Controversies in the specialist management of adult epistaxis: an evidence-based review

Spielmann, P.M.,* Barnes, M.L.* & White, P.S.*

**Ninewells Hospital & Medical School, Dundee, UK*

Accepted for publication 14 August 2012
Clin. Otolaryngol. 2012, **37**, 382–389

Dear Editor,

Epistaxis is the second commonest cause for emergency admission to ENT services (the most common being sore throat). There were over 21 000 emergency admissions in England in 2009/10 with a mean 1.9-day inpatient stay and the majority aged over 60 years (http://www.hesonline.nhs.uk). Despite the heavy caseload, there are no guidelines to inform management decisions and the most junior members of staff are often the main caregivers.[1] The epidemiology of epistaxis has been well described.[2,3] There are several areas of controversy and non-standardised practices exist, which need to be addressed in an evidence-based fashion. Across different centres, investigation profiles and treatment preferences vary; these areas will be discussed in detail with recommendations. The purpose of this paper is to review the literature concerning the management of epistaxis and to make evidence-based recommendations for treatment.

Methods

A literature review, last performed in July 2011, searched PubMed using the term 'epistaxis' [Majr] – from 1956 to present without language restrictions. The titles and abstracts were initially screened, and full text of potentially relevant articles obtained. (Relevant papers addressed the areas of controversy detailed below or described trials pertaining to the management of epistaxis). The bibliographies of articles were searched for relevant references. The articles were compiled and reviewed by two authors (MB & PS), and the manuscript reviewed by PW. The review process was conducted independently with the aim of identifying the highest level of evidence in each of the areas of controversy detailed below.

Results

Over 200 full text articles were retrieved: most presented only expert opinion but where relevant the highest level of evidence will be referred to. Several specific areas of controversy were identified and will be addressed:

1 Treatment-room management – assessment and resuscitation, preparation and examination, direct therapy, nasasl packs or dressings.

2 Medical management of coagulopathic epistaxis.

3 Failed conservative management – vascular intervention: arterial ligation or embolisation.

4 Novel therapies – and strategies for management of refractory epistaxis.

This review contributed to the development of a management algorithm – see Fig. 1.

Comment on classification and definitions

To facilitate research and the reporting of epistaxis management, it is necessary to standardise terms. Epistaxis has historically been classified into anterior and posterior, but no consistent landmark has been used to categorise bleeding points. Recently, McGarry[3] proposed a standardisation of the terms, Anterior epistaxis: Bleeding from a source anterior to the plane of the pyriform aperture (the anterior bony nasal aperture). This includes bleeding from the anterior septum and rare bleeds from the vestibular skin and mucocutaneous junction. Posterior epistaxis: Bleeding from a vessel situated posterior to the piriform aperture. This allows further subdivision into lateral wall, septal and nasal floor bleeding. Epistaxis can be classified as primary or secondary when there is an underlying coagulopathy including that associated with anti-coagulant/anti-platelet medication.

Areas of Controversy

I & II Initial assessment, control of bleeding, clinical examination

Treatment-room management

Initial examination and investigation (Steps 1 and 2 in management algorithm). A clinical assessment of the patient's circulatory state is necessary and can be supple-

Correspondence: P.S. White, Department of Otolaryngology, Ninewells Hospital and Medical School, Dundee DD1 9SY, UK. Fax: +44 1382 632816; e-mail: paulwhite2@nhs.net

