Paparella III: Section 2: Disorders of the Head and Neck

Part 1: Nose and Paranasal Sinuses

Chapter 3: Epistaxis

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Epistaxis is a common occurrence, with most of us experiencing at least one episode in a lifetime. Fortunately, these episodes are usually minor, resolve spontaneously, and do not require medical attention. Conversely, they may be more severe, ranging from recurrent episodes precipitated by minor trauma to major episodes of bleeding that can be life-threatening. Epistaxis is uncommon in infants but is quite common in young children. In children and young adults, bleeding usually occurs from the anterior nasal septum. In older patients, however, bleeding often occurs from the posterior aspect of the nasal cavity, rendering treatment more difficult. Appropriate management depends upon complete evaluation of the patient, isolation of the bleeding site, and control by cauterization or tamponade.

Blood Supply to the Nose

There is an extensive network of blood vessels supplying the nasal mucosa. These vessels are branches of both the external and internal carotid arteries. The ophthalmic artery, a branch of the internal carotid, enters the orbit through the superior orbital fissure. It has small anastomoses with vessels from both the middle meningeal and the internal maxillary arteries, which may be the reason for persistent bleeding after single-vessel ligations (Pearson et al, 1969). This artery divides into several branches, two of which supply portions of the nasal mucosa. These anterior and posterior ethmoidal arteries pass through the ethmoidal sinus complex and supply the superior aspect of the septum and lateral wall of the nose.

The *posterior ethmoidal artery* branches from the ophthalmic artery shortly after it enters the orbit. It passes between the superior oblique and the medial rectus muscles (sometimes above the superior oblique) to enter the posterior ethmoidal foramen. This foramen is only 3 to 7 mm anterior to the optic nerve. After transversing the ethmoidal sinuses, the artery enters the anterior cranial fossa and then descends through the cribriform plate to enter the nose, at which point it supplies the region of the superior turbinate and a corresponding portion of the septum.

The *anterior ethmoidal artery* is more constant and larger and leaves the orbit at a variable distance further forward by entering the anterior ethmoidal foramen, passing between ethmoidal cells to enter the anterior cranial fossa. In the anterior cranial fossa, both ethmoidal arteries give off twigs to the meninges. A branch from the anterior ethmoidal artery may be large enough to be called the anterior meningeal artery. The meningeal branches of the ethmoidal arteries anastomose with twigs from the sphenopalatine artery (from the maxillary artery), which ascends through the cribriform plate. The anterior ethmoidal artery descends through the anteromedial portion of the cribriform plate to enter the nose. It supplies the anterior one third

of the lateral wall of the nose and a similar portion of the septum, anastomosing with the sphenopalatine branches. These anastomoses occur in the area of the anterior caudal nasal septum known as Kiesselbach's plexus or Little's area, which is also supplied by branches of the superior labial and greater palatine arteries. A branch of the anterior ethmoidal artery emerges between the nasal bones and the upper lateral cartilages and runs down the dorsum of the nose to the tip.

The rest of the blood supply of the nasal cavity originates from the external carotid system and travels via the *external maxillary artery* (facial artery) and the *internal maxillary artery*, which provides the major blood supply to the nose.

The *facial artery* arises from the anterior surface of the external carotid artery near the lower border of the posterior belly of the digastric muscle. It passes deep to the digastric and stylohyoid muscles, around the submandibular gland, and onto the external surface of the mandible toward the side of the nose. It gives off (among many other branches) the superior labial artery, supplying the upper lip, at which point it gives off a septal branch that enters the nasal cavity supplying the anterior portion of the nasal floor and septum.

The *internal maxillary artery* is, together with the superficial temporal artery, a terminal branch of the external carotid artery.

