



## Emergency embolization in epistaxis resulting from midface fractures: A report of two cases

*Embolização de emergência em epistaxe resultante de fraturas do terço médio da face: Relato de dois casos*

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### ABSTRACT

The control of hemorrhage by embolization is an emergent popular treatment and may be considered of choice in severe acute epistaxis. The objective of the present study was to describe two cases of severe epistaxis as a result of facial trauma that was treated by superselective embolization of PVA (350-550  $\mu\text{m}$ / 250-355 $\mu\text{m}$ ) after the nasal tamponade had failed. The first case revealed discreet nasal flushing with nutrition from the internal maxillary artery, in which case embolization of the sphenopalatine and descending palatine arteries was indicated; the second case revealed significant hyperemia of the nasal region, in and embolization of the internal maxillary and left sphenopalatine arteries. Both patients had satisfactory outcomes without complications. These clinical results indicated the efficacy of the emergency embolization in refractory epistaxis. Suggesting the importance of the procedure being part of the list of emergency treatments in Oral and Maxillofacial Surgery and Traumatology, considering its uncommon incidence. This minimally invasive therapy provides efficient hemodynamic stability for patients in cases where the anterior and/or posterior nasal packing is not efficient.

**Keywords:** Fractures, Bone; Epistaxis; Embolization, Therapeutic

### RESUMO

O controle da hemorragia pela embolização arterial endoscópica é um tratamento popular emergente e pode ser considerado de escolha para epistaxe aguda grave. Este estudo teve por objetivo relatar dois casos de epistaxe grave resultante de trauma facial tratados com embolização superseletiva com PVA (350-550  $\mu\text{m}$ / 250-355 $\mu\text{m}$ ), após falha no tamponamento nasal. Onde, a arteriografia revelou no primeiro caso um discreto rubor nasal e nutrição da artéria maxilar interna sendo indicada embolização das artérias esfenopalatina e palatina descendente; no segundo caso, considerável hiperemia na região nasal sendo realizada embolização das artérias maxilar interna e esfenopalatina esquerda. Ambos os casos evoluíram satisfatoriamente sem complicações. Os resultados clínicos indicaram a efetividade da embolização emergencial em epistaxes refratárias. Sugerindo assim, a importância de fazer parte da lista de procedimentos de emergência em Cirurgia e Traumatologia Bucocomaxilofacial, apesar da rara incidência. Pois, trata-se de uma terapia minimamente invasiva e que, nos casos em que o tamponamento nasal anterior e/ou posterior não são efetivos, proporciona uma estabilidade hemodinâmica para o paciente de forma eficaz.

**Palavras-chave:** Fraturas ósseas; Epistaxe; Embolização Terapêutica

## INTRODUCTION

Embolization is indicated in cases of refractory epistaxis that is difficult to control<sup>1</sup>, where there is persistent bleeding from the nasal cavity and despite carrying out other procedures like anterior and/or posterior nasal packing, cauterization or endoscopic approaches, the bleeding was not controlled. The etiology is varied and could be caused by trauma, anticoagulant use, or conditions like hereditary hemorrhagic telangiectasia. Several services demonstrate that the obliteration of an artery for therapeutic purposes can also be considered as an integral part of surgical planning in cases where there is a risk of significant vascular damage, as well as an early approach to nosebleeds of traumatic origin where conservative treatment has been ineffective<sup>2-7</sup>.

These vascular manipulations should be performed using fluoroscopy in an attempt to prevent accidental backflow of the embolizing particles. The initial stage consists of angiography to locate the vessel supplying the bleeding, followed by the introduction of a guide catheter into the common carotid artery, ipsilateral to the bleeding, which will be sequentially exchanged for a microcatheter, which will be responsible for the route of administration of the embolizing material<sup>8,9</sup>. Thus, using specific adhesives or microparticles, the procedure aimed at reducing or blocking blood flow in a given region is carried out. In other words, it is proposed to occlude proximal arterioles without compromising capillary vascularization, helping to control perfusion pressures and blood flow, with the objective of preventing an ischemic lesion.

The materials used for embolization include the use of a balloon; gelatin sponge; nBCA (n-butyl cyanoacrylate), Onyx; embolic particles with a previously pre-defined shapes and size, like calibrated microspheres originated from polyvinyl alcohol (PVA) and trisacryl matrix soaked in gelatine, as well as metal springs and hydrophobic precipitating injectable liquid (PHIL)<sup>1,6,10-13</sup>.

This paper aims to report two cases of profuse epistaxis resulting from facial trauma treated with superselective embolization. Despite the conservative approach initially performed with anterior and posterior nasal tamponade by a

specialized emergency team, it was impossible to definitively manage the blood volume loss, or wait for otorhinolaryngology to approach the patient, which required a procedure through embolization by Vascular Surgery. The research ethics committee of the same hospital approved the publication of this study, under the CAEE protocol 60784922.3.0000.5198. Case reports were structured according to the CARE guideline.

