Epistaxis: A Contemporary Evidence Based Approach

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KEYWORDS

• Epistaxis • Evidence • Emergency ENT

KEY POINTS

- Epistaxis is the second most common cause for ear/nose/throat emergency admission.
- Given this fact, there are surprisingly few studies or guidelines, and management is usually based on experience rather than high level evidence. A stepwise approach to epistaxis management is advocated: initial management, direct therapy, tamponade, and vascular intervention.
- There is a changing emphasis in epistaxis management, with a move away from the traditional approaches of prolonged admissions and reliance on extensive nasal packing.
- Arterial ligation procedures are increasingly commonly used, offering higher success rates and much reduced morbidity.
- A protocol is provided for clinical guidance and as a framework for future studies.

INTRODUCTION

Epistaxis is the second most common cause for emergency admission to ear/nose/throat services (following sore throat). In 2009/2010, there were more than 21,000 emergency admissions in England with a mean inpatient stay of 1.9 days. The majority of admissions are aged 60 to 70 years,[1] but there is a bimodal age incidence, with an earlier peak in childhood.[2]

Death due to epistaxis is rare. In 2005 in the United States, 7 epistaxis-related deaths were recorded, all from the population 75 years or older[3]; an approximate incidence in that age group of 1:2,500,000, and an overall incidence of 2:100 million. The epidemiology of epistaxis in Scotland has been well reviewed,[4] and readers are referred here for more details.

Despite the heavy caseload there are no national or consensus guidelines to inform management decisions, and the most junior members of staff are often the main

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caregivers.[5] Across different centers, investigation profiles and treatment preferences vary. There are areas of controversy, and non-standardized practice exists. This situation needs to be addressed in an evidence-based fashion. The purpose of this article, therefore, is to review the literature concerning the management of epistaxis and to make recommendations (evidence-based where available) for treatment.

METHODS

A literature review was performed in July 2011. PubMed was searched using the term "Epistaxis"[Majr], limited to reviews within the last 10 years. Relevant articles were identified and obtained, as well as important ancestor references. Further specific searches were conducted without limits, to address each theme within the review, for example, "Epistaxis"[Majr] AND "Blood Coagulation Disorders"[Mesh]. More than 200 articles were reviewed, although few provided primary evidence beyond expert opinion to guide the development of an overall management protocol.

A MANAGEMENT PATHWAY

Management of Epistaxis

A stepwise approach to epistaxis management is advocated. In order, this should be initial management, followed by direct therapy, tamponade, and vascular intervention. When control of bleeding is not achieved, timely progression through the management steps is essential (**Fig. 1**).

Pathway Progression: Uncontrolled Epistaxis

Direct therapy or tamponade will almost invariably reduce bleeding, but sometimes control is not absolute, and intermittent or minor ongoing bleeding may occur. In such cases, a clinical decision must be made as to whether to progress with further management as per uncontrolled epistaxis, or to observe the patient. Such is not uncommon in cases of coagulopathy, where bleeding times may be significantly prolonged. The decision must be based on the ongoing rate of bleeding and the patient's risks. In some cases, a little further air in a tamponade balloon (often required within the hour after initial insertion), or applying a procoagulant dressing to an oozing cautery site (eg, Surgicel absorbable hemostat, Ethicon Inc, Somerville, NJ; or Algosteril Alginate Fiber Absorbable Hemostat, Smith & Nephew PLC, London, UK) may be helpful. Patients must not, however, sit for prolonged periods with poor control, multiple nasal packs, and no further intervention. These patients must receive a pack or vascular intervention if required.

Protocol Completion: Treated Epistaxis

Where possible, epistaxis should only be considered adequately treated when a topical therapy or vascular intervention has been used, although when a thorough examination has not identified a bleeding site, and simple vasoconstriction or tamponade has led to initial control, longer-term resolution may be achieved through normal hemostatic and tissue repair mechanisms in some cases.