In its first part, the internal maxillary artery passes horizontally beside the ramus of the mandible, giving off deep auricular, anterior tympanic, middle meningeal, and inferior alveolar branches. In its second part, anterior to the ramus, the artery passes either superficially or deep to the lower head of the lateral pterygoid muscle, giving off muscular branches to the masseter, temporal, buccal, and pterygoid muscles. The third part enters the pterygopalatine fossa giving off the posterior superior alveolar, infraorbital, pterygoid canal, pharyngeal, descending palatine, and sphenopalatine arteries.

Local Causes of Epistaxis

Trauma

Direct trauma to the nose, with or without fracture of the nasal bones, is frequently associated with epistaxis. The bleeding is usually short-lived and can be controlled by applying pressure to the nose by pinching the nostrils between index finger and thumb. Facial fractures involving the paranasal sinuses may also cause epistaxis. The bleeding in these cases may be more severe and require nasal packing to achieve control. Likewise, fractures to the base of the skull can result in profound epistaxis.

Habitual nose picking is another cause of nasal bleeding. Examination of the nose in these patients usually reveals crusting and excoriation of the anterior septum, the usual site of the hemorrhage. This is a particular problem in young children.

Bleeding after nasal surgery is not rare, particularly following surgery to the lateral walls, for example, turbinectomy. This bleeding is usually from the mucosal incisions but may be due to transecting a major vessel, for example, while performing osteotomies.

Barotrauma involving the paranasal sinuses may result in hemorrhage within a sinus cavity with subsequent epistaxis. This may occur during flying or scuba diving with an upper respiratory tract infection.

Inflammation

Upper respiratory infection or allergy, with congestion of the nasal and sinus mucosa, may lead to epistaxis. Usually this condition becomes manifested only as blood-streaked mucus and ceases with resolution of the infection. Epistaxis is more common in the winter months. Use of central hearing with low humidity leads to drying of the nasal mucosa with an increased tendency for bleeding. The workplace environment can exacerbate epistaxis, especially in dry, dusty environments and in the presence of noxious fumes from chemicals.

Tumors

Benign and malignant neoplasms in the nasal cavities, nasopharynx, and sinuses may present with nasal bleeding. Patients with severe or recurrent epistaxis must always be carefully examined to rule out such a tumor, not only when they present with the acute bleeding episode but also at a later time when bleeding is controlled and visualization is better.

Septal Deformity

Septal spurs and sharp deviations may lead to interruption of the normal air flow through the nose. On occasion, bleeding will occur from vessels on or near the deviations. A bleeding point posterior to such a septal abnormality may be impossible to visualize and thus difficult to control. Septal surgery with removal of the spur may be necessary to achieve control of the situation if bleeding recurs following initial unsuccessful packing.

Septal perforations due to a variety of causes (eg, septal surgery, habitual nose picking, trauma, syphilis, and tuberculosis) may result in epistaxis. Granulations and crusting are a constant feature on the margins of these perforations, and these changes frequently lead to bleeding. Septal perforations may be closed with difficulty using a variety of local flaps or a polymeric silicone (Silastic) button.

Granulomatous Disease

Several chronic granulomatous conditions may affect the nasal cavities. Tuberculosis, syphilis, sarcoid, and Wegener's granulomatosis are the most common causes. Epistaxis may also be a feature of these diseases, and a high index of suspicion is required to enable one to make the diagnosis. Widespread crusting, purulent secretions, and a granular, friable appearance of the

mucosa are features suggesting these diseases.

Systemic Causes of Epistaxis

Blood Dyscrasias

Epistaxis can be prolonged and severe in patients with systemic coagulopathies, for example, hemophilia or von Willebrand's disease, or in those who are taking anticoagulants.

Thrombocytopenia, whether primary or secondary to neoplastic disease or its chemotherapeutic treatment, is a common problem in tertiary care hospitals. Abnormalities of platelet function, even with the presence of normal platelet counts, can also cause troublesome epistaxis. Certainly a hematologist is most helpful in dealing with these refractory cases. Liver disease, with its disruption of many factors in the blood-clotting mechanism, can also result in systemic hemorrhage with resultant epistaxis.