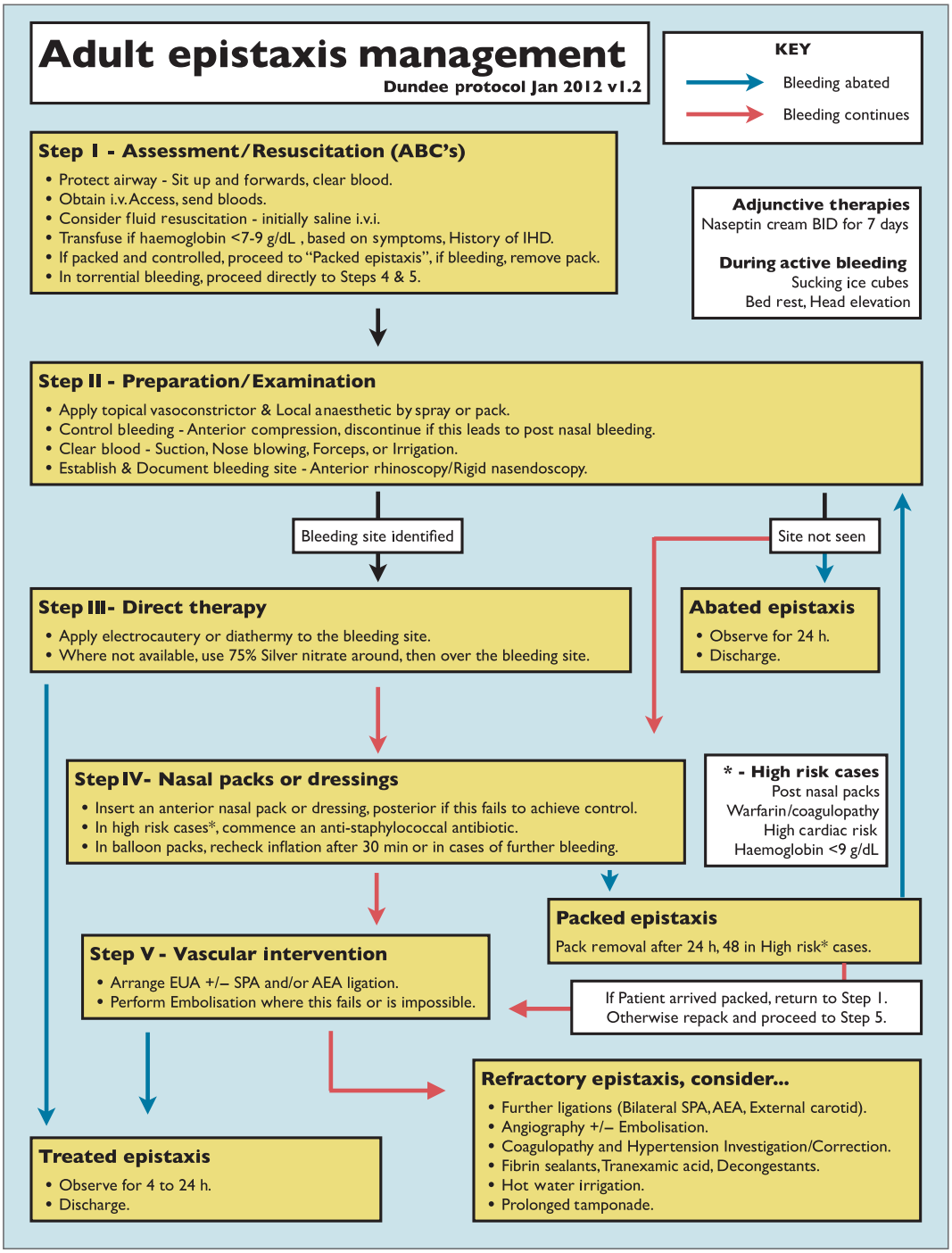

Fig. 1. Suggested treatment algorithm. Adapted from 'Barnes ML, Spielmann PM, White PS: epistaxis: a contemporary evidence-based approach in Otolaryngologic Clinics of North America: Smith, T: evidence based clinical practice in otolaryngology; October 2012.

mented by a full blood count, which is mandatory in severe epistaxis. Fluid resuscitation was not addressed in this review, but a transfusion threshold of 7–9 g/dL is recommended 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).[4] Several authors[5] have examined the results of routine coagulation studies in patients admitted with epistaxis: They unanimously conclude that there is no role for this investiga-

tion unless the patient takes warfarin or is admitted as a child.[6]

Initial management is aimed at identifying the bleeding source. Topical vasoconstrictors are used to reduce blood flow and facilitate examination of the nasal cavity; however, few comparisons have been conducted between 1 : 1000 adrenalin (epinephrine), 0.5% phenylephrine hydrochloride, 4% cocaine or 0.05% oxymetazoline solution. One study compared topical agents during nasotracheal intubation: oxymetazoline was more effective in preventing epistaxis than 1 : 100 000 (dilute) adrenalin and equally effective with less propensity to induce hypertension when compared to 4% cocaine.[7]

Nasendoscopy. Nasendoscopy facilities are essential, facilitating the identification of over 80% of bleeding sites not otherwise seen and thereby reducing the duration of hospital admission.[8] Chiu *et al.*[9] reported positive identification of 94% of posterior bleeding sites in 50 consecutive patients, and Supriya *et al.*[10] identified 38 of 47 (81%) posterior bleeding sites in a series of 100 consecutive patients, with an overall positive identification rate of 91%. The latter study was performed by junior otolaryngology trainees using a rigid nasendoscope. This should be compared with a large series from an emergency department where only 5% of epistaxis was felt to be 'posterior' (defined as blood running into the pharynx without an indentified anterior site). The benefits of nasendoscopy are clear: positive identification of the bleeding site and successful direct therapy allow rapid treatment and prompt discharge from hospital. Furthermore, Ahmed and Woolford[11] showed a potential cost saving with the use of rigid nasendoscopes and bipolar diathermy by avoiding hospital admissions in 74% of epistaxis attendances. Thus, it is recommended that nasal packs inserted in the community or emergency department should be removed to allow an attempt at bleeding site identification with a nasendoscope. Early assessment by an experienced endoscopist should no longer be a controversial issue – rather the optimum management in both the inpatient and outpatient setting. The implications for emergency cover, especially out of hours, and training of junior doctors in nasendoscopy are considerable.

