1. **EPISTAXIS**: Today I will be presenting on epistaxis.

2. **INTRODUCTION**: Epistaxis is the most common Otolaryngologic emergency in the U.S. It presents in 7-14% of the general population each year. The severity of epistaxis ranges from mild to life-threatening. The majority of bleeds are anterior as opposed to posterior. Epistaxis is more common in males than in females. Also, epistaxis episodes are more likely to occur in the winter as opposed to the summer. This is primarily due to indoor heat and ambient dryness which leads to drying of the nasal mucosa.

3. **OUTLINE**: The outline of my lecture begins with a brief overview of the vascular anatomy of the nose. I will then move on to discuss the multiple etiologies of epistaxis, including both local and systemic. Finally I will discuss the management and treatment of epistaxis starting with the least invasive interventions and progressing to the most invasive interventions. The non-surgical treatment options include topical treatments, cauterization, packs, and blocks (i.e. transpalatine blocks). I will then briefly go over some interventional radiology techniques and surgical interventions.

4. **VASCULAR ANATOMY**: Epistaxis primarily originates from the either the lateral nasal wall or the septum. The blood supply for the nose comes primarily from branches of the external carotid artery with some supply from branches of the internal carotid artery. Lateral nasal wall bleeding usually occurs in the region of the sphenopalatine artery. Septal bleeding usually occurs in the anterior region. Overall, 90-95% of all episodes of epistaxis are located anteriorly.

5. **PICTURE**: This is a picture of a latex injected human skull that shows the extensive vascular anatomy of the nose. It shows the rich supplies of anastomoses between the internal and external carotid artery.
6. **THE NEXT SLIDE SHOWS FLOWCHART OF THE NASAL CIRCULATION.**

7. **FLOWCHART:** This is a flowchart of the vasculature of the nose. The primary vascular source is from the external carotid artery with a more minor contribution from the internal carotid artery. The external carotid artery branches into the facial artery and the internal maxillary artery. The facial artery branches into the superior labial artery which supplies the septum and the nasal ala. The internal maxillary branches into the greater palatine artery and the sphenopalatine artery. The greater palatine artery supplies blood to the hard palate and the septum. The sphenopalatine artery branches off into the posterior lateral nasal artery and the nasal septal artery. These supply the lateral nasal wall and the posterior septum, respectively. The internal carotid artery branches into the anterior and the posterior ethmoid arteries. The anterior ethmoid artery supplies the anterior lateral wall and the anterior septum. The posterior ethmoid artery supplies the superior turbinate and the posterior septum.

8. **LATERAL NASAL WALL:** This is a picture of the vasculature of the lateral nasal wall. Anteriorly there is blood supply from the nasolabial artery and the anterior ethmoid artery. Posteriorly there is a minor contribution from the posterior ethmoid artery and a major contribution from the sphenopalatine artery.

9. **WOODRUFF’S PLEXUS:** Woodruff’s plexus is a plexus in the lateral nasal wall which is a common site of posterior nose bleeds. Woodruff’s plexus is located below the posterior end of the inferior turbinate. It consists primarily of anastomoses of branches of the internal maxillary artery including the posterior nasal, sphenopalatine, and pharyngeal arteries.

10. **SEPTUM:** This is a picture of the vasculature of the septum. Anteriorly there is blood supply again from the nasolabial artery and the anterior ethmoid artery. Posteriorly there is a minor contribution from the posterior ethmoid artery and a major contribution from the sphenopalatine artery.

11. **KIESSELBACH’S PLEXUS:** Kiesselbach’s plexus, also known as Little’s area, is a plexus in the nasal septum which is the area responsible for the majority of all nose bleeds, not just anterior bleeds. Kiesselbach’s plexus is located 1.5cm behind the anterior mucocutaneous junction. It consists primarily of anastomoses of the superior labial artery, anterior ethmoid artery, greater palatine artery, and posterior nasal artery.

12. **SEPTUM:** This is a picture of the vasculature of the septum. Anteriorly there is blood supply again from the nasolabial artery and the anterior ethmoid artery. Posteriorly there is a minor contribution from the posterior ethmoid artery and a major contribution from the sphenopalatine artery.