Step 1. Initial management of epistaxis

Immediate management includes an Advanced Life Support–type ABC assessment (Airway, Breathing, Circulation) and resuscitation. Epistaxis is not usually an immediate airway threat but patients should be sat upright, and encouraged to lean forward and clear any clots from their pharynx. An assessment of blood loss (eg, volume, time, number of tissues, towels, or bowls) and the degree of any hypovolemic shock should

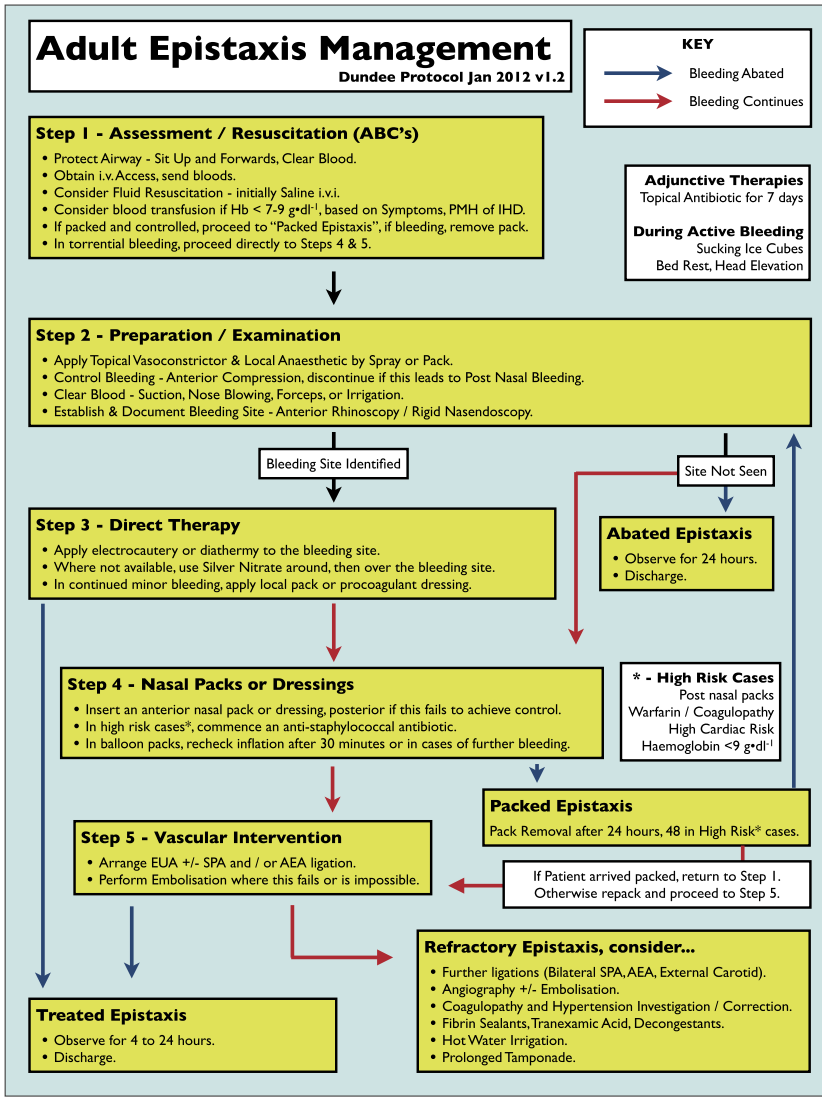

Fig. 1. Adult epistaxis management pathway. BID, twice a day; EUA, examination under anesthesia; IHD, ischemic heart disease; AEA, anterior ethmoid artery; SPA, sphenopalatine artery.

be made, while establishing venous access and fluid resuscitation where indicated. Gloves, gowns, and goggles are essential to protect both clinician and patient. A medical and drug history may elucidate precipitants. The side of bleeding as well as whether it is predominantly anterior or posterior should be determined.

