



INNOVATIONS IN Endoscopic Sinus Surgery

by Theresa Criscitelli, CST, RN, MS, CNOR

Endoscopic sinus surgery (ESS) has undergone exponential growth worldwide in the last two decades. Technology is advancing rapidly and it is the job of all healthcare professionals to keep abreast of changing technology in order to provide patients with current, safe, and effective treatment options. Approximately 37 million Americans suffer from sinusitis every year and it is one of the most common reasons for visiting a primary care physician.⁵ Sinusitis decreases one's quality of life and restricts activities which can further escalate into sinus infections and chronic headaches.

ESS is the examination of the nasal cavities through an endoscope with the possible resection of inflamed nasal tissue and the correction of anatomical defects in the sinuses. The goal is to ensure ventilation and restore mucociliary clearance, ultimately preventing sinus infection.⁴

HISTORICAL RELEVANCE

Endoscopic sinus surgery procedures originated in the late 1970s in Germany and Austria and were brought to the United States in the mid 1980s.³ In 1990, the use of sinusscopes, coupled with computer imaging modalities, redefined this surgical approach aiding in more thorough preoperative planning, safer and more precise surgical dissection with minimally invasive trauma to nasal tissue. This procedure helps to accelerate postoperative healing. Traditional craniotomies have become obsolete for selective lesions that now can be accessed via trans-sinonasal and transcranial endoscopic routes.

LEARNING OBJECTIVES

- ▲ Examine the nasal cavity prior to the operation
- ▲ Review the relevant anatomy for this procedure
- ▲ Compare and contrast the techniques used to perform an endoscopic sinus surgery
- ▲ Identify the surgical devices needed to perform sinus surgery
- ▲ Recognize the causes for concern following the operation



CT scan showing right opacified maxillary sinus with medial bulging causing expansion of the sinus and obstruction of the right nasal cavity.



Right maxillary mucocoele eroding superior wall of the sinus causing eye proptosis and cheek swelling.



Right maxillary mucocoele causing bulging of the uncinate process.

ANATOMY

Patients predisposed to developing chronic sinusitis may have anatomical deformities, nasal polyps, allergies, environmental factors, immunological abnormalities, or hormonal factors that cause nasal swelling. This results in retention of secretions of the nasal passages and an increased potential for sinus infections. Accordingly, the symptoms patients may experience includes headaches, facial pressure, pain, swelling or tenderness around the eyes, cheeks, nose, and/or forehead. Additional symptoms include nasal drainage that is yellow to green, nasal obstruction, decreased sense of smell and taste, cough, ear pain, halitosis, and fatigue.

It is important to understand the anatomy and functionality of the sinuses and surrounding structures in order to understand the surgical treatment options. The nasal cavity is divided midline by the nasal septum. The turbinate bones are layered one above the other, separated by grooves and superior, middle, and inferior meatuses aiding in drainage passages of the accessory sinuses. The nasal sinuses are comprised of the frontal, ethmoid, maxillary, and sphenoid sinus to serve as air spaces and conduits between the nasal cavities through meatuses. The frontal, anterior ethmoid, and maxillary sinus drain into the middle meatus. The posterior ethmoid and sphenoid drain into the superior meatus and sphenoethmoid recess. The sensory nerve supply originates in the trigeminal nerve, and the blood supply originates from the branches of the internal maxillary, anterior ethmoid, sphenoalatine, nasopalatine, pharyngeal, and posterior ethmoid arteries.⁴ The veins are located in the epithelial layer of the turbinate bones.

ADVANCES IN IMAGING

In the doctors' office, the patient will be examined with a flexible endoscope under topical anesthesia. Computer axial tomography (CAT) scan of the sinus in a coronal plan may be ordered to reveal abnormalities. CT-MRI fusions offer optimal information for the clinician to make crucial surgical decisions. These CT-3D reconstructions and stereotactic navigations are bridged and used perioperatively during imaged-guided ESS to facilitate complicated procedures and will decrease the need for revision procedures.²

TREATMENT PRIOR TO SURGERY

The patient may often be treated by his or her doctor prior to surgery in a medical modality where they are given a course of antibiotics, nasal sprays, nasal rinses, and allergy testing. This course of treatment, though effective, may eventually result in surgical intervention when all other explored options do not eliminate the patient's symptoms.

