Angiographic embolization for the treatment of epistaxis: A review of 108 cases

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Ninety-seven patients were referred to the Toronto Hospital (Western Division) between January 1984 and January 1992 for selective angiographic embolization (108 embolizations, including repeat procedures) to control intractable or recurrent severe epistaxis. Eighty-one patients (comprising 94 embolizations) were referred on an emergent basis because of failure of conventional conservative therapy, consisting of anterior and posterior packing. The remaining 16 patients (14 embolizations) were referred electively for recurrent epistaxis. A retrospective review of these cases was performed, with long-term telephone follow-up achieved in over 95% of cases. Embolization safely controlled active hemorrhage in 88% of the emergent cases. The success rate increased to 90% when two cases in which the source of epistaxis was found to be from the internal carotid artery were excluded (because these vessels could not be safely embolized). Of the patients whose epistaxis was initially controlled by embolization, 82% had no further nosebleeds (follow-up time ranged from 2 to 82 months; average, 26.8 months). More than half of the long-term failures were seen in patients with Osler-Weber-Rendu disease. Overall, the mortality rate was 0% and the long-term morbidity rate was 2% (one cerebral vascular accident and one case of skin slough in the territory of the superficial temporal artery). [OTOARYNGOL. HEAD NECK SURG 1994;111:44-50.]

Most patients who come to hospital with epistaxis have bleeds that originate in the anterior part of the nose, which can usually be controlled with conservative therapy (anterior packs and/or silver nitrate cautery). On the other hand, the management of posterior and superior epistaxis continues to be a difficult problem, often requiring posterior packs, which have reported failure rates of 26% to 52%.

In addition, many of the patients with epistaxis are elderly and have difficulty tolerating posterior packs. Reported complications associated with posterior packs are significant and include alar and septal necrosis, aspiration, and pack-induced hypoxia, which has been associated with sudden death, myocardial infarct, and stroke. Finally, increased awareness of serious transfusion-related diseases (risk of development of hepatitis C may be as high 5% to 10%) has led both the physician and the patient to look for alternative interventional therapies to control severe nosebleeds.

Since the transantral approach to the internal maxillary artery (IMA) was popularized by Chandler and Serrins in 1965, IMA ligation (with or without anterior and posterior ethmoid artery ligation) has been the most common surgical procedure used to treat severe epistaxis. Overall reported success rates for arterial ligation procedures range from 76% to 90%. Complication rates vary from 13% to 47%, mostly consisting of infraorbital nerve paresthesia and occasional oroantral fistulas and skin sloughs. More rarely, blindness and total ophthalmoplegia have been reported.

In 1974, Sokoloff et al. described two patients in whom selective angiography with embolization of the ipsilateral IMA, as an alternative to surgery, successfully stopped epistaxis that had not re-
responded to posterior pack management. Lasjaunias and Berenstein refined the technique further by describing the radioanatomic basis of the procedure and by suggesting a standard protocol. The primary goal of the procedure is to stop the bleeding by embolizing (injecting particles) as distally as possible; ideally, the particles should go directly into the vascular bed. In addition, Lasjaunias and Berenstein stressed the need for internal carotid artery (ICA) angiogram to identify unusual ICA sources of epistaxis, which may preclude embolization if the ICA cannot be safely embolized. Finally, they explained the importance of identifying potentially dangerous anastomoses between the external carotid artery (ECA) and the ICA that could lead to blindness and strokes, should inadvertent reflux of embolic materials occur. With respect to actual embolization, they suggested that the ipsilateral IMA and facial arteries both be embolized because the facial artery tends to redistribute blood to the bleeding bed, once the IMA has been embolized. Multiple centers (representing a total of 122 cases) have reported their success rates with the use of this procedure for intractable epistaxis, but many of the patients had previously undergone attempts of arterial ligation. In most of these studies, embolization was performed on the ipsilateral IMA alone, with reported success rates of 74% to 90%. Vitek was one of the first to analyze a group of 30 patients who were treated with embolization exclusively. He reported success rates of 87% to 97%, depending on whether the ipsilateral IMA was embolized alone or with the facial artery. Reported complication rates are 10% to 53%, mostly consisting of temporary facial pain, however, cases of stroke, facial nerve palsy, and skin slough have also been described.