III Direct therapy

Nasal cautery (step 3 in management algorithm)

Cautery of an identified bleeding point is advocated by most as the optimal management in adult epistaxis and can successfully control both anterior and posterior epistaxis. In 1993, only 24% of cases referred to specialist Otolaryngology units (in the UK) were managed in this way, while the rest underwent nasal packing.[1] In comparison, Supriya *et al.*[10] recently reported on 100 consecutive admissions for epistaxis in Aberdeen, Scotland. Overall, 100% of 53 patients with anterior and 64% of 47 with posterior epistaxis were successfully managed with cautery. Soyka *et al.*[12] reported on interventions for epistaxis between 2007 and 2008 in Zurich: 493 of 591 (84%) epistaxis attendances were treated primarily with cautery; the success rate is not reported, and failures were managed with anterior nasal packing. This illustrates a shift in philosophy of management towards direct therapy.

A histopathological study comparing 75% and 95% silver nitrate preparations found that the 95% compound caused twice the depth of burn, which might increase the risk of complications including septal perforation.[13] Simultaneous bilateral cautery could increase the risk of septal perforation although Link *et al.*[14] found this not to be the case using 75% silver nitrate at 2-month follow-up. Toner and Walby[15] found no difference in recurrent bleed rates at 2 months between hot-wire electrocautery and silver nitrate, although the confidence interval was broad. Soyka[16] reported a significantly lower failure rate at 1 month for bipolar compared with chemical coagulation (12% *versus* 22%). In the acute setting, electrocautery has advantages over silver nitrate, which can be difficult to apply to an actively bleeding site. A telephone questionnaire of on-call otolaryngology staff suggested that suction bipolar cautery was available in only 12 of 165 (7%) UK trusts.[17] Thus, while electrocautery is preferred, silver nitrate cautery is included in the treatment algorithm to reflect the situation in the majority of UK departments.

IV Nasal packing or dressings

Nasal packing (steps 3 and 4 in management algorithm)

The addition of a haemostatic dressing such as Surgicel® (Ethicon Inc., Somerville, NJ, USA) or Kaltostat® (ConvaTec Ltd., Skillman, NJ, USA) or the use of a localised pack to apply pressure over the bleeding site may assist haemostasis if minor bleeding persists after cautery.

If direct therapy fails, or the bleeding is too brisk to allow adequate assessment and cautery, then control of bleeding may be achieved with an anterior nasal pack. Polyvinyl acetate polymer sponges (e.g. Merocel®; Medtronic Inc., Minneapolis, MN, USA), nasal balloons (e.g. the Rapid Rhino® Balloon pack; ArthroCare Corp., Austin, TX, USA), ribbon packs [e.g. Bismuth, Iodoform, Paraffin Paste (BIPP)] or petroleum jelly-coated ribbon gauze are widely available. Few well-designed trials have compared these compounds. Rapid Rhino (RR) and Merocel packs have been compared prospectively for anterior epistaxis in two trials: they were effective as primary epistaxis management in 76%

and 81% of cases, respectively, in a trial by Moumoulidis *et al.*[18] and in 'approximately three quarters' of cases in a trial by Badran *et al.*[19] While no difference has been observed in epistaxis control rates, both trials found that RR packs were easier to insert and more comfortable both *in situ* and on removal. No studies investigating the optimum duration of nasal packing were identified. We recommend a minimum of 24 h (48 h in high-risk cases) if the pack was inserted after an experienced endoscopist has examined the nose and/or failed to control the bleeding.

A nasopharyngeal pack may be placed to control posterior epistaxis when anterior packing is insufficient. Traditional nasopharyngeal packs were rolled gauze attached to tapes passed out through the nose and mouth to secure. More recently, Brighton or Foley catheters have been used – inflated with saline and secured at the nasal columella with a clamp. Such packing is uncomfortable, distressing and prone to cause complications such as hypoxia and aspiration. Posterior nasal packs were required in 9% of patients in the series of 100 patients in the study by Supriya *et al.* and 5% of 591 in the study by Soyka *et al.*[10,12] Garcia *et al.*[20] prospectively compared nasopharyngeal gauze packs with inflatable balloon packs in patients when anterior rhinoscopy and anterior packing failed to control epistaxis: the gauze packs were significantly more effective in controlling epistaxis and produced less short- and long-term complications but took longer to insert and were more uncomfortable while *in situ*.