SURGICAL TECHNIQUE

The patient is placed in the supine position with his/her arms usually tucked at his/her sides. The elbows should be protected to prevent ulnar nerve damage. The face and nose are prepped according to the surgeon's preference, and guidelines. A head drape is usually applied after general anesthesia is administered. The eyes may remain untaped, yet protected, in order for the surgeon to visualize and palpate during the procedure so the orbital area will not be damaged during the procedure.

The surgeon usually injects the nose with 1% lidocaine with 1:100,000 epinephrine to numb the nose and decrease bleeding due to the vasoconstriction effects of the medication. Topical solutions, such as 4% cocaine or 4% lidocaine, are placed on cottonoid patties and packed in the nose bilaterally to reduce the risk of any potential bleeding and provide anesthesia.

A full array of endoscopes should be available including but not limited to 4mm in diameter with 0-, 30-, 45-, and 70-degree viewing angles. A 2.7mm diameter scope with varying viewing angles also should be accessible. The varying angles will allow a surgeon to view all aspects of each sinus. The lens may be dipped in an antifog solution to clean and prevent fogging during insertion due to the change in temperature from room air to the nasal cavity. Sinus content that needs to be removed can be taken out by using an array of graspers and tru-cut forceps placing the removed tissue on a non-adherent surface or in saline. The specimen must be clearly labeled so as not to confuse each specimen for diagnosis purposes.

Periodically, cottonoids with topical epinephrine, cocaine, oxymetazoline hydrochloride, or lidocaine may be placed in the nose to control bleeding for better visualization and to minimize blood loss.

At the conclusion of the procedure, hemostatic agents

may be placed in the nose to control bleeding postoperatively. Packing may be placed to physically apply pressure within the middle nasal meatus.

Surgical length can vary depending upon unilateral or bilateral pathology and surgeon specific techniques. Multiple sinuses may be affected which can increase the length of surgery.

Nasal polypectomy is the removal of polyps from the nasal cavity, which usually are comprised of benign grape-like clusters of mucous membrane and connective tissue.⁴ The removal of nasal polyps will free the airway of the obstruction. This may be performed in conjunction with other sinus surgery or septal surgery.

Ethmoidectomies usually are performed to treat chronic sinusitis or polyps that are a result of allergies. This is executed by removing the middle turbinate, ethmoid cells, and

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diseased tissue to ensure better drainage and aeration of the ethmoid sinus.⁴

Turbinectomies, outfracture of the turbinates, turbino-plasties, or submucous resection of the turbinates can be performed during this procedure. A turbinectomy is the removal of a portion of the inferior and middle turbinate to increase aeration and drainage. Outfracture of the turbinates is the movement of the inferior turbinates to lateral nasal wall. This technique is minimally destructive.¹ Turbinoplasties are performed to shrink the size of the turbinates. This can be done by using a radiofrequency device. A submucous resection of the turbinates is when an incision is made intranasally through the mucous membrane to access the turbinate and remove a portion of it.

SURGICAL DEVICES

A microdebrider is a powered instrument that is used to shave out sinus contents. The blade consists of an inner-rotating blade within a fixed sheath with a sharp-edge window. This blade can either rotate or oscillate depending on

the result desired by the surgeon. The microdebrider is usually attached to irrigation and suction to aid in keeping the lumen of the instrument patent. The sinus contents are suctioned into a collection device where they can be collected, labeled, and sent to pathology for microscopic evaluation. Surgeons commonly use the microdebrider for soft tissue and polypoid tissue, but burrs can be used to open up the ostia, for extensive bony dissection of the sinuses.

By using a computer monitor, image guidance during sinus surgery allows the surgeon and surgical team to view the exact location of surgical instrumentation. This is especially useful during revision sinus surgery when landmarks in the nasal cavity are not evident, due to alterations during previous surgery. This requires the surgeon to acquire a specific CAT scan prior to surgery that can be utilized by the image-guidance device on the day of surgery.