In exceptional circumstances, postnasal bleeding may be so heavy as to warrant an immediate balloon pack (eg, Foley catheter and anterior pack) to prevent further blood loss, with arrangements for transfer to theater. In general, however, the first priority is to visualize the bleeding area through initial hemostatic measures and examination. Depending on the bleeding site, and local skills and facilities, this may be best

achieved with a nasal thudicum or speculum in conjunction with a headlight or mirror, an auroscope, microscope, or endoscope, noting that each approach has its limitations. Nasoendoscopy facilities, above all others, are essential; identifying 80% of bleeding sites not otherwise seen.[6]

Blood will likely obstruct the view to the bleeding site. In anterior nasal bleeding, this can be controlled through anterior nasal compression for 10 to 60 minutes in conjunction with topical vasoconstrictors.[7] If hemostasis is not achieved or nasal compression only leads to postnasal bleeding, it should be discontinued, and an attempt made to clear blood and visualize the site with suction, forceps, irrigation,[8] or nose blowing. These methods may achieve initial hemostasis, and/or allow bleeding site visualization necessary for direct therapies such as cautery.

Topical vasoconstrictor preparations recommended include 1:1000 adrenalin (epinephrine),[9] 0.5% phenylephrine hydrochloride,[10] 4% cocaine, or 0.05% oxymetazoline solution,[7] but few comparisons have been conducted. One study suggested that oxymetazoline may be more effective than 1:100,000 (dilute) adrenalin, and equally effective with less propensity to induce hypertension when compared with 4% cocaine.[11]

Investigations A full blood count will facilitate assessment of blood loss and shock. A biochemistry profile may indicate circulatory effects on renal function or the breakdown products of a large volume of ingested blood. A sample should be sent to establish blood group and match of transfusion products (eg, red cells, plasma, or platelets). Routine coagulation profiles are not recommended,[12–14] unless the patient takes warfarin or is admitted as a child.[15] Angiography has an essential but infrequent role in excluding potentially fatal carotid aneurysms in trauma and in cases of heavy postsurgical bleeding.

Step 2. Direct therapy

Silver nitrate cautery Cautery using topical anesthetic is advocated by most investigators as the optimal management in adult epistaxis. Nonetheless, in 1993 only 24% of cases referred to specialist otolaryngology units in the United Kingdom were managed in this way, with 76% undergoing nasal packing.[5]

Silver nitrate cautery is common but is difficult in the context of active bleeding, where electrocautery or electrocoagulation (diathermy) may be more effective. A local cauterizing solution is achieved by touching a dry salt silver nitrate tipped applicator against moist mucosa. The objective is direct cautery of the bleeding site, but initial circumferential contact may facilitate control of bleeding and more definitive results.[8]

Silver nitrate is available in 75% and 95% preparations. A histopathological study comparing the two found that 95% silver nitrate caused twice the depth of burn, which it was thought might increase the risk of complications including septal perforation.[16] It is believed that bilateral cautery may also increase the risk of septal perforation,[17] with a 4- to 6-week interval being advocated between sides,[18] although Link and colleagues[19] found this not to be the case using silver nitrate (n = 46).

Silver nitrate ($AgNO_3$) can cause black staining, which may be addressed by application of saline (NaCl) to form silver chloride (AgCl) and sodium nitrate ($NaNO_3$)[20]; both are white crystals, and the latter is readily soluble in water. Stains usually resolve over a period of weeks,[21] but permanent mucosal tattooing has been reported.[22–24]

Electrocautery and electrocoagulation (diathermy) Toner and Walby[25] compared routine use of hot-wire electrocautery with use of silver nitrate, finding no difference in the rates of recurrent bleeding at 2 months, although the confidence interval (CI)

was broad, with some trend toward greater benefit with electrocautery (95% CI −11%–24%).

Although specialist equipment is required, electrocautery (hot wire) or diathermy may have advantages over silver nitrate, which can be difficult to apply to the site in cases of uncontrolled bleeding. No further electrocautery or electrocoagulation studies were identified.

After direct therapy, in some cases of minor ongoing bleeding, the addition of a hemostatic dressing such as Surgicel (Ethicon) or Kaltostat (ConvaTec Ltd, Skillman, NJ), or the use of a very localized pack over the bleeding site, may help to prevent further pathway progression.