13. **SPHENOPALATINE ARTERY:** The sphenopalatine artery (SPA) is very important in the discussion of epistaxis because it supplies the majority of blood supply to the nose. Knowledge about the anatomical position of the SPA is very important due to the need for possible surgical ligation in the case of refractory posterior bleeding. The SPA usually enters the nose through the SPA foramen which is located at the posterior end of the middle turbinate. The sphenopalatine foramen is bounded superiorly by the body of the sphenoid, the anterior border
is the orbital process of the palatine bone, the posterior border is bounded by the sphenoidal process of the palatine bone, and the inferior border is bounded by the perpendicular plate of the palatine bone.

14. **ETIOLOGY:** Now I am going to discuss the etiology of epistaxis, both local and systemic. One of the most common local causes is trauma, due to nose picking or fractures. Some of the other local causes include nasal sprays, inflammatory reactions, anatomical deformities (i.e. septal deviation, septal spurs), foreign bodies, intranasal tumors, chemical irritants, and nasal prongs for oxygen. Systemic causes include hypertension, vascular disorders, blood dyscrasias, hematologic malignancies, allergies, malnutrition, alcohol, drugs, and infection.

15. **LOCAL CAUSES:** One of the most common causes of nose bleeds, particularly in children, is digital trauma to the nasal mucosa. Nasal sprays are a common culprit as well. With nasal sprays, often the force of the spray creates damage to the epithelium of the nasal septum. For this reason patients should be educated to direct the spray away from the septum and instead towards the lateral wall. Anatomical abnormalities can cause local trauma as well. Septal deviation can often lead to crusting on the side of the deflection, which leads to excessive nose picking and/or nose bleeding. If the removal of crusting becomes habitual, the continuous trauma can cause a septal ulcer to form, thus reducing blood supply to the cartilage and ultimately leading to a septal perforation. The perforation itself may crust, thus leading to a chronic cycle of crust removal and subsequent bleeding. Foreign bodies are a less common cause of epistaxis and are more common in small children and individuals with Down Syndrome. These patients may present with a unilateral, bloodstained and foul-smelling (due to anaerobic infection) discharge.

16. **LOCAL CAUSES:** A common iatrogenic cause of epistaxis is the use of oxygen nasal prongs, particularly if they are manipulated by the patient (i.e. immediately following surgery) and damage the nasal mucosa. Intranasal tumors such as hemangiomas or juvenile nasopharyngeal angiofibroma can also cause intermittent epistaxis.

17. **LOCAL CAUSES, CONT’D**

18. **SYSTEMIC CAUSES:** Hypertension is often cited as a major systemic contributor to epistaxis. Although the two often occur in tandem, a causal link has not been elucidated. A systematic review by Kikidis et al. in the March 2013 issue of *European Archives of Otolaryngology* found that there are multiple confounding factors such as age and the use of anticoagulation medication that may be the cause of epistaxis and not the hypertension itself. Increased age induces fibrosis of the tunica media of the arteries, which may lead to inadequate vasoconstriction after rupture of a blood vessel. Individuals with altered clotting abilities are also more likely to develop hypertension. Medications implicated in epistaxis include aspirin, clopidogrel, NSAIDs, and warfarin.
19. **SYSTEMIC CAUSES**: Inherited blood diatheses are also associated with epistaxis and include hemophilia A and von Willebrand disease. Hemophilia A involves a deficiency of factor VIII. Von Willebrand disease involves a deficiency of von Willebrand factor, which combines with another procoagulant factor to form factor VIII. Both of these diseases lead to a prolonged partial thromboplastin time (PPT) and are sex-linked, thus they only occur in males. Desmopressin can be given preoperatively to these patients to increase the levels of factor VIII and vWF. Cryoprecipitate can also be given. The clotting cascade can also be altered by hematologic malignancies, liver disease, renal disease, rugs, and malnutrition.

