CHAPTER 5

Epistaxis: An Update on Contemporary Evidence-Based Approach

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INTRODUCTION

Epistaxis is the second most common cause for emergency admission to ear, nose, and throat (ENT) 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 patients admitted are aged 60–70 years,[1] but there is a bimodal age incidence, with an earlier peak in childhood.[2]

Death caused by epistaxis is rare. In 2005 in the United States, seven epistaxis-related deaths were recorded, all from the 75-year or older population,[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 caregivers.[5] Across different centers investigation profiles and treatment preferences vary. There are areas of controversy and nonstandardized practice exists, which need 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.

This article provides a contemporary management protocol for adult epistaxis admissions, evidence based where possible, otherwise based on our own experience.

METHODS

A literature review was performed in March 2017, Pubmed was searched using the term "Epistaxis"[Majr], limited to reviews within the last 10 years. Relevant papers were identified and obtained, as well as important ancestor references. Further specific searches were conducted without limits, to address each theme within the review, e.g., "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.

RESULTS–A MANAGEMENT PATHWAY

Management

A stepwise approach to epistaxis management is advocated. In order, this should be "Initial Management, Direct Therapy, Tamponade, and Vascular Intervention." Where control of bleeding is not achieved, timely progression through the management steps is essential (see Fig. 5.1).

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 whether to progress with further management as per uncontrolled epistaxis or to observe the patient. This 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), application of Haemostatic matrix (Floseal), or a procoagulant dressing to an oozing cautery site (e.g., Surgicel) 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 where a thorough