Balloon sinuplasty is a minimally invasive procedure performed during sinus surgery where a small, flexible, sinus balloon catheter is gently guided into a sinus then inflated. This procedure restructures and widens the walls of the sinus cavity while maintaining the integrity of the sinus lining. Most commonly this can be performed on the frontal sinus, but can be utilized on all the nasal sinuses. The procedure involves inserting a sinus guide catheter into sinus ostia under endoscopic visualization or transillumination via an illuminating system. The balloon catheter is then threaded over the guide wire and inflated then deflated. An irrigation catheter also can be utilized to flush the sinus at completion of the balloon sinuplasty.

PREPARING THE OPERATING ROOM

The OR must be equipped with a video monitor display system, high definition camera, and light source placed opposite the surgeon. Any other devices such as microdebrider, cautery, suction, and other surgeon-specific devices should be placed toward the patient's feet. An imaged-guided machine is placed next to the video monitor in order for the surgeon to continuously check the placement of instrumentation. An additional Mayo stand may be draped and placed above the patient's head to place sterile equipment, but most importantly to support the surgeon's elbow that is holding the camera. Any foot pedals should be placed prior to the procedure to ensure correct placement where the surgeon will be standing during the procedure.

SURGICAL TECHNOLOGIST CONCERNS

The surgical technologist should use a Mayo stand to hold equipment that will be used during the procedure and a back table to encompass all additional trays of instruments. Basic nasal instruments should be available and endoscopic sinusscopes should be checked prior to surgery for clear visualization and functionality for optimal viewing. All equipment should be in optimal working condition and checked prior to the commencement of surgery. A separate preparation area may be a surgeon's preference where pre-operative injection of local anesthesia and topical medications may be administered.

All specimens must be accurately checked for laterality for diagnostic purposes and should be handled according to the policy and procedures of the institution. If irrigation is utilized during the procedure, it is important to be aware of the amount in order to calculate accurate blood loss at the termination of the procedure.

POSTOPERATIVE CARE

The patient will leave the OR in the supine position with his/her head slightly elevated. The patient will be instructed to breathe through his or her mouth due to the swelling and possible packing that may be in the nasal cavity. The post-anesthesia care unit (PACU) nurse will administer humidified oxygen and observe the patient for bleeding, pain, facial swelling or abnormal hypertension, level of consciousness or pupil dilatation.

Complications are uncommon yet range from synechia (a disease of the eye) or scar formation to cerebral spinal fluid leaks and orbital hematomas. Initially, slight oozing or bleeding may occur; however, any hemorrhage would need to be addressed with the surgeon immediately.

Balloon sinuplasty is a minimally invasive procedure performed during sinus surgery where a small, flexible, sinus balloon catheter is gently guided into a sinus then inflated.

The surgical technologist must be cognizant of sinus anatomy, be up-to-date with technology, and aware of surgical technique in order to perform as an integral part of the surgical team during an endoscopic sinus surgery. This can aid in decreased OR time for the patient and positive patient outcomes. Limited invasive surgeries are increasingly being performed in order to get patients out of the hospital quicker and back to normalcy sooner.

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ABOUT THE AUTHOR

Theresa Criscitelli, CST, RN, MS, CNOR, has been in the OR for 24 years

and is a nurse educator at Winthrop University Hospital in Mineola, New York. She is also a clinical instructor of surgical technology at Nassau Community College in Garden City, New York. She obtained her Master's Degree in nursing education and is now pursuing a Doctorate of Education. Her clinical expertise is otolaryngology and educating staff and students.