20. **HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)**: A less common but noteworthy disease that can cause epistaxis is Hereditary Hemorrhagic Telangiectasia (HHT). This is also known as Osler-Weber-Rendu disease. This is an autosomal dominant disease that is characterized by telangiectasias of all the mucosal surfaces of the body. Due to the telangiectasias thin vessel walls and lack of smooth muscle, they may group together to form arteriovenous malformations in various organs of the body including the brain, lungs, liver, and gut. In the nose these manifest as raised lesions.

21. **HHT PICTURES OF LIPS**: Here are two pictures of the oral manifestations of HHT. Each of these individuals has lip telangiectasias which are more prevalent on the bottom lip. There are also telangiectasias of the tongue.

22. **HHT PICTURES OF THE NASAL CAVITY**. A small anterior and posterior V-shaped cut of the septal cartilage is made prior to replanting skin. Here are intraoperative endoscopic views of a nasal cavity containing HHT AV malformations. On the left is a picture of the right nasal cavity. There are multiple AV malformations that can be visualized on the septum. On the right is picture of a bipolar that is about to cauterize an AV malformation on the lateral nasal wall.

23. **HHT EPISTAXIS TREATMENT**: Outline

24. **HHT EPISTAXIS TREATMENT**: Milder cases of HHT can be treated with electrocautery. In a recent case series from Medical College of Wisconsin, it was found that the most effective treatment of epistaxis in patients with isolated bleeding telangiectasia was electrocautery. This allows precise localization of the bleeding source with less risk of damaging adjacent tissue. By contrast, chemical cauterization silver nitrate can inadvertently spread to surrounding tissues and cause further damage. Notably, recurrent electrocautery over the lifetime of an individual with HHT can ultimately lead to septal perforations. For more moderate to severe cases of HHT, particularly those in which the patient has a septal perforation, nasal dermoplasty with a split thickness skin graft is an option. Laser treatment for vessel photocoagulation is another option – this can be done using a KTP laser. A newer treatment is the use of intranasal Bevacizumab, a human monoclonal VEGF inhibitor. This treatment was
introduced in response to past studies demonstrating that HHT patients have elevated plasma and mucosal levels of VEGF. Of note, Bevacizumab cannot be used on the cartilaginous septum as this may lead to septal perforations.

**25. HHT EPISTAXIS TREATMENT:** On the left is a picture of the cuts that would be made prior to skin replantation in nasal dermoplasty. A small anterior and posterior V-shaped cut of the septal cartilage is made prior to replanting skin.

**26. HHT EPISTAXIS TREATMENT:** The next slide shows a flowchart for the treatment and management of epistaxis.

**27. EPISTAXIS TREATMENT AND MANAGEMENT: flowchart:** This is a flowchart for the treatment and management of epistaxis. The initial management of epistaxis should always begin with the” ABC’s” of ATLS initial resuscitation. After ensuring a secure airway with adequate ventilation, focus should be directed towards stopping the source of bleeding. There are several general measures that can performed at this point to slow or stop the bleeding. These include having the patient sit upright, compressing the right and left nasal ala between the thumb and index finger, having the patient lean forward so as not to swallow blood, and placing an IV line. Once the patient is stable, a thorough history and physical examination should be pursued. After identifying the site of bleeding, there are a variety of treatment options that range from chemical cautery to nasal packs to surgical intervention.

**28. INITIAL MANAGEMENT:** Outline.

**29. INITIAL MANAGEMENT:** The patient’s hemodynamic status should then be evaluated. If the blood pressure is elevated the patient may require volume resuscitation with a crystalloid such as normal saline. If the patient has lost more than 30% of their blood volume or is hemodynamically unstable, blood products may be infused. If the blood pressure is elevated, the patient may require an antihypertensive agent such as a beta blocker. Once the patient is stabilized, a thorough history and physical examination should be pursued. The primary goals of the physical exam are to establish the site of bleeding, stop the bleeding, and treat the cause.