The treatment of epistaxis caused by coagulopathy is fraught with difficulty. The use of chemical or electrical cauterization leads to recurrent or persistent bleeding and is contraindicated. Likewise, the use of standard nasal packing controls the epistaxis while it is in place but results in excoriation of the mucosa as it is removed, frequently aggravating the situation. Detailed discussion regarding the management will be covered in the section on management.

Hereditary Hemorrhagic Telangiectasia

Hereditary hemorrhagic telangiectasia (Osler-Weber-Rendu disease) is a hereditary disease carried by a dominant gene. It may occur in either sex and is associated with intermittent bleeding from vascular abnormalities scattered throughout the body, particularly on mucosal surfaces. The telangiectasia is common on the face and on the mucous membranes of the tongue, lips, and nose but can be found almost anywhere on the body. Gastrointestinal, respiratory, and genitourinary systems may also be involved. The most common symptom is recurrent, spontaneous epistaxis that begins after puberty and worsens with age. The central lesion is a small arteriovenous fistula, and histologic examination shows prominent vascular spaces without elastic or muscular tissue in the vessel wall. Bleeding is caused by a combination of telangiectatic vessels, trauma, and fragile mucous membranes. Because of the lack of contractile elements in the vessel wall, the bleeding may not stop spontaneously. The resulting epistaxis can be very severe, necessitating multiple transfusions over the yes. Treatment is extremely difficult

Arteriosclerosis

Arteriosclerotic changes in the blood vessels are thought to be a major factor in the increased incidence of nosebleeds in elderly persons, with hypertension considered as a factor, especially in older patients.

Idiopathic Causes

Despite thorough evaluation, approximately ten per cent of patients will fall into this idiopathic group.

Management

As in every aspect of medical care, an accurate, concise history of the patient's problem is critical. Answers to specific questions can indicate whether the epistaxis is anterior or posterior, new or recurrent, spontaneous or caused by specific incident, severe or mild, related to anticoagulation or to a coagulopathy, and so on.

It is not uncommon for patients to have stopped bleeding by the time they reach the otolaryngologist's care. In such a situation, one is tempted to do nothing because the problem appears to have resolved. Unfortunately, all too often the bleeding recurs after the patient returns home, necessitating a return visit, usually at night! It is prudent to attempt to identify the bleeding site in all patients and not be reticent in attempts to provoke bleeding by removing crusts or by having the patient blow the nose.

Nasal hemorrhage is a very frightening experience, especially for children and elderly persons. Since they are unfamiliar with anatomy, it is not uncommon for many patients to believe that the blood is coming from somewhere inside the head. Likewise, there is a common misconception that nasal bleeding prevents stroke by releasing the pressure! Patients must be reassured in a compassionate, efficient, and professional manner.

Physical Examination

After ensuring that the patient is hemodynamically stable, a full head and neck examination should be performed, including examination of the nasopharynx and nose. This examination is enhanced by the use of topical anesthesia and vasoconstriction. Direct examination of the nose and indirect nasopharyngoscopy are augmented today by the use of the flexible nasopharyngoscope and rigid nasal endoscopes. Laboratory evaluation for anemia and coagulopathies may be indicated. Sinus x-ray studies can be helpful, especially in cases of low-grade chronic epistaxis without an obvious site of bleeding, since tumors can cause this type of hemorrhage. It may be necessary to hospitalize patients with epistaxis because they may be hemodynamically unstable or may need posterior packing or surgical intervention.

Treatment of Anterior Epistaxis

Cautery

Examining the nose of a patient who gives a history consistent with minor, but recurrent, anterior epistaxis usually reveals the presence of one or more prominent blood vessels in Little's area. Bleeding may or may not be active at the time of the examination. The placement of a

topical vasoconstrictor and an anesthetic enhances the view of the nose, helps to remove crusts and clots, and provides appropriate anesthesia if cautery is necessary.