OTHER APPROACHES TO SINUS SURGERY

Jodi B Farmer

Before more common procedures were developed, functional endoscopic sinus surgery was part of a surgical strategy that removed all the sinus mucosa from the major sinuses. The nasal endoscope was developed in the 1950s as a "natural pathways" approach. It was thought that the endoscope was the best way to obtain healthy sinuses. FESS includes the insertion of the endoscope, a thin fiber-optic tube, into the nose for examination of the sinus openings. The endoscope allows the surgeon to identify the abnormal and obstructive tissues and remove them. Most of the procedure is completed through the nostrils and usually leaves no external scarring. Common side effects include swelling and mild discomfort. The patient usually will have some nasal packing after the surgery. FESS is usually less extensive than other sinus surgeries and frequently can be performed on an outpatient basis.

Image-guided surgery allows a mapping system that features computed tomography (CT) scans and real-time information to show the surgeon the position of surgical instruments by using infrared signals. Typically, this technique is recommended for severe cases of chronic sinusitis. It may be recommended if the patient had previous sinus surgery that altered anatomical landmarks, or when a patient's sinus anatomy is unusual.

Since the sinuses are close to the brain, eyes and major arteries, there is major concern when tubes are inserted into this region. However due to advancing technology, image-guidance surgery is becoming very effective. The practice uses similar principles that the United States armed forces use to guide bombs to their target.

The Caldwell Luc operation relieves chronic sinusitis by improving the drainage of the maxillary sinus. The procedure is done by inserting tubing through the upper jaw above one of the second molar teeth. A window is created that connects the maxillary sinus with the nose. This action allows for an improvement in drainage. This procedure is often performed when a malignancy is present in the sinus cavity.

Sinus Surgery. American Academy of Otolaryngology – Head and Neck Surgery. <http://www.entnet.org/HealthInformation/SinusSurgery.cfm>. Accessed May 16, 2011.

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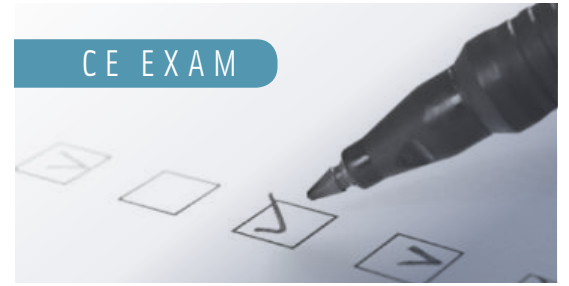
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Innovations in Endoscopic Sinus Surgery

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1. The OR must be equipped with these devices _____ for an endoscopic sinus surgery.
 - a. Video monitor display system
 - b. High-definition camera
 - c. Light source
 - d. All of the above
2. Balloon sinuplasty is a minimally invasive procedure performed during sinus surgery where a _____ is guided into the sinus then inflated.
 - a. Microdebrider
 - b. Suction
 - c. Sinus balloon catheter
 - d. Sinuscope
3. The goal of an ESS is to _____.
 - a. Ensure ventilation
 - b. Restore mucociliary clearance
 - c. Prevent sinus infection
 - d. All of the above
4. The nasal sinuses are comprised of _____.
 - a. Frontal and sphenoid sinuses
 - b. Ethmoid and maxillary sinuses
 - c. None of the above
 - d. A and B.
5. Where did endoscopic surgery procedures originate?
 - a. United States
 - b. Germany and Austria
 - c. The Netherlands
 - d. Australia
6. Approximately how many Americans suffer from sinusitis yearly?
 - a. 37,000
 - b. 37 million
 - c. 31 million
 - d. None of the above
7. Symptoms of chronic sinusitis may include _____.
 - a. Headaches, facial pain, nasal drainage
 - b. Nasal obstruction, halitosis
 - c. Fatigue
 - d. All of the above
8. The nasal cavity is divided midline by the _____.
 - a. Nasal septum
 - b. Turbinate bones
 - c. Maxillary sinus
 - d. Superior meatus
9. Nasal polypectomy is the removal of _____ from the nasal cavity.
 - a. Muscous membrane
 - b. Connective tissue
 - c. Middle turbinate
 - d. Polyps
10. Although uncommon, what complications can arise from ESS?
 - a. Synechia
 - b. Cerebral spinal fluid leakage
 - c. Orbital hematomas
 - d. All of the above

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Mark one box next to each number.

Only one correct or best answer can be selected for each question.