**30. PHYSICAL EXAM:** Outline.

**31. PHYSICAL EXAM:** Before beginning the physical exam protective equipment such as a cap, gown, mask, and eye protection should be utilized. Anterior rhinoscopy with a nasal speculum may in itself be sufficient for visualization. Any visible clots should be suctioned. If visualization is not adequate an endoscopic exam may be warranted. The area of bleeding should be identified. Important aspects of identification include which quadrant the bleeding (i.e. left lateral nasal wall, left septum, right lateral nasal wall, or right septum) is coming from, anterior versus posterior bleeds, and whether or not the bleeding is in a plexus area. The
location of bleeding can guide the treatment. For example a posterior bleed is more likely to require a pack or surgical intervention than an anterior bleed.

32. **TREATMENT**: Outline.

33. **TREATMENT**: A stepwise approach should be followed in the treatment of epistaxis. Non-surgical treatments should initially be pursued including topical treatment, cauterization, nasal packs, and blocks. These treatments will generally stop the bleed 90% of the time. If the bleed is refractive to these treatments, surgical intervention should then be pursued. In most cases of epistaxis the best initial step is to spray the nasal cavity with a mix of afrin and lidocaine for anesthetic and decongestant effects. Alternatives include pseudoephedrine, lidocaine with epinephrine, and cocaine (which has fallen largely out of favor). The vasoconstrictive effect of this solution may take up to 10 minutes to take full effect. This may stop the bleed in itself or slow it down to a point that provides improved visualization.

34. **CAUTERIZATION**: Outline.

35. **CAUTERIZATION**: Silver nitrate can be a very effective treatment. The area of the bleed should first be dried with suction – this allows better penetration of the silver nitrate into the mucosa. When silver nitrate is combined with water it forms nitric acid, which is a highly corrosive acid that acts as a cauterization agent. After application a greasy antiseptic such as Bacitracin should be applied to deactivate the silver nitrate and prevent further cauterization and breakdown of the tissues. Of note, silver nitrate is not an option for bilateral septal bleeds as this can lead to a septal perforation. If the vessel is large a local anesthetic should be injected prior to using the bipolar. Following any form of cauterization the patient should be advised to avoid nose blowing for 1 week and to apply a greasy antiseptic barrier ointment such as Bacitracin to the nose three times a day. It is important to tell the patient not to apply ointments with their finger or a Q-tip, as this can cause further trauma and re-bleeding. Instead the ointment should be applied to the rim of the nose and massaged upwards.

36. **NASAL PACKS**: Nasal packs are intranasal devices that function by applying constant local pressure to an area of bleeding. They have similar efficacy to bipolar cauterization. There are anterior packs, posterior packs, and anterior and posterior packs. Nasal packs are a foreign body and as such have several iatrogenic complications including toxic shock syndrome, sleep apnea, alar necrosis, hemodynamic changes, and patient discomfort. There are a multitude of nasal packs that are available on the market. There are no validated guidelines on whether to give patients with packs prophylactic systemic antibiotics versus topical antibiotics alone. Recent studies have found that topical antibiotics alone may be sufficient in most case of epistaxis, particularly those patients with anterior packs alone. Another precaution is for patients with comorbidities to be admitted to the ICU for cardiopulmonary monitoring if a posterior pack is placed. All packs should be removed within 2-3 days of initial placement.
37. **ANTERIOR NASAL PACKS:** For anterior packs, bayonet forceps can be used to apply ointment impregnated gauze or a ready-made foam pack that expands on contact with fluid. Impregnated gauze should be applied in a “ribboning” fashion. This is done by using forceps to pack the nose starting with the first layer on the nasal floor and subsequent layers placed on top of the underlying layer until the nose is packed.

38. **PICTURES OF ANTERIOR NASAL PACKS AND GELS:** There are a multitude of ready-made foam packs available on the market including merocels, nugauze, Floseal, epistats, and rapid rhinos. In terms of anterior packs, some of the most popular ones are Merocel and Nu Gauze. On the top left is a standard merocel foam pack which expands upon contact with fluid. The top middle picture is the bioresorbable Meropack. This is highly advantageous in a setting where a patient is likely to be lost to follow-up. On the top right is a standard Merocel with an airway built in. This is great for patient comfort and for apnea.