Other complications of nasal packs include pressure necrosis of the palate alar or columellar skin, displacement with airway obstruction and sinus infection or toxic shock syndrome. *Staphylococcus Aureus* can be isolated from the nasal cavity in one-third of patients, of which 30% produce the exotoxin responsible for toxic shock syndrome (TSST-1).[21] The role of antibiotic prophylaxis in patients with nasal packs was investigated by Biswas *et al.*[22] in a survey of UK practice: 37% of ENT clinicians prescribed antibiotics for patients with packs *in situ* for over 24 h, and 28% prescribed antibiotics if packs remained *in situ* for over 48 h, 22% did not use antibiotics routinely and 5% used antibiotics in all patients. Prolonged packing should be avoided; despite the lack of a strong evidence base, we suggest anti-staphylococcal antibiotics be prescribed if a pack is to remain *in situ* for more than 24 h.

Key points on steps I, II, III, IV

- Nasendoscopic examination of the nasal cavity is essential in the contemporary management of epistaxis and should facilitate bleeding point identification.
- Patients attending an Otolaryngology unit with nasal packs inserted in the community or by emergency medicine staff should have the packs removed, and the nasal cavity examined with an endoscope to identify the bleeding site
- Direct therapy with bipolar electrocautery or silver nitrate is the treatment of choice, especially for anterior epistaxis.
- Nasal packs are effective for direct therapy that fails, but prolonged or repeated packing should be avoided as nasopharyngeal packs carry significant risks.

Management of coagulopathic epistaxis and blood transfusion

Antiplatelet therapy

Antiplatelet agents (aspirin or clopidogrel) are commonly prescribed in the elderly population and complicate epistaxis management: patients taking antiplatelet agents require more interventions to control epistaxis and have a longer hospital stay.[12] There is little short-term benefit in discontinuing antiplatelet agents due to their prolonged action on platelet function. Local treatments such as cautery are unlikely to be effective, so nasal packing is often required and a 'procoagulant' dressing such as Kaltostat™ or Rapid Rhino™ may be preferred to limit further trauma to the nasal cavity. If massive, uncontrolled haemorrhage occurs, platelet transfusions may be required.

Anticoagulant therapy

It is important to be aware of any underlying bleeding predisposition due to medication, as techniques to control primary epistaxis may not be effective in cases of over anticoagulation.

Warfarin is a commonly prescribed anticoagulant for atrial fibrillation, venous and arterial thrombo-embolism and prosthetic heart valves. The therapeutic level is measured with the international normalised ratio (INR). In an audit of patients referred to an ENT unit in a district general hospital with epistaxis, 21% were taking warfarin.[23] This group was older, had a longer mean hospital stay and showed a trend to require more aggressive treatment to control the epistaxis (posterior nasal pack or theatre). The authors also noted that more than 75% patients taking warfarin were over-anticoagulated at the time of admission. Otolaryngologists must be skilled in the management of anticoagulant medication. As a general rule, if the INR is within the therapeutic range and the bleeding controlled with nasal packing, the medication