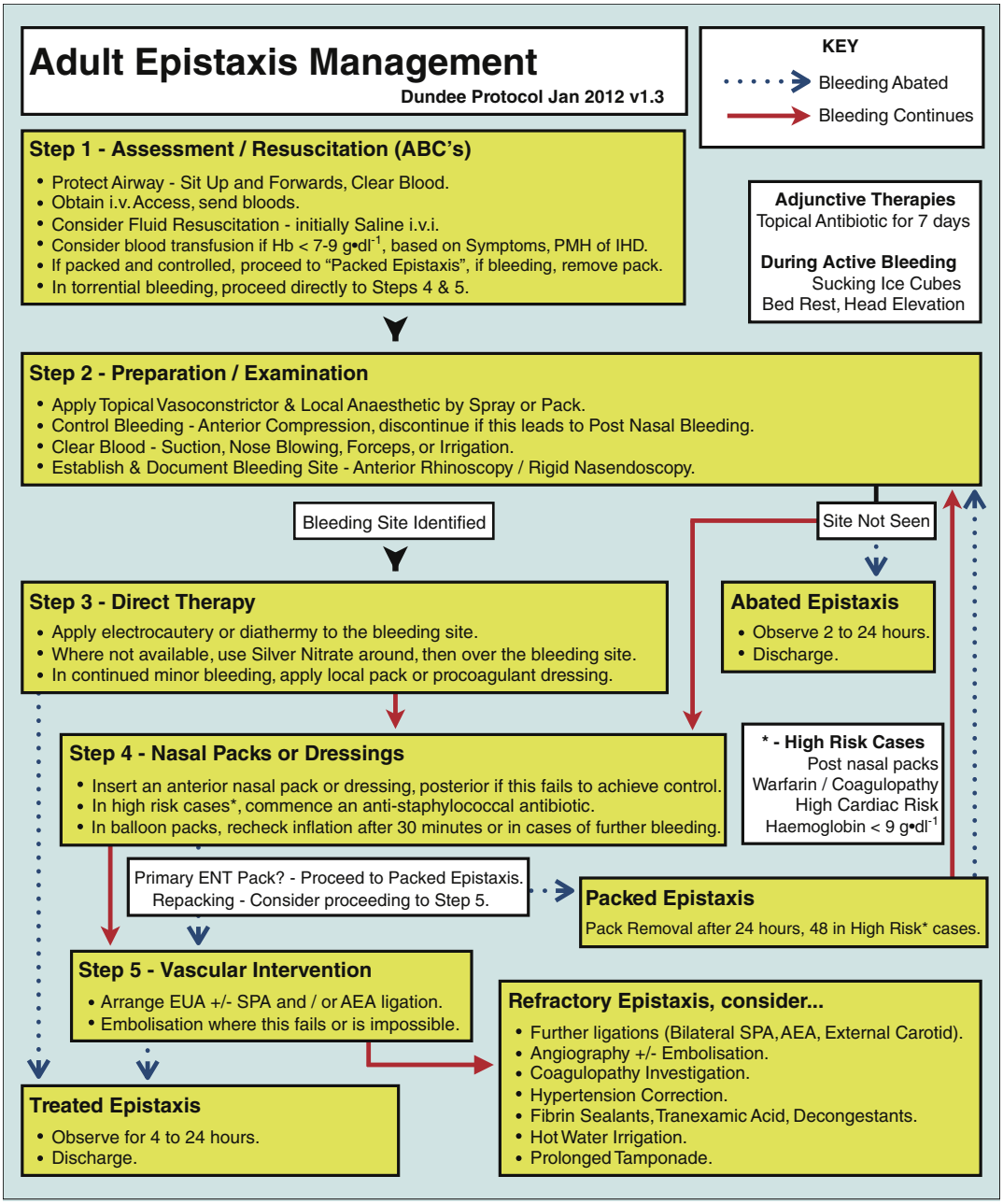

FIG. 5.1 **Adult Epistaxis Management Pathway.** *AEA*, anterior ethmoid artery; *SPA*, sphenopalatine artery; *PMH*, past medical history; *IHD*, ischaemic heart disease; *EUA*, examination under anaethesia.

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 haemostatic and tissue repair mechanisms in some cases.

Step 1. Initial management. Immediate management includes an Adult Life Support-type Airway, Breathing, Circulaion assessment and resuscitation. Epistaxis is not usually an immediate airway concern, but the patient should be made to sit upright and encouraged to lean forward

and clear any clots from the pharynx. An assessment of blood loss (e.g., volume, time, number of tissues, towels, or bowls) and the degree of any hypovolemic shock should be made, while establishing venous access and fluid resuscitation where indicated. Gloves, gowns, and goggles are essential to protect both yourself and the patient from contamination. A medical and drug history, including complementary and alternative medicine, may elucidate precipitants.[6] 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 (e.g., 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, local skills, and facilities, this may be best achieved with a nasal thudicum or speculum in conjunction with a headlight or mirror, an auroscope, a microscope, or an endoscope, noting that each approach has its limitations. Nasendoscopy are essential for identifying 80% of bleeding sites not otherwise seen.[7]

Blood will likely obstruct the view to the bleeding site. In anterior nasal bleeding, this can be controlled through anterior nasal compression for 10–60 min in conjunction with topical vasoconstrictors.[8,9] 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,[10] 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),[11] 0.5% phenylephrine hydrochloride,[9] 4% cocaine, or 0.05% oxymetazoline solution,[8] 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.[12] Topical vasoconstrictors can be applied in conjunction with topical anesthetics, such as 4% lignocaine, to improve patient comfort.

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 (e.g., red cells, plasma, or platelets). Routine coagulation profiles are not recommended[13–15] unless the patient takes warfarin or the patient is a child.[16] Angiography has an essential but infrequent role in trauma and cases of heavy postsurgical bleeding to exclude potentially fatal carotid aneurisms.

Step 2. Direct therapy

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

Silver nitrate cautery is common but difficult in the context of active bleeding, in which case 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 by application with gentle pressure to the bleeding point for a few seconds. Initial circumferential contact may facilitate control of bleeding and more definitive results.[10]

Silver nitrate is available in 75% and 95% preparations. A histopathologic study comparing the two found that 95% silver nitrate caused twice the depth of burn, and it was thought to increase the risk of complications including septal perforation.[17] It is thought that bilateral cautery may increase the risk of septal perforation,[18] with a 4- to 6-week interval being advocated between sides,[19] although Link et al.[20] found this not to be the case using silver nitrate (n = 46).