Despite similar success and complication rates, few institutions have adopted embolization as an alternative to surgery, and instead reserve it for failed surgical procedures. The purpose of this study was to provide a more accurate assessment of success and complication rates because we have experience with over 100 embolizations in which a uniform protocol was used in patients who had not had previous attempts at IMA ligation before referral. Further, we have followed up these patients on a long-term basis to determine whether the results remain stable with time.

METHODS

Between 1984 and 1992, 97 patients were referred to Toronto Western Hospital for angiographic embolization to treat severe epistaxis. A total of 108 embolizations were performed (some patients required repeat embolization, usually months to years later). The male to female ratio was approximately 2 to 1 (64 men and 33 women). The mean age was 53 years (range, 12 to 91 years). Eighty-one patients were referred to the radiology service on an emergent basis (accounting for 94 embolizations). Referrals were screened by the radiology and ear, nose, and throat departments, and transfers were accepted, provided that the patient had had a trial of conservative management. Most patients had failed to respond to treatment with anterior and posterior packs, where failure was defined as recurrent bleeding after pack removal or persistent oozing despite packs. The three patients who were referred with anterior packs only were elderly patients with poor respiratory reserve in whom the referring physician had believed packs would be poorly tolerated. Before referral, one patient had had an anterior ethmoidal artery ligation, and another had had a septoplasty. The remaining patients had no other prior surgical procedures.

Of note, several patients with Osler-Weber-Rendu (OWR) disease had had either IMA or ECA ligation performed or attempted during a previous admission for treatment of a nosebleed, but no surgical procedures were performed immediately before the present hospitalization. The mean preembolization hospital stay was 5.8 days. Most patients had multiple blood transfusions, and the remaining 20% of patients had reported decreases in hemoglobin from 15 gm/ml to below 10 gm/ml.

Sixteen patients were referred electively for recurrent, severe epistaxis (but at the time of referral had no packs and were not actively bleeding). In two of these cases, the procedures were not performed because one patient had idiopathic thrombocytopenia with an unacceptably low platelet count of 3000, and the second patient, who had a remote history of facial trauma, had negative ICA and ECA angiograms.

The data were collected retrospectively, and both immediate and long-term results were analyzed. Telephone follow-up was achieved in over 95% of the cases. In several cases in which the patient had died or could not be located, the family physician provided the follow-up information.

The procedures were performed while patients were under neuroleptanalgesia in 50% of the cases and under general anesthesia in the remaining 50%. An intravenous bolus of 3000 to 5000 U of heparin was given to two patients who had histories sugges-
al of 108 patients re-

tients were ac-

tuals performed.

tive of previous transient ischemic attacks. The femoral artery approach was used in all cases; a

Seldinger technique was used to cannulate the ves-

sel. A 5F to 7F sheath and then a 4F or 5F guiding catheter were used for select angiographic stud-

eies of both internal carotid arteries and both exter-

nal carotid arteries. In rare cases, the probable site of bleeding was identified angiographically, and

more often the site was determined by clinical his-


tory alone. Once it was determined that no dangerous anastomoses existed between the two arterial

systems, embolization was carried out with either

the traditional 4F catheter or, more recently, with a

 coaxial variable stiffness microwire catheter (2.7F tip,

Tracker 18, Target Therapeutics, Inc., San Jose,

Calif.) that allowed for “super” selective emboliza-

tion because this catheter could be placed more
distally in the arterial system. Nonabsorbable small

and medium-sized polyvinyl alcohol particles were

used to perform bilateral distal internal maxillary

artery embolizations until adequate stasis of blood

occurred. Angiograms of the facial arteries were

usually performed afterward. In one third of the

cases, unilateral or bilateral facial artery emboliza-

tions were performed because these vessels contrib-

ute collateral anastomotic arterial flow to the nose

and may contribute to persistent bleeding. The

ascending pharyngeal artery was embolized in sev-

eral patients who had nasopharyngeal tumors supplied

by this vessel. The nasal packings were removed in

the angiogram suite, and if the nasal cavity

remained dry, the patient was transferred to the

recovery room.