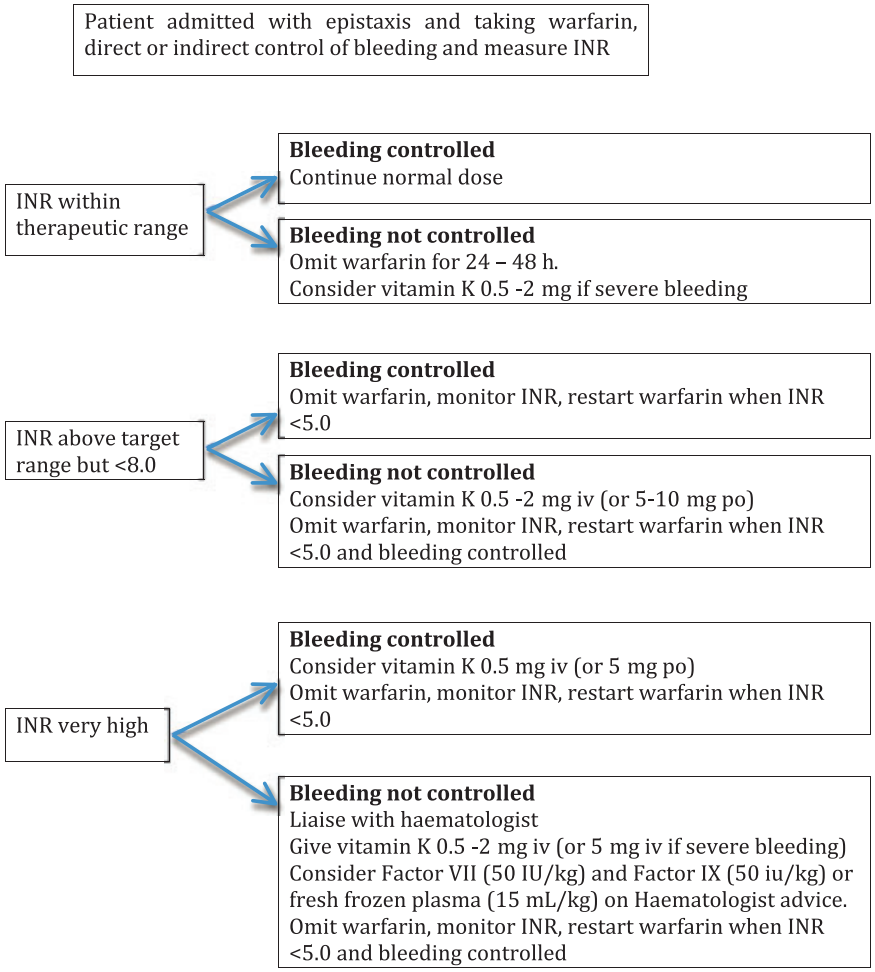

Fig. 2. Management of anticoagulant therapy in a patient with epistaxis.

should be continued. If over-anticoagulation has occurred, the INR should be brought into therapeutic range by omission of warfarin if the epistaxis is controlled. If the INR is very high (>8), the use of vitamin K should be considered in consultation with a haematologist. Figure 2 provides a schematic for the management of anticoagulant therapy in a patient with epistaxis (adapted from recommendations in SIGN guideline 36).[24]

Blood transfusion

We did not identify a study specifically related to patients with epistaxis. Patients that have recently received coronary artery stents may prove particularly challenging; in this situation, liaison with both Cardiologists and Haematologists may be helpful. The management of patients with hereditary haemorrhagic telangiectasia beyond the scope of this article; readers are referred to articles by Geisthoff *et al.*[25]

Key points on management of coagulopathic epistaxis and blood transfusion

- There is little short-term benefit in discontinuing antiplatelet agents.
- Pro-coagulant nasal dressings may be required to achieve haemostasis.

V Vascular interventions for failed conservative management

Failed conservative management – arterial ligation and embolisation

Surgery (Step 5 on management algorithm). The use of surgery to control epistaxis has evolved over the past 20 years: A 1993 UK national survey of practice reported that 9% of patients referred to an Otolaryngologist for

epistaxis required a nasopharyngeal pack (commonly a Foley catheter). A general anaesthetic was required in 5.6% to control bleeding, but <1% had formal arterial ligation (ethmoid, maxillary or external carotid).[1] Such a survey has not been repeated in recent years, but data from Ninewells Hospital, Dundee from the past two complete years show that of 593 acute admissions for epistaxis, 47% had hospital stays of 1 day or less. Of the 317 longer-term cases, 23 (7%) were taken to theatre and underwent arterial ligation: 21 of the sphenopalatine artery and two of the anterior ethmoid artery. Whereas in the past, patients would be subjected to repeated nasal packing with ever-larger pack volumes and balloons into the nasopharynx, a careful examination under anaesthesia and ligation of the speno-palatine artery and all branches provides a high short and long-term success rate.[27] We concur with the conclusion of Holzmann *et al.*[28] that ligation of the posterior septal branch is important in the success of the procedure. The outcomes of SPA ligation were reviewed by Feusi *et al.*[29] in 2005: 13 authors reported results in 264 patients with 12-month success rates between 70% and 100%. These success rates were maintained with longer-term studies (75–100% with 15–25-month follow-up).[30] The benefits of speno-palatine artery ligation are well described: patients have a shorter hospital stay and are not subjected to repeated haemorrhage and painful packing procedures. A cost saving of over US$7000 per patient has been reported, by performing early arterial ligation compared with nasal packing.[31] Sphenopalatine artery ligation carries minor complications such as nasal crusting, decreased lacrimation and parasthesia of the palate or nose.[32] Anterior ethmoidal artery ligation has an essential role in the management of traumatic epistaxis, when nasal injury leads to repeated, high-volume bleeding from high in the nasal cavity. Sphenopalatine and anterior ethmoidal artery ligation can be combined to control intractable posterior epistaxis, at the expense of greater surgical morbidity and external scars.[33] The scars can be minimised by employing an endoscope-assisted external approach.[34] Endonasal anterior ethmoidal artery ligation has been described[35] and appears to be both safe and feasible when the artery is approached through the lamina papyracea.[36,37] This, however, requires pre-operative CT scans and preferably an image guidance system. A transcaruncular approach has also been described in nine patients with successful resolution and no complications.[38] Septoplasty has been described in the management of epistaxis, primarily for access to allow effective packing or cautery.[39] Elevation of septal mucoperichondrial flaps for anterior epistaxis is also described,[40] and the authors propose that haemostasis is achieved by a process of fibrosis and hypovascularisation of the anterior septal mucosa. Similarly, trans-septal mattress suture has been described to control persistent anterior epistaxis.[41]