Step 3. Nasal packs or dressings

If local therapy fails, control of bleeding can be achieved by tamponade, using a variety of nasal packs, or by promotion of hemostasis through nasal dressings. Modern nasal packs are easily and relatively comfortably inserted by practitioners not specialized in otorhinolaryngology, for example, in the emergency department, ambulance, or family practice. As a consequence, many patients now arrive at the authors' department with packs inserted. However, this does prevent immediate direct therapy, which might otherwise allow a treated patient to be sent home. Once a pack is inserted, it is usually recommended that it is left in place for 24 hours, necessitating admission, although care at home with packs has been described.[10]

A variety of nasal packing materials is available. Examples include polyvinyl acetal polymer sponges (eg, Merocel, Medtronic Inc, Minneapolis, MN), nasal balloons (eg, the Rapid Rhino Balloon pack with a self-lubricating hydrocolloid fabric covering, ArthroCare Corp, Austin, TX), nasal dressings (eg, Kaltostat calcium alginate, ConvaTec Ltd), and traditional ribbon packs, for example, BIPP (Bismuth, Iodoform, Paraffin Paste) or petroleum jelly–coated ribbon gauze. Each of these packs is illustrated in **Fig. 2**. Some (eg, Rapid Rhino, Kaltostat) are reported to provide procoagulant surfaces, which may be helpful in coagulopathic patients, most commonly those on warfarin.

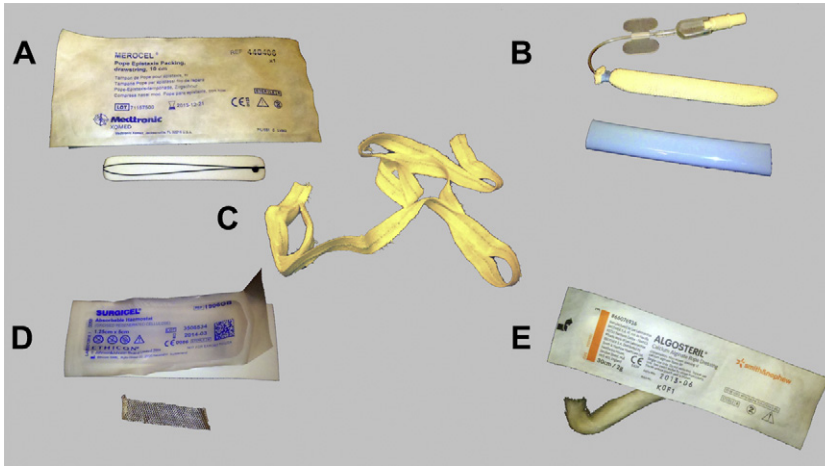

Fig. 2. Common nasal packs and dressings. (*A*) Merocel (polyvinyl acetal polymer sponge pack); (*B*) Rapid Rhino (self-lubricating hydrocolloid covered balloon pack); (*C*) a traditional ribbon pack, in this case BIPP (Bismuth Iodoform Paraffin Paste); (*D*) Surgicel (oxidized regenerated cellulose absorbable hemostat); (*E*) Algosteril (alginate fiber absorbable hemostat).

A nasopharyngeal pack may be placed in posterior epistaxis (approximately 5% of cases[26]), especially when initial anterior packs fail. Traditional postnasal packs were rolled gauze attached to tapes passed out through the nose and mouth to secure.[26] More recently, Brighton or Foley catheters have been used, inflated with saline and secured transnasally with an anterior clamp, for example, an umbilical clip.