## PRESENTATION OF CASE

### CASE N°1

A woman, 40 years old, without a history of medical illness, victim of a car accident in November 2020 who, on clinical examination, was conscious and orientated. Inspection revealed right periorbital ecchymosis, facial swelling, and epistaxis, with preserved ocular acuity and motricity and satisfactory mouth opening. Palpation revealed signs of fracture in the middle third of the face, confirmed by the findings of a CT scan of the face, which revealed a Le Fort I maxillary fracture, a nasal bone fracture (OPN) and a complex fracture of the zygomatic bone on the right, all with no significant displacement (Figure 1 a, b)

In the initial consultation, the clinical and tomographic findings instituted a conservative treatment with an anterior nasal packing using Vaseline gauze to control the bleeding. Coadjutant therapy with anti-inflammatory steroids for about three days, pain medication in case of any pain and a seven-day course of antibiotic therapy were also started.

But the nasal bleeding was not stopped completely, and it became necessary to use a posterior nasal packing with a Foley catheter, together with an anterior nasal packing made with Vaseline gauze. Both were used for five days, and the victim was monitored. During the removal of the tampons on the fifth day of hospitalization, she had refractory epistaxis and was transferred to the Vascular Surgery Department, where she underwent arteriography without difficulties.

During arteriography, a discrete blush was detected in the region of the nose with nutrition from the internal maxillary artery on both sides, and embolization was immediately

recommended. The material of choice was PVA 350-550 $\mu$ m, and the sphenopalatine artery was first approached in order to limit the embolized area and consequently control bleeding. Despite the unsuccessful result and the continued

irrigation of the descending palatine artery (Figure 1 c, d), embolization of the artery was proceeded with, which resulted in a successful therapeutic. (Figure 1 e, f).



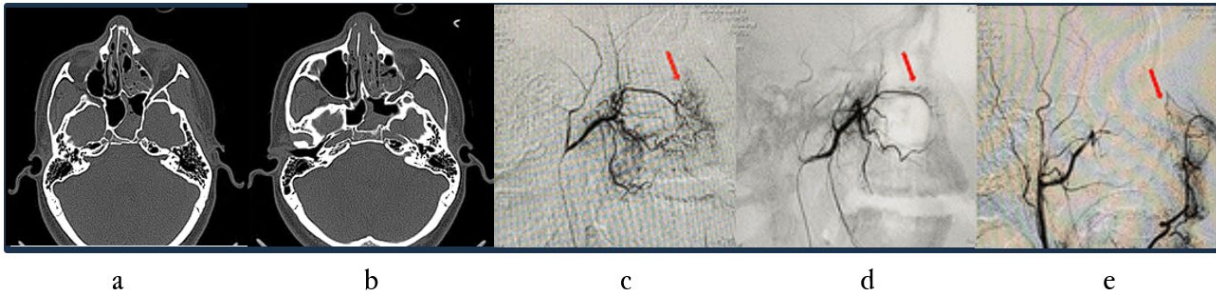
**Figure 1.** CT scan of the face, which revealed a Le Fort I maxillary fracture, a nasal bone fracture (OPN) and a complex fracture of the zygomatic bone on the right, all with no significant displacement (a,b). Superselective arteriography of the left internal maxillary artery in the lateral projection, showing hypervascularization of the nasosinusal region irrigated by the sphenopalatine and descending palatine arteries (c). Post-embolization angiographic control with PVA (350-550 $\mu$ m) showing irrigation by the descending palatine artery (d). Anastomoses between the internal and external carotid arteries should be excluded before embolization. Postembolization angiographic control with PVA (350-550 $\mu$ m) of the sphenopalatine artery (e,f).

#### CASE N°2

A male patient, 25 years old, without a history of medical illness, victim of physical aggression in January 2021, was conscious and orientated on clinical examination. Inspection showed edema in the middle third of the face and epistaxis and, on palpation, signs of fracture of the nasal bones without displacement, findings confirmed by CT scan of the face (Figures 2 a, b). As in the previous case, a conservative approach was instituted with anterior nasal packing with Vaseline gauze and posterior packing with a Foley catheter, maintained for three days, and drug therapy was started as in case 1.

The patient developed refractory epistaxis on the third day of hospitalization and

was transferred to the Vascular Surgery Department, where an arteriography was done, without difficulties. Revealed significant hyperemia in the nasal region and indicated an embolization. During the superselective arteriography of the internal left maxillary artery, a moderate vascularity was detected in the nasal region which was supplied by the sphenopalatine artery, and embolization was done with PVA (250-355 $\mu$ m), while maintaining perfusion of the facial artery branches (Figure 2 c, d, e). It is very important to check the irrigation of the external carotid artery after embolization in order to rule out reflux of PVA to non-target branches and to detect any recanalization, which may be responsible for a recurrent epistaxis.