Interventional radiology – embolisation (Step 6 in management algorithm). When arterial ligation fails or is deemed not possible due to anaesthetic concerns, selective embolisation of the maxillary or facial arteries should be considered. A variety of materials have been used including Gelfoam, cyanoacrylate glue and metal coils with success rates between 79% and 96%.[42] Complications that are not uncommon include cerebrovascular event, arterial dissection, facial skin necrosis, facial numbness and groin haematoma; these can occur with historic rates up to 47%, but only 6% in larger, more recent series.[43] It is important to remember that any BIPP packing must be removed, as the iodine will interfere with visualisation during angiography.

Key points on step VI: Vascular interventions

- Early intervention with endoscopic sphenopalatine artery ligation for refractory epistaxis is safe, cost-effective and has a high long-term success rate.
- Embolisation of more proximal vessels is effective if arterial ligation fails.

Novel and adjunctive therapies. Vasoconstrictors (Step 6 in management algorithm). Two uncontrolled, retrospective studies were identified reporting the topical application of oxymetazoline nasal spray in the initial management of epistaxis. Control was achieved in 65% in one[44] and 100% in another[45] with medical therapy alone. Vasoconstrictor agents certainly have a role in epistaxis management, particularly to facilitate a thorough examination of the nasal cavity, but their role as a primary treatment modality remains unproven.

Hot water irrigation. The use of hot water irrigation in the management of epistaxis was described by Stangerup *et al.*[46] in 1996. A balloon is placed in the nasopharynx to prevent aspiration, and the water delivered to the nasal cavity for approximately 3 min at 50°C to induce mucosal oedema (and occlude the bleeding vessel) but avoid tissue necrosis. Control of posterior epistaxis has been reported in 43–82% of cases;[47] additionally the hot water irrigation requires a significantly shorter hospital stay, is less traumatic to the nose and is significantly less painful.[48]

Floseal. Floseal (Baxter Healthcare Corp., Deerfield, IL, USA) is a topical haemostatic compound consisting of bovine-derived gelatin granules and human thrombin. Two

studies investigating its use in epistaxis were identified: Mathiasen and Cruz[49] reported a prospective randomised, controlled crossover trial comparing Floseal with nasal packing in anterior epistaxis. The Floseal group had higher effectiveness and ease-of-application scores while the patients reported lower discomfort scores for both insertion and removal. Cote *et al.*[50] reported a prospectively collected cohort of patients receiving Floseal for persistent epistaxis following adequate nasal packing, who would normally have proceeded to arterial ligation. Eighty percentage of patients treated in this manner avoided surgical intervention. The high control rates for anterior epistaxis using cautery may make the extra cost of Floseal (£160) difficult to justify. When compared with surgery however, the ease of use, cost-effectiveness and low morbidity of Floseal may encourage its use. Studies of long-term efficacy are required if it is to replace arterial ligation as treatment for refractory epistaxis.

Key points on novel and adjunctive therapies

- Hot water irrigation appears to be an effective, low morbidity treatment.
- Topical haemostatic agents may have a cost-effective role in posterior epistaxis.
- Longer-term studies of effectiveness are warranted and desirable.

Conclusion

Epistaxis constitutes a significant proportion of the Otolaryngologist's emergency workload and as such management should aim to be evidence based. The suggested algorithm provides a road map for patient management and emphasises that prompt direct intervention is the optimum treatment.

Conflict of interest

None to declare.

References

1 Kotecha B., Fowler S., Harkenss P. *et al.* (1996) Management of epistaxis: a national survey. *Ann. R. Coll. Surg. Eng.* **78**, 444–446

2 Walker T.W., Macfarlane T.V. & McGarry G.W. (2007) The epidemiology and chronobiology of epistaxis: an investigation of Scottish hospital admissions 1995–2004. *Clin. Otolaryngol.* **32**, 361–365

3 McGarry G.W. (2009) *Epistaxis in Scott-Brown's Otorhinolaryngology Head & Neck Surgery*, 7th edn. Vol. 2, Chapter 126, Gleeson M. (ed.), pp. 1596–1608. Hodder-Arnold, London.