Cocaine is the most efficient medication for these purposes. The maximum safe dose of topical nasal cocaine in an adult is 200 mg. Surprisingly, it is very difficult to find documented information confirming the toxic levels of cocaine (Johns, 1977). Anecdotal information demonstrates that severe cocaine reactions can occur at doses much lower than 200 mg and that much higher doses are frequently used without complication. The best advice is to use as little topical cocaine as is necessary to obtain adequate vasoconstriction and topical anesthesia. Whenever the medication is used, its side effects should be looked for, and resuscitative equipment and short-acting barbiturates should be available for use in the event of a toxic reaction. Because of the fear of toxicity, many physicians prefer to use a combination of 4 per cent topical lidocaine mixed with topical epinephrine to a dose of 1:100.000 or to alternate the use of 4 per cent topical lidocaine and 0.5 per cent phenylephrine.

Topical anesthesia can be applied with cotton-tipped applicators or aerosol, but the author prefers to use a custom-made cotton pledget. The placement and replacement of such pledgets provide broad application of the medication and some pressure to the bleeding site and help in cleaning the nose of clot.

Once the active or inactive bleeding site is identified and anesthetized, and at least partial hemostasis is achieved, silver nitrate is commonly used to cauterize the vessel. It is advisable to cauterize circumferentially around the bleeding site first before applying the cautery to the bleeding area, otherwise the mere act of cautery may provoke bleeding. Beware of performing overly aggressive cautery on both sides of the nasal septum, as septal perforation or exposure of cartilage may result, with prolonged problems of crusting until the lesion heals.

Electrocautery can be used safely in experienced hands, but because there is less control of the depth of cautery, it is associated with a higher incidence of ulceration, and septal perforation may result. An actively bleeding vessel is, however, virtually impossible to cauterize with silver nitrate, so if hemostasis is not achieved, electrocautery may be the only choice. An alternate method of obtaining temporary hemostasis prior to cautery is to inject the septum submucosally with local anesthesia or even saline, which will tamponade the vessel.

After the cautery, the patient is instructed to open the mouth when sneezing, and to avoid blowing the nose or picking at the eschar for 7 days. The patient is also advised to apply an antiseptic ointment to the area until it is healed. It may be necessary to recauterize the nose if bleeding recurs.

Anterior Packing

When cautery is unable to control epistaxis or when the bleeding site cannot be identified (the bleeding may be behind an anterior septal spur or under the inferior turbinate), placement of an anterior nasal pack is required. There are many different techniques of packing and types

of packing materials used. Most commonly, petroleum jelly strip gauze (1/2 inch x 72 inches) is used after being coated with an antibiotic ointment. The effective placement of an anterior nasal pack requires appropriate topical anesthesia and vasoconstriction. Such a pack can be left in place for 2 to 7 days while the patient takes broad-spectrum antibiotics.

The technique for placing an anterior pack is critical. A poorly placed pack will not control bleeding, may fall out sooner than is desired, or may fall posteriorly into the nasopharynx, with the potential for aspiration. "Blind" packing with large amounts of loose gauze should not be attempted. The key to the placement of packing is adequate visualization and placing it in a layered manner.

If the general area of epistaxis is under the inferior turbinate or just behind the valve area of the nose, a more localized nasal pack can be positioned in such a way that will not completely obstruct air passage.

Occasionally a dissolvable packing may be used. This is particularly useful in the patient with a coagulopathy because there is no trauma on removing the nasal packing. Oxidized cellulose preparation (Oxycel, Surgicel) or an absorbable gelatin sponge (Gelfoam) can be used for this purpose. Oxycel tends to soften and dissolve more quickly, whereas Surgicel may harden and take longer to disappear. Depending on the clinical situation, these characteristics may be used to advantage.