Postnasal packs are extremely uncomfortable and are prone to cause significant hypoxia.[27] Hospitalization, oxygen therapy via face mask, and in some cases sedation are required; a combination that increases the risks of hypoxia and aspiration. Other complications of nasal packs (especially nasopharyngeal) include displacement with airway obstruction, pressure necrosis of the palate, alar or columellar skin, and sinus infection or toxic shock syndrome. The latter is caused by staphylococcal exotoxin TSST-1, and presents with fever, diarrhea, hypotension, and a rash.[26] *Staphylococcus aureus* can be isolated in one-third of patients, of which 30% produce the exotoxin.[28] Therefore, prolonged packing should be avoided and anti-staphylococcal antibiotics prescribed if a pack is to remain in situ for more than 24 hours[8] (see discussion on high-risk cases).

Balloon packs may deflate over time,[29] so should be checked after the first hour or if bleeding recommences. Some minor ongoing bleeding is not uncommon immediately following pack insertion, and may resolve given careful observation.

Following pack removal it is imperative to examine the nasal cavity, to exclude underlying abnormality and to identify and manage the bleeding source if possible.

Step 4. Ligation/embolization

Surgery In a 1993 United Kingdom national survey of practice, 9.3% of epistaxis patients referred to an otolaryngologist required a posterior nasal pack (commonly a Foley catheter). A general anesthetic was required in 5.6% to control bleeding, and fewer than 1% had a formal arterial ligation (ethmoid, maxillary, or external carotid).[5]

In the authors' own center, with 593 acute admissions for epistaxis over the last 2 years, 47% had hospital stays of 1 day or less. Of the 317 longer-term cases, 7% were taken to theater and underwent arterial ligation: 21 of the sphenopalatine artery (SPA) and 2 of the anterior ethmoid artery (AEA). In some cases, the theater equipment and anesthetic will facilitate visualization of the bleeding site, bleeding control, and direct cautery. Where this remains impossible, or uncertainty is present about the control established, arterial ligation is performed.

In the past, ligation was commonly of the maxillary artery or the external carotid artery. Although the distribution of these arteries is wider, recent studies suggest that SPA ligation is more successful, possibly because of difficulties completing the other procedures, or a failure to address more distal collateral circulation.[30] SPA ligation is associated with minor complications such as nasal crusting, decreased lacrimation, and paresthesia of the palate or nose.[31] Septal perforation and inferior turbinate necrosis have also been reported.[32,33]

By contrast, ligation of the maxillary artery through a canine fossa approach can be complicated by dental or nasolacrimal duct injury, facial and gum numbness, or oroantral fistula.[34] Ligation of the external carotid artery is associated with a small risk of injury to the hypoglossal and vagus nerves, and a lower success rate.[30]

When compared with traditional packing techniques, SPA ligation has been shown to enable a reduced inpatient stay, improved patient satisfaction, and cost reductions.[35] Feusi and colleagues.[36] reviewed SPA ligation efficacy studies in 2005: 13 investigators reported 264 patients with 1-year success rates of between 70% and 100%. More recent studies with longer-term follow-up (15–25 months) reported

success rates of between 75% and 100%.[37–40] Ligation of all[41] SPA branches is essential.[42]

AEA ligation has an essential role in traumatic or postsurgical epistaxis, in which nasal or ethmoid bony injury leads to bleeding beyond the SPA distribution. Recent attempts have been made to avoid the external scar, performing AEA ligation by endonasal or transcaruncular approaches. The endonasal approach, first described by Woolford and Jones,[43] requires either an artery within a mesentry[44] or an approach to the artery through the lamina papyracea.[45] The former was feasible in 20% or fewer of cases.[44] The latter, performed through the lamina, appears to be safe and feasible in most cases,[45,46] although this is likely an approach best left to expert hands. In both cases, preoperative or intraoperative computed tomography scans and image guidance are advised.