39. **PICTURES OF ANTERIOR NASAL PACKS AND GELS:** The bottom left picture shows Nu Gauze packing strips. The bottom middle picture is of Floseal which is a hemostatic matrix that contains high concentrations of thrombin and can be injected at the site of bleeding. The major advantage of Floseal is that it can conform to abnormal geometric surfaces, allows good visualization, and is bioresorbable. On the bottom right is MeroGel injectable which is similar to Floseal; however, it uses hyaluronic acid instead of hemostatic agents.

40. **ANTERIOR NASAL PACKS AND GELS**

41. **POSTERIOR NASAL PACKS:** As with anterior packs, there are multiple posterior nasal packs available. The advantages of these packs over the traditional “gauze pad” is patient comfort, the presence of an airway (in some cases), and the ability to insert them transnasally.

42. **POSTERIOR NASAL PACKS:** The posterior pack is traditionally placed by threading a catheter through the nare and into the posterior pharynx. A tonsil clamp is used to grab the catheter transorally and pull it out through the mouth. A gauze pad is then tied to the catheter with suture and “launched” back into the posterior nasopharynx and lodged against the choana. An alternative to this is to insert a foley catheter through the nare and advance until the tip of the catheter can be visualized in the back of the pharynx. The balloon is then filled with 10cc of sterile water and pulled back into the nasopharinx.

43. **POSTERIOR NASAL PACKS - ILLUSTRATION:** The posterior pack is traditionally placed by threading a catheter through the nare and into the posterior pharynx. A tonsil clamp is used to grab the catheter transorally and pull it out through the mouth. A gauze pad is then tied to the catheter with suture and “launched” back into the posterior nasopharynx and lodged against the choana. An alternative to this is to insert a foley catheter through the nare and
advance until the tip of the catheter can be visualized in the back of the pharynx. The balloon is then filled with 10cc of sterile water and pulled back into the nasopharynx.

44. **PICTURES OF POSTERIOR NASAL PACKS:** The picture on the top left is of a Bivona Epistaxis catheter. This is made of silicon and has two independently inflatable cuffs for proper placement and a built in airway as well. On the top right is a picture of a 10 French Foley catheter that can be used in a pinch as well. The picture on the bottom left is an Epistat Nasal catheter with a built in airway. The bottom right is a picture of the Rapid Rhino nasal tampon, which is one of the most popular intranasal packs used for posterior bleeds. The tamponade is initially inserted in sterile water which allows it to expand. The tampon is then inserted into the nare and advanced parallel to the septal floor. Once in place the balloon is inflated.

45. **DR. QUINN’S “EPISTAXIS PEARLS”:** Outline.

46. **DR. QUINN’S “EPISTAXIS PEARLS”:** There are multiple anecdotal “pearls” that have also been suggested in epistaxis management from Dr. Quinn’s “epistaxis pearls” from the Internet. One is that trichloracetic acid (TCA) is a better alternative to silver nitrate as a chemical cauterization agent. The argument is that TCA has a stronger vasoconstrictive effect and can provide deeper penetration than silver nitrate. Salt pork has been used as a packing agent – it is unknown if this is more efficacious than regular packing alternatives. Hot water irrigation has been advocated in the past and is better tolerated than packs by the patient. Additionally, some Otolaryngologists advocate a “hard nose blow” to clear clots from the nose. This provides visualization of the bleeding site while also allowing better penetration of oxymetazoline or other vasoconstricting medications. This may in itself stop the bleeding.

47. **GREATER PALATINE INJECTION:**

48. **GREATER PALATINE INJECTION:** The greater palatine injection offers yet another non-surgical alternative for epistaxis treatment. This method is often used to reduce bleeding in endoscopic sinus surgery for both analgesia and control of bleeding. The injection involves accessing the pterygopalatine fossa through the greater palatine canal. Either 1% lidocaine with epinephrine or sterile water can be used. The tamponade effect of the fluid itself is postulated to be the primary method of stopping the bleeding rather than the vasoconstrictive properties of epinephrine. The technique involves bending the needle at 45 degrees and advancing it 25-28mm once inside the foramen.