Porcine Strip Packing is another material that has been used for anterior nasal packing. It is especially useful in the treatment of epistaxis resulting from blood dyscrasia. This salty, fatty material is salt pork or fat-back, which can be bought frozen in the meat case of most supermarkets and is thought to control epistaxis in several ways (Heywood et al, 1976; Davis et al, 1982). Because of its high salt concentration, it is hydrophilic and therefore swells to fit the various nooks and crannies of the nasal cavity, controlling the epistaxis by pressure. Porcine tissue also accelerates platelet aggregation and blood coagulation in vitro (Davis et al, 1982) and may do likewise when used as a nasal pack.

The material tends to liquefy over a period of 1 to several days and to dislodge spontaneously from the nose, but it can be removed after several hours or the next day.

Treatment of Posterior Epistaxis

The most practical definition of posterior epistaxis is epistaxis that cannot be treated effectively by an anterior nasal pack. Posterior epistaxis can be quite severe, whereas at other times it is surprisingly occult, with some patients swallowing many units of blood without seeming to be aware of it.

Posterior epistaxis can be treated by a classic posterior nasal pack, balloon tamponade, arterial ligation of several types, and embolization. There is some controversy concerning the order in which these various techniques are best used and also when to proceed to the next form

of therapy. This controversy is fueled by different authors placing varying weight on the potential complications associated with each technique.

Posterior Nasal Packs

Although the posterior pack may directly tamponade the bleeding point, it may also act as a buttress against which an effective anterior pack can be placed, thereby preventing the anterior pack from falling into the nasopharynx. There are two major types of posterior nasal packs: (1) the classic pack consisting of a gauze tampon placed transorally into the nasopharynx and held in place by silk suture or umbilical tape brought out through the nostril and (2) an inflatable balloon that is placed transnasally, inflated in the nasopharynx, and retracted into the posterior nasal cavity. Because they are more convenient to use and less uncomfortable to the patient during placement, balloon devices have become more popular (Cook et al, 1985; Elwany et al, 1986).

The *classic gauze nasal pack* is created from either rolled gauze or a gauze pad filled with lamb's wool and soaked in antibiotic ointment or solution. The packing is secured with 0 silk ties or umbilical tapes that are left long. The pack should be small enough to fit into the choanae but not become displaced into the oropharynx. After anesthetizing the patient's nose and posterior pharyngeal wall, a small, red rubber catheter is placed through the bleeding nostril and brought out through the mouth. A second catheter may be placed in the nonbleeding nostril to retract the palate while the pack is being positioned. The silk ties are secured to the end of the first catheter and are used to retract the pack into the nasopharynx. The placement of the pack is facilitated by directing the packing material into the patient's oral cavity and nasopharynx with a finger. This uncomfortable step must be accomplished as smoothly and efficiently as possible. The third silk tie is left protruding from the mouth and is taped to the cheek and used later for removing the pack. Mild tension is then placed on the ties to hold the posterior pack in place while anterior nasal packing is placed. After the anterior pack is positioned, the silk ties are tied over a large gauze pad or dental roll. This pad can cause alar or columella necrosis if it is too small or too tight.

The conventional posterior nasal pack is left in place for 4 to 7 days, and the patient is hospitalized and observed carefully. The entire procedure is obviously uncomfortable for the patient; however, if it is clearly explained in advance and completed swiftly, a very effective, custom-made tampon can be placed. In some patients, however, this is impossible, and the placement should be done under general anesthesia.

Inflatable balloon packs are more convenient to place than conventional posterior nasal packs but are not quite as successful in controlling posterior epistaxis. There are two types of balloon tampons: Foley catheters and catheters designed solely for control of epistaxis. After clearing the nose of clots, determining the site of bleeding, and applying topical anesthesia and vasoconstrictors, a No. 12 to 16 French Foley catheter with a 30-cc balloon is placed along the floor of the nose until the balloon is seen in the nasopharynx. The balloon is then slowly inflated with 10 to 20 mL of saline, and the Foley catheter is retracted anteriorly to wedge the balloon

snugly into the posterior nasal cavity. If the soft palate is grossly displaced inferiorly or if there is significant pain, the balloon is slightly deflated. An anterior pack is then placed. The catheter is held in position with slight tension by padding the ala and nasal columella with gauze and taping the catheter to the cheek and nose.