A transcaruncular approach is an appealing alternative. Morera and colleagues[47] report a case series of 9 patients in which all were successful with no reported complications. For now, however, a pragmatic approach may be to use an endoscope in a conventional external approach, allowing the scar to be minimized.[48]

The choice of surgical ligation type is a clinical decision, which must be based on the history and examination findings. Epistaxis traditionally has been defined as anterior or posterior, with posterior bleeds considered to relate to the Woodruff plexus. The definitions have been inconsistent, however,[49] and the relevance of the Woodruff plexus recently questioned.[50]

An understanding of the anatomy is essential for both surgeons and interventional radiologists. To this end, the reader is referred to excellent texts by Lee and colleagues[42] and Biswas and colleagues.[51]

Interventional radiology: embolization Selective embolization of the maxillary or facial arteries should be considered in cases where surgical ligation fails, or is impossible because of anesthetic concerns. A variety of materials have been used including metal coils, Gelfoam, and cyanoacrylate glue. Success rates between 79% and 96% are reported,[52] but complications are not uncommon: cerebrovascular accident, arterial dissection, facial skin necrosis, facial numbness, and groin hematoma can occur, with historic rates of up to 47% but only 6% in larger, more recent series.[53]

Percutaneous angiography is performed to identify the vascular anatomy. Extravasation may suggest the site of epistaxis, but is not often seen. Radiopaque nasal packing (such as BIPP) must be removed. Selective embolization of the relevant arterial supply, typically the internal maxillary artery, reduces the hydrostatic pressure of blood to the nasal cavity, allowing hemostasis, which must be balanced against devascularizing the facial soft tissues. Embolization of the ethmoidal arteries is not possible; cannulation of the ophthalmic arteries carries a high risk of blindness.

Refractory Acute Epistaxis

Occasionally bleeding will continue (usually slowly or intermittently), despite all conservative measures, good nasal packs, examination under anesthetic, and even arterial ligations. In such cases, it is important to reconsider questions regarding anatomy and physiology.

For anatomy

Which side is it bleeding? Is it passing through a perforation, or around the choana? Has a competent practitioner visualized the area of bleeding directly? In cases with a history of trauma, is there an anterior ethmoid laceration, or a carotid aneurysm? Is there a role for further ligations of the bilateral sphenopalatine, or anterior and

posterior ethmoid arteries? Will a maxillary artery or external carotid ligation add anything (eg, minor contributions from the facial and greater palatine branches)? Will angiography be informative and potentially therapeutic?

For physiology

Is the patient coagulopathic? Are they bleeding diffusely? Have measures been taken to reverse any drug-induced coagulopathy? If they have bled extensively, have their clotting factors been replaced? Has hypertension been addressed? Will tranexamic acid,[54] topical hemostatics,[55] or fibrin sealants[56,57] help?

Adjunctive Treatments

Topical treatments

For the purposes of the current protocol, regarding epistaxis requiring admission, topical treatments are considered to be inappropriate as sole therapy. However, topical agents may have a role as an adjunct and, noting their efficacy in minor recurrent epistaxis, especially in childhood,[58] the authors recommend them in all cases. Options include Naseptin cream (0.1% chlorhexidine dihydrochloride with 0.5% neomycin sulfate), petroleum jelly, Bactroban, triamcinolone 0.025%,[59] and others.[60]

Ice packs

Ice packs are a tradition on many of our wards. When ice cubes are sucked, there is a measurable reduction in nasal blood flow assessed by nasal laser Doppler flowmetry.[61] However, no change is seen when ice is applied to the forehead or neck.[62]

Preventing Epistaxis Deaths

In 1961, Quinn[63] wrote of his own experience and reviewed previous cases of fatal epistaxes, recognizing the groups at risk; those with significant comorbidity (eg, ischemic heart disease, coagulopathy) and endonasal tumors, or following head and facial trauma or surgery. He advocated angiography following trauma, as well as "adequate blood replacement and an informed attitude toward surgical interruption of the blood supply." He also reported the association of anterior ethmoid bleeding with trauma, the use of ferrous sulfate, and the association of cranial nerve signs with internal carotid laceration or aneurism. His observations seem just as relevant today as then, and still address the most important issues; in particular, the recognition of high-risk groups and the need in such cases for early and relatively aggressive fluid resuscitation to prevent complications and deaths, most commonly in elderly patients with ischemic heart disease.