49. **PTERYGOPALATINE INJECTION:** The contents of the pterygopalatine canal are the sphenopalatine artery (SPA) and V2 or the maxillary nerve. This includes the greater petrosal nerve and deep petrosal nerve. One can see that by injecting a solution of lidocaine with
epinephrine, it not only provides analgesia, but also a tamponade effect of the SPA in the confined space of the fossa.

50. **SURGERY/IR OUTLINE**: This slide shows some of the more common surgical or interventional radiological methods of treating epistaxis. Surgical treatments include endoscopic SPA ligation, anterior or posterior ethmoidal artery ligation, and transantral ligation of the internal maxillary artery (IMAX). Interventional radiology can also perform an embolization of the IMAX.

51. **ENDOSCOPIC CAUTERIZATION OF SPHENOPALATINE ARTERY (SPA)**: This procedure used to be performed via a Caldwell-Luc approach; however, now endoscopic surgery has gained more popularity. The advance of endoscopic cauterization of the SPA is that it allows direct cauterization of vessels. It is highly effective as a second-line treatment if other non-surgical interventions fail. The procedure itself has relatively low morbidity, rare complications, is fast to perform, not technically difficult, and is 96-100% effective.

52. **ENDOSCOPIC SPA CAUTERIZATION**: At the beginning of this procedure, the nasal cavity is decongested and 1% lidocaine with epinephrine is injected into the mucosa of the lateral nasal wall adjacent to the posterior aspect of the middle turbinate. A small vertical incision is created 1cm anterior to the posterior aspect of the middle turbinate. A mucoperiosteal flap is elevated with a Freer and dissected posteriorly. At this point the crista ethmoidalis is identified anterior to the SPA foramen. Finally, the SPA itself is identified in the SPA foramen. A vascular clip or bipolar cautery is applied to the SPA.

53. **ENDOSCOPIC SPA CAUTERIZATION**: Detail.

54. **PICTURE OF INCISION FOR SPA CAUTERIZATION**: The dotted line marks the incision site approaching the SPA endoscopically. The incision is roughly 1cm anterior to the posterior aspect of the middle turbinate.

55. **ENDOSCOPIC PICTURES OF SPA CAUTERIZATION**: These are intraoperative endoscopic views of the dissection of the SPA behind the ethmoidal crest. On the left bipolar cautery is being used on the 1st branch of the SPA below the ethmoidal crest. On the right is the final view of the branches of the SPA after cauterization. The suction is placed in the right sphenoid sinus.

56. **NASOETHMOID FRACTURES – ANTERIOR AND POSTERIOR ETHMOID BLEEDS**: When you see a patient with a nasoethmoid fracture that presents epistaxis, you should suspect that the bleeding is coming from the anterior or posterior ethmoid artery. The most common cause of these fractures is motor vehicle accidents or assault – basically any injury that involves impact of the central face. Clinical presentations include soft tissues welling, ecchymoses, gross blood, and hematoma. Palpation may reveal bony step-offs, mobile
bony segments, or crepitus. Another good test is to measure the intercanthal distance and compare it to the interpalpebral distance. If the former is much larger than that is suggestive of a nasoethmoid fracture. This is demonstrated in the top right picture. Number 2, the intercanthal distance, and number 3, the interpalpebral distance, are normally very similar. On the bottom right is an axial CT view of a complex nasoethmoidal fracture. On the bottom right is a coronal CT view of the same patient.

57. **ENDOSCOPIC SPA CAUTERIZATION**: Speaker notes for Slide 56.

58. **NASOETHMOID FRACTURE**: Nasoethmoid fractures include Type 1, 2, and 3 fractures which I have here for review. A Type 1 nasoethmoid fracture involves a single, noncomminuted, central fragment without medial canthal tendon disruption. Type II involves comminution of the central fragment without medial canthal tendon disruption. Type III involves severe central fragment comminution with medial canthal tendon disruption.

59. **NASOETHMOID FRACTURE**: Speaker notes for Slide 58.

60. **ANTERIOR AND POSTERIOR ETHMOID ARTERY LIGATION**: Outline.

