival | 15 / 19 (78.9%) | 12/16 (75%) | | 0.43

*Wilcoxon Rank Sum test

Outcomes: T3/T4 Lesions

- N = 31 pts
- Mean age: 58 years
- Curative surgical resection in 28 cases
- Image guidance in all cases
- Multilayered skull base reconstruction
- Lumbar drains in 8 cases (25.6%)

Pathology Recurrence Rate

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Recurrence Rate No. (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epithelial Malignancies (Adenoca, SCC, ACC, SNUC)</td>
<td>25/111 (23%)</td>
</tr>
<tr>
<td>Melanoma</td>
<td>11/17 (65%)</td>
</tr>
<tr>
<td>Olfactory neuroblastoma</td>
<td>3/22 (13%)</td>
</tr>
</tbody>
</table>

Open Vs. Endoscopic Comparison

- Study population: 25 patients
- 9 patients – MIER (58 years)
- 16 patients – CFR (55 years)

Outcomes: T3/T4 Lesions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MIER (%)</th>
<th>CFR (%)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS 2-year</td>
<td>86.2%</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>DFS 5-year</td>
<td>58.6%</td>
<td>61.7%</td>
<td></td>
</tr>
</tbody>
</table>

Nicolai et al: Largest Study to Date….

- 184 patients
- Mean F/U 34.1 months
- Adenoca (37%), SCC (14%), ON (12%)
- T1: 28%, T2: 14%, T3:17%, T4:28%
- EEA (73%), CEA (27%)
- 5-year disease-specific survival was 91.4 % and 58.8% (p = 0.0004) for EEA and CEA groups, respectively.

Pathology: ON (17%), sarcoma (15%), adenoca (14%), melanoma (14%), SCC (13%)
- surgery alone (50%), surgery + XRT (37%), surgery + CXRT (13%)

- 120 patients
- EEA (77.5%), CEA 22.5%
- Stage: T1: 25%; T2: 25%; T3: 22%, T4: 28%
- Pathology: ON (15%), sarcoma (15%), adenoca (14%), melanoma (14%), SCC (13%)
- surgery alone (50%), surgery + XRT (37%), surgery + CXRT (13%)

Outcomes: Hanna et al.

- 5-year disease-specific survival rate 87%
- 5-year overall survival rate 76%
Remember Limitations of Endoscopy…

- Bilateral massive disease*
- Vascular tumors*
- Extensive brain involvement^
- Infiltration of facial soft tissues^*
- Lateral orbital extension^*
- Inoperable by traditional methods^*

*Dedicated Skull Base Team and Accrued Experience Prerequisites....

**Limitations of outcome analysis….
- Relative short follow-up and heterogeneity of tumor histology in published series
- Lack of standardized treatment protocols

Data to date encouraging…
- Comparable outcomes
- Reduction of complications
- New emerging standard???