Quinn[63] recognized the difficulty of balancing the need to transfuse anemic epistaxis patients against the risks, noting the possible contribution of a blood transfusion to the death of at least one patient. Prolonged admissions with nasal packs and poorly controlled bleeding will exacerbate this risk, and for these reasons Kotecha and colleagues[5] recommended earlier surgical intervention in some elderly patients with compromised respiratory or cardiovascular systems.

In the current protocol, the authors recommend a transfusion threshold of 7 to 9 g/dL. This figure is based primarily on a study in critically unwell patients in which a restrictive policy (transfusion indicated if hemoglobin <8 g/dL cf <10 g/dL) was shown to improve survival outcomes, particularly in the young (<55 years) and those relatively less unwell.[64]

Although rare, death in association with epistaxis has also been reported to occur through airway obstruction. Again, significant comorbidity (eg, neurologic impairment caused by preexisting disease or head injury) may be present. Airway obstruction secondary to nasal packing is a risk, attributable to either pack or clot dislodgment.[65]

In some patients, nasal obstruction itself can lead to significant arterial oxygen desaturation.[27] Again, an awareness of these potential scenarios with appropriate measures to prepare the patient, protect the airway, and monitor oxygenation is important to prevent fatal complications.

The most common case report of death secondary to epistaxis relates to rupture of an internal carotid aneurysm, often of traumatic or surgical origin. In torrential bleeds of this nature, only early suspicion with angiography, coil occlusion, stenting, or surgical ligation of the aneurysm or the internal carotid in the neck will prevent death.[66] In the operative context, Valentine and colleagues[67] recently compared several measures for initial hemostasis in carotid injury, concluding that crushed muscle hemostasis followed by U-clip repair was the most effective, achieving primary hemostasis while maintaining vascular patency in all cases.

LITERATURE REVIEW ON EPISTAXIS

In reviewing the epistaxis literature, one is confronted with a wealth of expert opinion and descriptive articles. Few primary research studies are conducted, and those available focus on management techniques rather than on pathway decisions. Without placing the patients in the context of a management pathway, these studies may lack transferability; one's own patients may represent a different population at a different point in the pathway. It is for these reasons that a management pathway must be defined, and as a starting point the authors advocate the protocol described herein.

In developing a contemporary protocol, one must recognize the changing emphasis of epistaxis management with a move away from traditional approaches of prolonged admissions and reliance on extensive nasal packing. Refined arterial ligation procedures are increasingly commonly used, offering higher success rates and less morbidity. These procedures have facilitated shorter admissions, with happier patients as well as hospital managers.

The current protocol excludes contexts such as coagulopathy, hereditary hemorrhagic telangiectasia (HHT), and children, although useful generalizations can be made. Of admitted epistaxis patients, 62% have an iatrogenic coagulopathy (21% warfarin, 41% antiplatelet). This group requires longer inpatient stays and more aggressive management.[68,69] Although management follows the same principles, the coagulopathy itself must be addressed, and care must be taken not to cause further trauma through aggressive cautery, nasal packing, or vascular intervention. Procoagulant dressings may be helpful. The authors hope to provide further guidance on the management of this group in a later article.

The authors are aware of several different approaches to epistaxis that have not been recommended in this guideline, from simple vasoconstrictor treatments[70] to hot-water irrigation[71–73] or cryotherapy.[74] Although efficacy studies are reported, few if any comparisons have been performed against conventional techniques in the context of a defined management protocol. It is hoped that this article will facilitate future scientific comparisons to allow the best timing of such interventions to be established.

As always, further research in the field is needed. Despite the frequency of epistaxis as a presentation, little formal research has been conducted. The authors recommend that any interventional studies place themselves in the context of the overall pathway of patient management, as well as tightly defining patient flow (stepwise by protocol) and demographics; for example, age, sex, blood pressure, anticoagulant use, other medications (including herbal), HHT, prior episodes, trauma or operative history,

and so forth. The authors are developing an epistaxis admission data set, optically captured from an admission pro forma, and would be happy to hear from any other interested centers.

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