61. **ANTERIOR AND POSTERIOR ETHMOID ARTERY LIGATION**: Bleeds from the anterior or posterior ethmoid arteries have to be treated surgically. The most common surgical approach is externally via a Lynch incision. This consists of a curvilinear incision halfway between the medial canthus and tip of the nasal dorsum that is brought down to the level of the periosteum. An endoscopic approach has also been advocated as well in the literature as a safe and feasible alternative to the open approach. Major complications of the procedure include stroke, blindness, ophthalmoplegia, and epiphora. The major surgical landmark in anterior/posterior ethmoidal artery ligation is the lacrimal crest. The anterior ethmoid artery is located 24mm from the anterior lacrimal crest and the posterior ethmoid artery is located 36mm from the anterior lacrimal crest.

62. **EMBOLIZATION OF THE IMAX**: Embolization of the IMAX is an alternative to SPA ligation for control of posterior epistaxis. The benefits of embolization are that it is a good option for poor surgical candidates. Furthermore, it can serve as a back-up to unsuccessful surgical ligation. The downsides are that it requires a highly skilled interventional radiologist. Furthermore, the complications are high and include facial pain, numbness, and stroke. Embolization has a higher failure rate than surgical ligation. It is less cost effective than surgical ligation.

63. **ANGIOGRAM PICTURES PRE AND POST-EMBOLIZATION**: On the left is a picture of a bilateral superselective angiogram of the SPA (rather than the IMAX). On the right is the postembolization view.
64. **TRANSANTRAL LIGATION OF IMAX**: This is an older method that has largely been replaced today by SPA ligation. It is performed via a Caldwell-Luc approach, which involves fracturing the posterior wall of maxillary sinus flaked off the bone to expose the pterygopalatine fossa. Within the fossa the tortuous IMAX is identified and ligated. The downsides of transantral ligation are that the failure rate is relatively high (11-20%). The complication rate is also relatively high (14-20%) and includes facial paresthesia, facial pain, dental pain, numbness, hematoma, ophthalmoplegia, and blindness.

65. **CALDWELL-LUC APPROACH**: The Caldwell-Luc approach begins with retraction of the upper lip and an incision of the mucous membrane above the teeth. Soft tissue over the maxillary sinus is elevated to visualize the anterior wall of the sinus. An incision is made in the soft tissue to expose the bony face of maxillary sinus

**FACULTY DISCUSSION: Farah Saddiqui, M.D.**

Dr. Foon, that was an excellent talk on a very important topic, very relevant to us as we will see it throughout all of our careers, no matter where we go. The important thing is a lot of time nosebleeds come into the clinic as postops, and you must remind your patients about the simple things. Most people have the simple reflex to hold the head back and let all the blood get into the airway column. It’s better if they sit forward and hold constant pressure on the nose, and once the bleeding stops a little bit, get the clots out, put some Afrin in there. This may keep them from coming into the Emergency Room especially in our postop sinus cases, and even adenoids and turbinates. It’s also important to recognize you can get potentially life-threatening bleeding even from our postoperative patients.

Iatrogenically we can cause nosebleeds even with a simple turbinate reduction can warrant a trip back to the O.R. if it’s bleeding enough because you can actually go in and cause injury to the blood vessels in Woodruff’s area and the sphenopalatine branches posteriorly and maybe during surgery that vessel went into spasm.

Then postoperatively especially if they’re bleeding really early on you don’t want to ignore it. If anybody calls you within the first 24 hours and they’re having major bleeding they need to come in and they may need to go back to the operating room.

Then the other thing I want to offer as a minor correction, is when you describe a NOE fracture you said “Le Fort one, two and three…” Le Fort is more for midface fractures. NOE types ONE TWO and THREE we don’t call them Le Forts. One important relationship you did highlight in your talk which you guys will probably be asked about through some question that’s coming up was the relationship of the anterior lacrimal crest to the anterior and posterior ethmoid arteries. The crest is 34-36 mm. back from the crest in cadaveric dissections. The posterior ethmoid artery is about 8 mm. posterior to that and another 2 mm. takes you to the optic foramen and optic nerve.

I think you went over everything very well and you summarized it very well. Thank you.
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