Epistaxis balloon tampons provide a low-pressure double-balloon system that serves as both an anterior and posterior pack. To use the balloon, the nose is cleared of clots, the device is lubricated with an anesthetic ointment (or the nose is topically anesthetized), and the deflated system is slowly passed along the floor of the nose so that the posterior balloon extends into the nasopharynx. The posterior balloon is inflated, and forward traction is applied. The anterior balloon is then inflated with 10 to 25 cc of air or saline.

If balloon tampons are unsuccessful in controlling epistaxis, they should be replaced with conventional packs. Patients with balloon devices are treated similarly to those with conventional posterior packs.

Studies by Ogura and colleagues (1968) showed a decrease in pulmonary compliance in patients with nasal obstruction. They postulated that these changes were due to "nasopulmonary reflex". Subsequent studies by Cassisi and associates (1971) showed a consistent lowering of PO_2 without significant alteration of PCO_2 in patients with posterior packs. Cook and coworkers (1972) demonstrated more severe PO_2 alterations, along with a significant rise in PCO_2. They demonstrated a rise in PO_2 obtained by use of 40 per cent oxygen by mask while posterior packs were in place. Although there is some controversy about the pathophysiology of respiratory changes associated with the use of posterior packs, there is no question that alterations can occur and are more severe in patients with previous cardiorespiratory disease. These potential complications and others lead to the following recommendations for the care of the patient with a posterior nasal pack:

All patients with posterior nasal packs should be admitted to the hospital. Elderly and infirm patients and those with demonstrated blood gas changes should be admitted to intensive care and monitored carefully. All patients are placed on a broad-spectrum antibiotic and 40 per cent oxygen by face mask. Very mild sedation and analgesia can decrease the discomfort associated with the posterior nasal pack, but extreme caution must be used to avoid any significant pharmacologic respiratory depression. Oral intake is frequently compromised because of discomfort, so fluid balance must be carefully monitored. If necessary, the patient should undergo tracheostomy in order to ensure satisfactory oxygenation.

Arterial Ligation

Although extremely effective, nasal packing is not without complications, which include pain and discomfort; nasal obstruction; dysphagia; eustachian tube obstruction; infection; synechia; scarring of the lip, ala, and columella; the need for prophylactic antibiotics; and repacking and transfusion if packing is not successful. Selective arterial ligation has therefore been proposed as an alternate, more effective technique to control epistaxis.

Ligation of the External Carotid Artery

External carotid artery ligation has long been used in the treatment of epistaxis that fails to respond to packing. It can be performed under local anesthesia and involves anatomic landmarks well known to the head and neck surgeon. A horizontal incision is made about two fingerbreadths below the margin of the mandible, crossing the anterior border of the sternocleidomastoid muscle. After subplatysmal flaps have been raised, the sternocleidomastoid muscle is retracted posteriorly, and the dissection is carried down to the carotid sheath. The carotid bifurcation is identified, and the external carotid artery is isolated. Although ligation is usually performed just distal to the superior thyroid artery, it is probably better to ligate below the origin of the ascending pharyngeal artery, particularly if the epistaxis may be coming from the posterior portion of the nose or nasopharynx.

Ligation of the external carotid artery can fail, since ligation is performed far from the bleeding site and flow in the distal artery can be substantial through anastomotic connections from the opposite side and between the internal and external carotid systems.

Transantral Ligation of the Internal Maxillary Artery

Local or general anesthesia is required for transantral ligation of the internal maxillary artery. A Caldwell-Luc incision is made. The maxillary antrum is entered, and an inferiorly or laterally based flap is outlined and raised on the posterior sinus wall.