4 Hebert P.C., Wells G., Blajchman M.A. *et al.* (1999) A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. *N. Eng. J. Med.* **340**, 409–417

5 Thaha M.A., Nilssen E.L.K., Holland S. *et al.* (2000) Routine coagulation screening in the management of emergency admission for epistaxis – is it necessary? *J. Laryngol. Otol.* **114**, 38–40

6 Sandoval C., Dong S., Visintainer P. *et al.* (2002) Clinical and laboratory features of 178 children with recurrent epistaxis. *J. Ped. Hematol. Oncol.* **24**, 47–49

7 Katz R.I., Hovagim A.R., Finkelstein H.S. *et al.* (1990) A comparison of cocaine, lidocaine with epinephrine, and oxymetazoline for prevention of epistaxis on nasotracheal intubation. *J. Clin. Anesth.* **2**, 16–20

8 McGarry G.W. (1991) Nasal endoscope in posterior epistaxis: a preliminary evaluation. *J. Laryngol. Otol.* **105**, 428–431

9 Chiu T.W. & McGarry G.W. (2007) Prospective clinical study of bleeding sites in idiopathic adult posterior epistaxis. *Otolaryngol. Head Neck Surg.* **137**, 390–393

10 Supriya M., Shakeel M., Veitch D. *et al.* (2010) Epistaxis: prospective evaluation of bleeding site and its impact on patient outcome. *J. Laryngol. Otol.* **124**, 744–749

11 Ahmed A. & Woolford T.J. (2003) Endoscopic bipolar diathermy in the management of epistaxis: an effective and cost-efficient treatment. *Clin. Otolaryngol.* **28**, 273–275

12 Soyka M.B., Rufibach K. & Huber A. (2010) Is severe epistaxis associated with acetyl-salicylic acid intake? *Laryngoscope* **120**, 200–207

13 Amin M., Glynn F., Phelan S. *et al.* (2007) Silver nitrate cauterisatopn, does concentration matter? *Clin. Otolaryngol.* **32**, 197–208

14 Link T.R., Conley S.F., Flanary V. *et al.* (2006) Bilateral epistaxis in children: efficacy of bilateral septal cauterization with silver nitrate. *Int. J. Ped. Otorhinolaryngol.* **70**, 1439–1442

15 Toner J.G. & Walby A.P. (1990) Comparison of electro and chemical cautery in the treatment of anterior epistaxis. *J. Laryngol. Otol.* **104**, 617–618

16 Soyka M.B., Nikolaou G., Rufibach K. *et al.* (2011) On the effectiveness of treatment options in epistaxis: an analysis of 678 interventions. *Rhinology* **49**, 474–478

17 Duvvi S., Khattab A., Khalil H.S. *et al.* (2006) Shortfalls in epidstaxis management. A nationwide survey in UK (correspondence). *Clin. Otolaryngol.* **31**, 560–561

18 Moumoulidis I., Draper M.R., Patel H. *et al.* (2006) A prospective randomised controlled trial comparing Merocel and Rapid Rhino nasal tampons in the treatment of epistaxis. *Eur. Arch. Otorhinolaryngol.* **263**, 719–722

19 Badran K., Malik T.H., Belloso A. *et al.* (2005) Randomized controlled trial comparing Merocel and Rapid-Rhino packing in the management of anterior epistaxis. *Clin. Otolaryngol.* **30**, 333–337

20 Garcia C.F.J., Munoz F.N., Achiques M.M.T. *et al.* (2010) Nasal packing in posterior epistaxis. Comparison of two methods (Spanish). *Acta Otorrinolaringol. Esp.* **61**, 196–201

21 Breda S.D., Jacobs J.B., Lebowitz A.S. *et al.* (1987) Toxic shock syndrome in nasal surgery: a physiochemical and microbiologic evaluation of Merocel and NuGauze nasal packing. *Laryngoscope* **97**, 1388–1391

22 Biswas D., Wilson H. & Mal R. (2006) Use of systemic prophylactic antibiotics with anterior nasal packing in England, UK. *Clin. Otolaryngol.* **31**, 566–567