RESULTS

The causes of epistaxis are shown in Table 1, with

the majority of the patients fitting into the idiopathic

category. Many of these patients had associated risk

factors, as shown in Fig. 1. In most cases patients

who were referred with a history of recent trauma

directly to the nose, but one had severe bleeding after septorhinoplasty. Tumors were

thought to be the primary cause of bleeding in 10

cases and usually arose within the nasal cavity or

paranasal sinuses (Table 2).

Fifteen patients had marked atherosclerotic dis-

ease throughout their vessels, and five patients were

found to have anastomoses between the ICA and

ECA (Table 3). In these cases the embolizations

were more limited in that only one or two of four

possible vessels were embolized.

Of the patients who were seen on an emergent

basis, the total immediate success rate of the pro-

cedure was 88% with complete cessation of bleeding for at least 1 week

without packs (see Table 4 for breakdown of sub-

groups). Of the failures, two occurred in cases in

which the source of bleeding was found to be a

branch of the ICA, thereby precluding safe embo-

lization (one anterior ethmoid artery traumatic

pseudoaneurysm and one anterior cerebral artery

arteriovenous malformation). The latter case has been reported in a separate publication.22 Similarly,

four failures occurred in patients who initially failed to

to respond to embolization, but whose bleeds were

eventually controlled by subsequent anterior eth-

moid ligation. The remaining failures occurred as a

result of technical failures. Three of these were

limited embolizations caused by atherosclerosis or

severe spasm, and two were caused by ability to

catheterize the ECA (one patient had a remote

previous ECA ligation and one had a severely tor-

tuous ECA).

The long-term success rate for patients whose

nosebleeds had been successfully treated in the

hospital was 82%, with a mean follow-up time of

26.8 months (range, 2 to 82 months). The majority of

the failures occurred in patients with OWR disease

(Table 5). If this group is excluded from analysis, the

success rate increases to 90%.

Similar long-term results were seen in the
Fig. 1. Associated risks observed in 75 patients with idiopathic epistaxis. Hx: History; abn LFT’s: abnormal liver function tests; ASA, acetylsalicylic acid; NSAID, nonsteroidal antiinflammatory drug.

Table 3. Number of patients with conditions necessitating more limited embolization (excluding patients with tumors or previous embolization/surgery)

<p>| | | | |</p>
<table>
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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Patients with severe atherosclerosis (mean age = 67 yr)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>“Dangerous” ICA-EC A anastomoses identified</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Middle meningeal artery-ophthalmic artery</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Retrograde supply to IMA by artery of foramen rotundum</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Middle meningeal artery as primary supply to ipsilateral cerebral cortex</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>ICA source of epistaxis (embolization not attempted)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Intracranial arterial-venous malformation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Traumatic anterior ethmoid artery pseudoaneurysm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Incidental ICA aneurysm (not related to epistaxis)</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

14 patients who had recurrent nosebleeds treated electively, with most of the failures occurring in the patients with OWR disease (Table 6).

Pack-, anesthesia-, and transfusion-related complications were observed; the most serious complication was hepatitis C in a patient who had received 10 transfusions (Table 7). Most of the embolization-related complications were related to facial pain, which resolved within 1 week of the procedure and was thought to be ischemic in nature. The mortality rate was 0%, and the long-term morbidity rate was 2%. The most serious complication occurred in a patient who had a cerebral vascular accident and central ophtalmic artery occlusion. This patient had severe atherosclerosis and a history of previous transient ischemic attacks. His preembolization angiogram demonstrated that the main blood supply to his cerebral cortex came from the ipsilateral middle meningeal artery. Despite performance of a more limited embolization of the distal IMA, a hemorrhagic middle cerebral artery stroke developed while the patient was in the recovery room. The other major complication occurred in a patient in whom trismus and patch skin slough developed in the region of the superficial temporal artery distribution, both of which resolved after several months.
Table 4. Results of embolization in stopping epistaxis on an emergent basis and keeping it stopped for at least 1 week after the procedure