The posterior sinus wall is carefully removed with a small chisel, curette, or drill, beginning inferiorly and medially to avoid entering the orbit. After a "window" of bone is removed, the posterior periosteum is incised. The operating microscope is positioned, and the area is carefully observed for pulsation, which may localize the artery. Adipose tissue and fine connective tissue in the pterygopalatine fossa is dissected free, using hemostats, alligator clips, the bayonet forceps of the bipolar electrocautery unit, and nerve hooks. When the internal maxillary artery is identified, it is retracted with a nerve hook and its branches are identified.

Ideally, clips are placed on the internal maxillary artery, the sphenopalatine artery, and the descending palatine arteries. Locking clips are preferred, and the vessels need not be transected. A nasoantral "window" is created, and a light pack of antibiotic-impregnated gauze is placed for 24 hours. Previously placed nasal packing is removed. Brief, mild oozing often occurs but stops promptly (Montgomery et al, 1970; Montgomery and Reardon, 1980; Cook et al, 1985; Montgomery, 1970; Pearson et al, 1969).

Transoral Approach to Ligation of the Internal Maxillary Artery

Citing the technical demands of the transantral approach, Maceri and co-workers (1984) described a transoral approach for ligation of the internal maxillary artery. The plane of the buccinator is entered through a gingivobuccal incision. The buccal fat pad is removed, and the attachments of the temporalis muscle to the coronoid process of the mandible are identified. Blunt

dissection in this area reveals the internal maxillary artery, which is isolated, clipped or ligated, and divided. This procedure is particularly useful if the transantral approach cannot be performed because of sinus trauma or malignancy.

The primary criticism of this approach is that the site of ligation is more proximal than the transantral approach, with a greater chance of failure. The most significant complications of this procedure are cheek swelling and trismus that may take up to 3 months to resolve and can be quite severe.

Ligation of the Ethmoidal Arteries

Bleeding high in the nose superior to the middle turbinate is on occasion best treated by ligation of the anterior or posterior ethmoidal arteries, or both. The arteries are ligated just before they leave the orbit through the anterior and posterior ethmoidal foramina situated in the frontoethmoidal suture line. The anterior ethmoidal foramen is approximately 1.5 cm posterior to the posterior lacrimal crest. The posterior ethmoidal foramen is only 4 to 7 mm anterior to the optic nerve.

An external ethmoidectomy incision is used for exposure. Orbital retractors are used to retract the orbital periosteum and the lacrimal sac, and dissection proceeds posteriorly along the suture line in a subperiosteal plane. Two arterial clips are placed on the anterior ethmoidal artery, and the nose is re-examined. If bleeding has stopped, the posterior ethmoidal artery is not approached in order to avoid the potential for optic nerve injury. If bleeding persists, the artery is divided, and the posterior ethmoidal artery is exposed and clipped but is not divided or cauterized, once again to avoid injury.

Arterial Ligation Versus Packing

The mere existence of multiple techniques for the treatment of epistaxis implies that no one technique is ideal. Each technique for the treatment of epistaxis has its own technical difficulties, its unique complications, and its failures.

The failure of packing to control active hemorrhage, at least temporarily, is usually caused by inadequate placement of the pack, anatomic abnormalities, such as septal deviation, or lack of cooperation by the patient. These failures are corrected by replacing the pack, performing a septoplasty, or sedating the patient.

Even after successful packing, bleeding may recur after the packing has been removed. This is the most common indication for arterial ligation.

The controversy between those who advocate primary vessel ligation and those who advocate the use of arterial ligation only after traditional packing has failed has already been alluded to. Arguments in favor of early ligation include changes in blood gas parameters, a 25 per cent failure rate of packing, fewer complications, shorter hospitalizations, and greater patient

acceptance. The arguments against early surgery include the need for general anesthesia and the fact that in most cases surgery will not be needed.