Silver nitrate ($AgNO_3$) can cause dark staining on the vestibular skin. This may be addressed by application of saline (NaCl) to form silver chloride (AgCl) and sodium nitrate ($NaNO_3$)[21]; both are white crystals, and the latter is readily soluble in water. Stains usually resolve over a period of weeks,[22] but permanent mucosal tattooing has been reported.[23–25]

Electrocautery and electrocoagulation (diathermy). Toner et al.[26] compared routine use of hot wire electrocautery with silver nitrate and found 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 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.

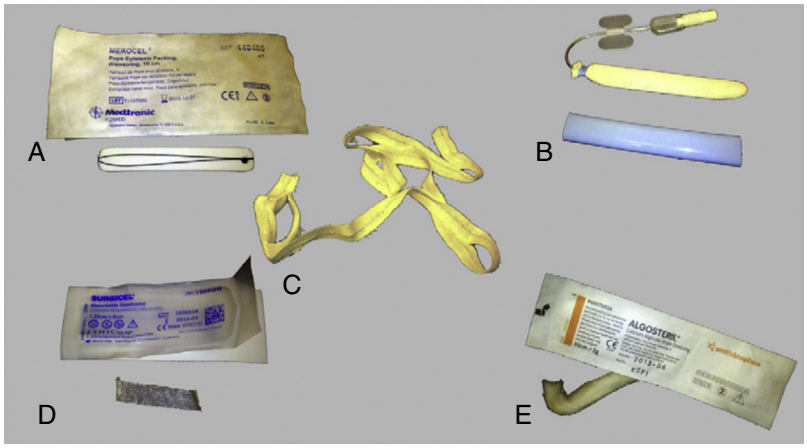

FIG. 5.2 **Common Forms of Nasal Pack.** Common nasal packs and dressings. **(A)** Merocel (polyvinyl acetal polymer sponge pack); **(B)** Rapid Rhino (self-lubricating hydrocolloid covered balloon pack); **(C)** a traditional ribbon pack, in this case BIPP (Bismuth Iodoform Paraffin Paste); **(D)** Surgicel (oxidized regenerated cellulose absorbable hemostat); **(E)** Algosteril (alginate fiber absorbable hemostat).

After direct therapy, in some cases of minor ongoing bleeding, the addition of a hemostatic dressing, such as Surgicel (Ethicon Inc. Somerville, NJ) 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. Where local therapy fails, control of bleeding can be achieved by tamponade, by 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 outwith otorhinolaryngology, e.g., in the emergency department, ambulance, or family practice. As a consequence, many patients now arrive in our department with packs inserted. This does prevent immediate direct therapy, however, which might otherwise allow a treated patient to be sent home. The authors therefore advocate removal of the packing for proper examination if possible. Once a pack is inserted, it is usually recommended to be left for 24 h, necessitating admission, although care at home with packs has been described.[9]

A variety of nasal packing materials are available. Examples include polyvinyl acetal polymer sponges (e.g., Merocel, Medtronic Inc., Minneapolis, MN), nasal balloons (e.g., the Rapid Rhino Balloon pack with a self-lubricating hydrocolloid fabric covering, ArthroCare Corp., Austin, TX), nasal dressings (e.g., Kaltostat calcium alginate, ConvaTec Ltd., Skillman, NJ), and traditional ribbon packs, e.g., BIPP (Bismuth, Iodoform, Paraffin Paste) or petroleum jelly-coated ribbon gauze. Each of these packs is illustrated in Fig. 5.2. Some (e.g., Rapid Rhino, Kaltostat) are reported to provide procoagulant surfaces, which may be helpful in coagulopathic patients, most commonly those given warfarin.