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percent successful</th>
<th>No. of successful embolizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>88</td>
<td>64/72</td>
</tr>
<tr>
<td>OWR disease</td>
<td>100</td>
<td>11/11</td>
</tr>
<tr>
<td>Trauma</td>
<td>66</td>
<td>4/6</td>
</tr>
<tr>
<td>Tumor</td>
<td>80</td>
<td>4/5</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>83/94</td>
</tr>
</tbody>
</table>

Table 5. Long-term results of embolization

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percent successful</th>
<th>No. of successful embolizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>90</td>
<td>54/60</td>
</tr>
<tr>
<td>OWR disease</td>
<td>30</td>
<td>3/10</td>
</tr>
<tr>
<td>Trauma</td>
<td>100</td>
<td>4/4</td>
</tr>
<tr>
<td>Tumor</td>
<td>75</td>
<td>3/4</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>64/78</td>
</tr>
<tr>
<td>Total (without OWR)</td>
<td>90</td>
<td>61/68</td>
</tr>
</tbody>
</table>

Five patients were lost to follow-up. Mean follow-up time was 26.8 months (range, 2 to 82 months).

Table 6. Long-term results of 15 embolizations performed electively

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percent successful</th>
<th>No. of successful embolizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>33</td>
<td>1/3</td>
</tr>
<tr>
<td>OWR disease</td>
<td>17</td>
<td>1/6</td>
</tr>
<tr>
<td>Trauma</td>
<td>100</td>
<td>1/1</td>
</tr>
<tr>
<td>Tumor</td>
<td>100</td>
<td>5/5</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>8/15</td>
</tr>
<tr>
<td>Total (without OWR)</td>
<td>78</td>
<td>7/9</td>
</tr>
</tbody>
</table>

Patients had histories of severe, recurrent bleeding but were not actively bleeding at the time of embolization. Mean time to failure was 9 months, and mean follow-up time was 35 months.

DISCUSSION

In most institutions embolization has been reserved for cases of severe epistaxis that have failed to respond to traditional surgical management (the most common being ipsilateral IMA ligation, usually along with anterior ethmoid ligation). At our institution embolization has been used as the primary treatment in cases of severe epistaxis that have failed to respond to conservative therapy with packing. We have followed the guidelines set by Lasjaunias and Berenstein: all patients have bilateral internal carotid artery and external carotid angiograms performed before embolization. Embolization cannot be safely performed on ICA branches, so this is done to detect possible dangerous anastomoses between the two arterial systems. In doing this, we detected five such cases in which less aggressive embolizations were done to avoid embolization near the anastomosis (Table 3). In addition, as stated above, embolization was not performed in two cases after angiograms detected that the bleeding came from an ICA branch. Incidential (non-bleeding) ICA aneurysms were detected in two cases and later referred to the neurosurgery department for further evaluation, once the epistaxis was controlled. In the patients who had normal anatomy, bilateral IMA embolizations were performed in most cases. One third of the patients also had facial artery embolizations in order to eliminate the collateral facial artery contribution to the epistaxis.10

By following this protocol, we have demonstrated that the procedure is at least as successful as surgery in controlling intractable epistaxis. The immediate success rate was 88% compared with reported success rates of 75% to 90% for patients treated surgically.12,7 Two of the failures occurred because the bleeding source was an identifiable ICA branch, so that safe embolization was impossible. These cases should be excluded to calculate the true success rate of 90%, which describes the actual ability of the procedure to stop presumed external carotid artery bleeding. Unlike many of the previous studies, fol-
**Table 8. Estimated cost comparison of treatments once referred to tertiary center (in Canadian dollars)**