Septoplasty

Septoplasty for visualization of the bleeding site and cauterization has been proposed. It is also indicated in a very deviated septum to allow more adequate packing. This procedure can be performed after failed anterior packing and is frequently performed at the time of insertion of a nasopharyngeal pack under general anesthesia.

Angiography and Embolization

Sokoloff (1974) first described therapeutic percutaneous embolization of the internal maxillary artery with an absorbable gelatin sponge for intractable epistaxis. Previous reports discussed the ability of angiography to demonstrate the site of bleeding in epistaxis. Merland and colleagues (1980) discussed the use of embolization for the treatment of hereditary hemorrhagic telangiectasia, epistaxis (primary and traumatic), angiomas, nasopharyngeal fibromas, malignant tumors, and bleeding disorders. They noted the inaccessibility of the ethmoidal arteries to embolization but considered embolization to have significant advantages over internal maxillary artery ligation because of distal obliteration of the artery and because it is carried out with a single femoral artery puncture.

Complications of embolization include facial paralysis (DeVries et al, 1986) and hemiplegia (Merland et al, 1980). Facial pain and trismus are common, brief side effects.

Many materials have been used for embolization, but absorbable gelatin sponges are most commonly used (Wills and Russel, 1979; Roberson and Reardon, 1979).

Although it is controversial, there is general agreement on the use of embolization for the treatment of patients with epistaxis when other treatments fail and when there are contraindications to surgery.

Treatment of Hereditary Hemorrhagic Telangiectasia

The treatment of hereditary hemorrhagic telangiectasia can be quite frustrating. Packing can be of benefit temporarily but does not provide long-term control, and cautery disrupts the mucous membranes and can exacerbate bleeding. Systemic estrogen therapy has not proved beneficial, and all patients need to be maintained on long-term iron administration. The treatment of the disease, when severe, has consisted of septal dermoplasty, as described by Saunders (1960, 1968). More recently, laser treatment has proved of some benefit.

Septal Dermoplasty

The purpose of septal dermoplasty is to replace the anterior nasal mucosa with a skin graft. As with all types of treatment, most patients will have bleeding even after treatment, but usually the frequency and severity are greatly decreased.

Septal dermoplasty, as described by Saunders ((1968), is performed under local anesthesia using a medium-thickness skin graft obtained from the anterior portion of the thigh. Working through an alar incision (lateral rhinotomy is not necessary), the mucosa is removed from the anterior half of the nasal septum, the floor of the nose, and the lateral wall, using a sharp ring curette. The rich vascular bed of perichondrium is left in place. Bleeding is controlled with topical epinephrine packs, and the skin graft is placed. The grafts are securely fixed anteriorly with sutures and subsequently with meticulously placed packing. Careful packing is of extreme importance.

Strauss and associates (1985) discuss the use of regional facial cutaneous flaps for the treatment of severe and recurrent epistaxis secondary to this condition. They acknowledge that the technique is very aggressive and should be used only as an adjuvant, "sometimes lifesaving" technique, when other methods of treatment have not been successful.

Laser Treatment

Lasers have been used with mixed success for the treatment of hereditary telangiectasia. Parkin (1981), Parkin and Dixon (1984), and Shapshay and Oliver (1984) discuss the use of the neodymium-yttrium-aluminum-garnet (Nd-YAG) laser and the argon laser for the treatment of nasal and oral lesions in patients with hereditary hemorrhagic telangiectasia. Parkin feels that the argon laser is superior to the Nd-YAG laser, and he treats patients under general anesthesia by photocoagulating the lesion, beginning at the periphery and ending at the center of each lesion. Since the laser is not effective in the face of acute hemorrhage, the lesion may be electrically coagulated immediately prior to the use of the laser.

Retreatment is almost always necessary, and better results are obtained after subsequent treatments, approximately 4 to 6 months apart. The vast majority of patients report less severe or less frequent bleeding. All patients who had had previous dermoplasty and who subsequently underwent laser treatments reported better control of symptoms and less morbidity with the laser treatments.