FloSeal hemostatic sealant can be considered as an alternative or adjunct to nasal packing for both anterior and posterior epistaxis. The current literature supports the use of FloSeal as an alternative method for anterior epistaxis. A recent study has demonstrated a success rate of 90% in controlling epistaxis with improved patient tolerance.[27,28]

A nasopharyngeal pack may be placed in posterior epistaxis (approximately 5% of cases[29]), especially when initial anterior packs fail. Traditional postnasal packs were rolled gauze attached to tapes passed out through the nose and mouth to secure.[29] More recently, Brighton or Foley catheters have been used, inflated with saline and secured transnasally with an anterior clamp, e.g., umbilical clip.

Postnasal packs are extremely uncomfortable and prone to cause significant hypoxia.[30] 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 last condition is caused by staphylococcal exotoxin TSST-1 and presents with fever, diarrhea, hypotension, and rash.[29] *Staphylococcus aureus*

can be isolated in one-third of patients, of which 30% produce the exotoxin.[31] Therefore, prolonged packing should be avoided and antistaphylococcal antibiotics prescribed if a pack is to remain in situ for more than 24 h[10]; see notes on high-risk cases.

Balloon packs may deflate over time,[32] so they 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 pathology and identify and manage the bleeding source if possible.

Step 4. Ligation/embolization

Surgery. In a 1993 UK national survey of practice, 9.3% of patients with epistaxis 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 <1% had a formal arterial ligation (ethmoid, maxillary, or external carotid).[5]

In authors's center, with 593 admissions for acute 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 bleeding site visualization, bleeding control, and direct cautery. In cases in which 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. 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.[33] SPA ligation is associated with minor complications such as nasal crusting, decreased lacrimation, and paresthesia of the palate or nose.[34] Septal perforation and inferior turbinate necrosis have also been reported.[35,36]

In 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.[37] External carotid artery ligation is associated with a small risk of injury to the hypoglossal and vagus nerves and a lower success rate.[33]

When compared with traditional packing techniques, SPA ligation has been shown to enable a reduced inpatient stay, improved patient satisfaction, and cost reductions.[38] Feusi et al.[39] reviewed SPA ligation efficacy studies in 2005: 13 authors reported 264 patients with 1-year success rates between 70% and 100%. More recent studies with longer-term follow-up (15–25 months) reported success rates between 75% and 100%.[40–43] Ligation of all SPA branches is essential.[44,45]

AEA ligation has an essential role in traumatic or postsurgical epistaxis in which nasal or ethmoid bony injury leads to bleeding outwith the SPA distribution. Attempts have been made to avoid the external scar by performing AEA ligation by the endonasal or transcaruncular approach. The endonasal approach, first described by Woolford and Jones,[46] requires either an artery within a mesentry[47] or an approach to the artery through the lamina papyracea.[48] The former was feasible in 20% or less of cases.[47] The latter, performed through the lamina, seems to be safe and feasible in most cases,[48,49] although this is likely an approach best left to expert hands. In both cases, pre- or intraoperative CT scans and image guidance are advised.

A transcaruncular approach is an appealing alternative. Morera et al.[50] report a case series of nine patients in which all cases 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.[51]

The choice of surgical ligation type is a clinical decision, which must be based on the history and examination findings. Traditionally, epistaxis has been defined as anterior or posterior, with posterior bleeds considered to relate to Woodruff plexus. The definitions have been inconsistent, however,[52] and the relevance of Woodruff plexus recently questioned.[53]

An understanding of the anatomy is essential for both surgeons and interventional radiologists. To this end, the reader is referred to excellent texts by Wormald, Lee, Biswas, and others.[45,54]

Interventional radiology—embolization. A number of studies have demonstrated that surgical ligation is more cost-effective and safer than embolization[55–57]; however, selective embolization of the maxillary or facial arteries should be considered in cases in which 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,[58] but complications are not uncommon: Cerebral Vascular Accident, arterial dissection, facial skin necrosis, facial numbness, and groin hematoma can occur with historic rates up to 47% but only 6% in larger, more recent series.[59]

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. This 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 the 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, anterior and posterior ethmoid arteries? Will a maxillary artery or external carotid ligation add anything, e.g., minor contributions from the facial and greater palatine branches? Will angiography be informative and potentially therapeutic?