<table>
<thead>
<tr>
<th></th>
<th>Embolization (Bilateral IMA/facial)</th>
<th>Surgery (Ipsilateral IMA/ACE)</th>
<th>Nasal packs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedure time</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital ward</td>
<td>2 hr</td>
<td>3 hr</td>
<td>$5328.00</td>
</tr>
<tr>
<td></td>
<td>$2264.40 (3.4 days)</td>
<td>$3130.20 (4.7 days)*</td>
<td></td>
</tr>
<tr>
<td>Procedural fees‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aniogram</td>
<td>$410.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embolization</td>
<td>$251.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMA ligation</td>
<td>$165.70</td>
<td>$371.00</td>
<td></td>
</tr>
<tr>
<td>Anterior etmoid ligation</td>
<td></td>
<td>$273.20</td>
<td></td>
</tr>
<tr>
<td>Special materials (estimates)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-ray contrast</td>
<td>$150.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catheters</td>
<td>$250.00</td>
<td></td>
<td></td>
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<tr>
<td>Anesthetic drugs</td>
<td>$225.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating room costs§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anesthesiologist</td>
<td>$925.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurses/technologists</td>
<td>$225.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$3941.10</td>
<td>$4524.40</td>
<td>$5328.00</td>
</tr>
</tbody>
</table>

*Rosinagle et al.* (n = 60).  
1Wang and Vojte  (n = 35).  
2Ontario Health Insurance Program.  
3Includes anesthetic drugs.  
4Anesthesiologist’s fee similar in both procedures and therefore not included in calculations.

...low-up patients in this study was carried out to assess long-term success rates and showed that the results were stable in 90% of the cases, once the patients with OWR disease had been excluded. Most of these latter patients experienced bleeding again within 5 months of the procedure. This finding is not unexpected, given the nature of their disease. Although the numbers are small, the results of the 14 patients who had elective embolizations were similar to those seen for the long-term emergent group, with the majority of the failures occurring in patients with OWR disease. We believe that embolization should be reserved for patients with OWR disease who have intractable epistaxis at presentation, because septodermoplasty and yttrium albumin garnet laser treatments may provide better long-term control in this group of patients.36

The overall complication rate in our series was 25%, mostly consisting of short-lived facial pain occurring in the distribution of the superficial temporal and/or facial arteries. This was thought to be caused by local ischemia, which resolved as collateral vessels developed. The frequency and degree of facial pain have both decreased since a more selective coaxial catheter system that allows a smaller catheter to be threaded more distally in the arterial tree has been in use. As a result, the likelihood of reflux of particles into more proximal arterial branches has markedly decreased. Likewise, our impression is that both of the more serious complications (the cases of the cerebrovascular accident and the skin slough) may not have occurred if this catheter system had been available when these embolizations were performed. Despite this postulation, we inform all of our candidates for embolization that the observed risk of stroke is 1%. Interestingly, among the patients who had severe atherosclerosis as determined by angiogram (15 in our series), the failure and complication rates with a more limited (1 to 2 vessel) embolization were no worse than those observed in the patients who had the full 4-vessel embolization. In two of these patients, who also had histories of prior transient ischemic attacks or stroke, a small bolus of heparin was given just before embolization. Although not yet studied, this may be beneficial in preventing strokes.

With the use of literature controls for the surgical group and for patients treated with posterior packs alone, a cost comparison was done, and it shows that embolization was slightly less expensive than surgery and significantly less expensive than a trial of prolonged conservative therapy (Table 8). The main cost difference as attributed to the fewer postoperative days in the hospital for the embolization group compared with the surgical group (3.4 vs 4.7 days, respectively).

**CONCLUSION**

On the basis of our experience we have found that embolization is a successful way to treat epistaxis that has failed to respond to conservative pack therapy. In the hands of an experienced neuroradi...
ologist, the complication rate is acceptably low, especially when the superselective coaxial catheter system is used. The success is limited by an inability to safely treat ICA bleeding sources (2% of the cases) and to control recurrent bleeding in patients with OWR disease. We believe that embolization should be viewed as an alternative to surgery in the treatment of intractable epistaxis, rather than being reserved for surgical failures.

REFERENCES