23 Smith J., Siddiq S., Dyer C. *et al.* (2011) Epistaxis in patients taking oral anticoagulant and antiplatelet medication: prospective cohort study. *J. Laryngol. Otol.* **125**, 38–42
24 *Scottish Intercollegiate Guidelines Network*. No. 36 Antithrombotic therapy, March 1999, p. 55
25 Geisthoff U.W., Fiorella M.L. & Fiorella R. (2006) Treatment of recurrent epistaxis in HHT. *Curr. Pharm. Design* **12**, 1237–1242
26 Harvey R.J., Kanagalingam J. & Lund V.J. (2008) The impact of septodermoplasty and potassium-titanyl-phosphate (KTP) laser therapy in the treatment of hereditary hemorrhagic telangiectasia-related epistaxis. *Am. J. Rhinol.* **22**, 182–187
27 Abdelkader M., Leong S.C. & White P.S. (2007) Endoscopic control of the sphenopalatine artery for epistaxis: long-term results. *J. Laryngol. Otol.* **121**, 759–762
28 Holzmann D., Kaufmann T., Pedrini P. *et al.* (2003) Posterior epistaxis: endonasal exposure and occlusion of the branches of the sphenopalatine artery. *Eur. Arch. Otorhinolaryngol.* **260**, 425–428
29 Feusi B., Holzmann D. & Steurer J. (2005) Posterior epistaxis: systematic review on the effectiveness of surgical therapies. *Rhinology* **44**, 300–304
30 Nouraei S.A.R., Maani T., Hajioff D. *et al.* (2007) Outcome of endoscopic sphenopalatine artery occlusion for intractable epistaxis: a 10-year experience. *Laryngoscope* **117**, 1452–1456
31 Moshaver A., Harris J.R., Liu R. *et al.* (2004) Early operative intervention *versus* conventional treatment in epistaxis: randomized prospective trial. *J. Otolaryngol.* **33**, 185–188
32 Snyderman C.H., Goldman S.A., Carrau R.L. *et al.* (1999) Endoscopic sphenopalatine artery ligation is an effective method of treatment for posterior epistaxis. *Am. J. Rhinol.* **13**, 137–140
33 Asanau A., Timoshenko A.P., Vercherin P. *et al.* (2009) Sphenopalatine and anterior ethmoidal artery ligation for severe epistaxis. *Ann. Otol. Rhinol. Laryngol.* **118**, 639–644
34 Douglas S.A. & Gupta D. (2003) Endoscopic assisted external approach anterior ethmoid artery ligation for the management of epistaxis. *J. Laryngol. Otol.* **117**, 132–133
35 Woolford T.J. & Jones N.S. (2000) Endoscopic ligation of anterior ethmoid artery in treatment of epistaxis. *J. Laryngol. Otol.* **114**, 858–860
36 Pletcher S.D. & Metson R. (2007) Endoscopic ligation of the anterior ethmoid artery. *Laryngoscope* **117**, 378–381
37 Camp A.A., Dutton J.M. & Caldarelli D.D. (2009) Endoscopic transnasal transethmoid ligation of the anterior ethmoid artery. *Am. J. Rhinol. Allergy* **23**, 200–202
38 Morera E., Artigas C., Trobat F. *et al.* (2011) Transcaruncular electrocoagulation of anterior ethmoidal artery for the treatment of severe epistaxis. *Laryngoscope* **121**, 446–450
39 Srinavasan V., Sherman I.W. & O'Sullivan G. (2000) Surgical management of intractable epistaxis: audit of results. *J. Laryngol. Otol.* **114**, 697–700
40 Gaurisco J.L., Cheney M.L., Ohene-Frempong K. *et al.* (1987) Limited septoplasty as treatment for recurrent epistaxis in a child with Glanzmann's thrombasthenia. *Laryngoscope* **97**, 336–338
41 Nitek S.K., Wysocki J. & Niszczota C.S. (2011) Use of trans-septal mattress suture of Little's area for anterior epistaxis. *J. Laryngol. Otol.* **125**, 399–401
42 Smith T.P. (2006) Embolization in the external carotid artery. *J. Vasc. Interv. Radiol.* **17**, 1897–1913
43 Elahi M.M., Parnes L.S., Fox A.J. *et al.* (1995) Therapeutic embolization in the treatment of intractable epistaxis. *Arch. Otolaryngol. Head Neck Surg.* **121**, 65–69
44 Krempl G.A. & Noorily A.D. (1995) Use of oxymetazoline in the management of epistaxis. *Ann. Otol. Rhinol. Laryngol.* **104**, 704–706
45 Doo G. & Johnson D.S. (1999) Oxymetazoline in the treatment of posterior epistaxis. *Hawaii Med. J.* **58**, 210–212
46 Stangerup S.E., Dommerby H. & Lau T. (1996) Hot-water irrigation as a treatment of posterior epistaxis. *Rhinology* **34**, 18–20
47 Schlegel-Wagner C., Siekmann U. & Linder T. (2006) Non-invasive treatment of intractable posterior epistaxis with hot-water irrigation. *Rhinology* **44**, 90–93
48 Stangerup S.E., Dommerby H., Siim C. *et al.* (1999) New modification of hot-water irriagation in the treatment of posterior epistaxis. *Arch. Otolaryngol. Head Neck Surg.* **125**, 686–690
49 Mathiasen R.A. & Cruz R.M. (2005) Prospective, randomized, controlled clinical trial of a novel matrix hemostatic sealant in patients with acute anterior epistaxis. *Laryngoscope* **115**, 899–902
50 Cote D., Barber B., Diamond C. *et al.* (2010) FLoSeal hemostatic matrix in persistent epistaxis: prospective clinical trial. *J. Otolaryngol. Head Neck Surg.* **39**, 304–308