For physiology: Is the patient coagulopathic? Is the patient bleeding diffusely? Have measures been taken to reverse any drug-induced coagulopathy? If the patient has bled extensively, have the clotting factors been replaced? Has hypertension been addressed? Will tranexamic acid,[60] topical hemostatics,[61] or fibrin sealants[27,62,63] help?

Adjunctive Treatments

For the purposes of the current protocol relating to epistaxis requiring admission, topical treatments are considered to be inappropriate as sole therapy. They may have a role as an adjunct, however, and noting their efficacy in minor recurrent epistaxis especially in childhood,[64] we recommend them in all cases. Options include Naseptin cream (0.1% chlorhexidine dihydrochloride with 0.5% neomycin sulfate), petroleum jelly, Bactroban (xx), Triamcinolone 0.025%,[65] and others.[66]

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.[67] However, no change is seen when ice is applied to the forehead or neck.[67,68]

Preventing Epistaxis Deaths

In 1961, Quinn[69] wrote of his own experience and reviewed previous cases of fatal epistaxes, recognizing the groups at risk: those with significant comorbidity (e.g., ischemic heart disease, coagulopathy), those with 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[69] recognized the difficulty of balancing the need to transfuse anemic patients with epistaxis against 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 et al.[5] recommended earlier surgical intervention in some elderly patients with compromised respiratory or cardiovascular systems.

In the current protocol, we recommend a transfusion threshold of 7–9 g/dL. This is based primarily on a study in critically unwell patients in which a restrictive policy (transfusion indicated if Hb < 8 g/dL cf. < 10 g/dL) was shown to improve survival outcomes, particularly in the young (<55 years) and those relatively less unwell.[70]

Although rare, death in association with epistaxis has also been reported to occur because of airway obstruction. Again, significant comorbidity (e.g., neurologic impairment caused by preexisting disease or head injury) may be present. Airway obstruction secondary to nasal packing is a risk, caused by either pack or clot dislodgement.[71] In some patients, nasal obstruction itself can lead to significant arterial oxygen desaturation.[30] 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 aneurism or the internal carotid in the neck will prevent death.[72] In the operative context, Valentine et al.[73] 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.

DISCUSSION

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 their patients in the context of a management pathway, these studies may lack transferability—our 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, we advocate the protocol herein described.

In developing a contemporary protocol, we 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 lesser morbidities. These have facilitated shorter admissions, with happier patients as well as hospital managers.

The current protocol excludes contexts such as coagulopathy, Hereditary Haemorrhage Telangiectasia (HHT), and children, although useful generalizations can be made. Of admitted patients with epistaxis, 62% have an iatrogenic coagulopathy (21% warfarin, 41% antiplatelet). This group requires longer in-patient stays and more aggressive management.[74,75] 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. We hope to provide further guidance on the management of this group in a later manuscript.

We are aware of a number of different approaches to epistaxis that have not been recommended in this guideline—from simple vasoconstrictor treatments[76] to hot water irrigation[77–79] or cryotherapy.[80] Although efficacy studies are reported, few if any comparisons have been performed against conventional techniques in the context of a defined management protocol. We hope that the current article will facilitate future scientific comparisons to allow us to establish the best timing of such interventions.

As always, further research in the field is needed. Despite the frequency of epistaxis as a presentation, little formal research has been conducted. We recommend (as before) that any interventional studies place themselves in the context of the overall patient management pathway, as well as tightly defining patient flow (stepwise by protocol) and demographics, e.g., age, sex, blood pressure, anticoagulant use, other medications (including herbal), HHT, prior episodes, trauma, or operative history. We are developing an epistaxis admission dataset, which will be optically captured from an admission proforma. We would be happy to hear from any other interested centers.

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