**Figure 2.** Axial CT scan of the face fracture of the nasal bones without displacement (a,b). Superselective arteriography of the left internal maxillary artery in the lateral projection, showing moderate hypervascularization of the nasosinusal region irrigated by the sphenopalatine arteries (c). Partial angiographic control after embolization with PVA (250-355 $\mu$ m) of the sphenopalatine artery, showing reduced irrigation of the nasal mucosa (d). After embolization of the internal maxillae bilaterally and the right facial artery, selective angiography of the left external carotid artery still shows irrigation of the nasal mucosa by branches of the facial artery (e), preventing the risk of ischemic complications.

Both patients, attended at the Hospital of Restauração/Recife-PE/Brazil, had their laboratory parameters controlled and did not need volume reposition using crystalloid or blood products or coagulant agents. After embolization, both patients had a satisfactory evolution and there were no medical history reports any complaints or hemorrhagic recurrences or any other complications resulting from the embolization, or the cause of the original hospital stay, with hospital discharge 72 hours after the endovascular procedure. This suggests that endovascular epistaxis treatment offers good medical prognosis.

They received a hospital discharge with the antibiotic therapy being continued, oral, to end the posology interval, in addition to the prescriptions of pain support therapy, if necessary. The patient was given professional recommendations for follow-up in the department of Oral and Maxillofacial Surgery and Traumatology and Vascular Surgery.

## DISCUSSION

Even though epistaxis that develops into immediately massive bleeding is rare in facial trauma<sup>14,15</sup>, the first treatment for these cases is the compression of the area of bleeding - a conservative, simple and often very effective procedure<sup>16-18</sup>, which is carried out using nasal packing. However, we agree that in certain cases more invasive approaches are needed, such as

embolization, vessel ligation, endoscopic electrocautery, or fibrin glue<sup>1,15,17</sup>.

Post facial trauma epistaxis may present late and/or recurrent and may be associated with pseudoaneurysm formation. As the literature shows, any topography can be involved, such as the internal maxillary artery, which can be embolized with 355–500-micron PVA particles followed by the placement of 2mmx2mm micromoles using local anesthesia<sup>19</sup>, as well as the internal carotid artery, where a nitinol coil can be used under general anesthesia<sup>20</sup>.

Pseudoaneurysms are the consequence of a partial lesion of the vascular endothelium, a morbidity that can be clinically diagnosed by angiography, and may be discovered soon after the trauma or in a period of time that can vary from days to months<sup>21</sup>. The time interval for mediate epistaxis can occur 30 minutes after trauma, as mentioned by Kurata et al. (1993)<sup>22</sup> in which it was associated with a fracture of the posterior walls of the maxillary sinus and sphenoid bone, and bleeding supplied by a branch of the ascending pharyngeal artery. As well as epistaxis eleven months post-trauma<sup>23</sup>.

In severe epistaxis, arterial embolization is considered a less invasive immediate treatment, despite the possible complications; these include partial necrosis of the tongue, inguinal hematoma, necrosis of the palate, blindness due to damage to the ethmoidal arteries; infarction due to involvement of the internal and external carotid arteries; allergic reaction to intravenous contrast materials; risk of atherosclerotic plaque

displacement or embolic sequelae<sup>2,3,9,10,11,16,19,22,24,26-36</sup>.

Emergency cases of oral and/or nasal bleeding may pose a threat to the airways, and generally there is no distinction by gender or age group<sup>9,24</sup>. A study carried out on a population of 1,668 patients with facial injuries found that 39 (2.3%), aged between 16 and 55, had life-threatening oral or nasal bleeding and required embolization, with Le Fort type fractures and the internal maxillary artery being the most prevalent<sup>37</sup>. However, the origin of the scientific information must be considered, as the articles that deal with this subject and serve as a basis for decision-making are generally all-or-nothing, involving case reports or series and retrospective studies.

The etiology of difficult-to-control traumatic epistaxis depends on the dynamics of the trauma and the topography of the involvement. It can be associated with automobile accidents, falls from a height, furnace explosions, firearm attacks and other types of traumas, and fractures associated with Le Fort, such as the mandibular fracture, zygomatic complex, fractures of the anterior and posterior walls of the frontal sinus, nasorbithmoidal sinus, skull base and/or nasal bones<sup>2,9,10,13,20,23,26,28-30</sup>.

When located anteroinferior to the nasal septum - anatomically this is the region of Kiesselbach's plexus - where the vascularization comes from branches and anastomoses of the superior labial, sphenopalatine and anterior ethmoidal arteries. When it is more posterior, it can compromise the sphenopalatine artery - in the region of Woodruff's plexus - located in the inferior nasal meatus, approximately 1cm anterior to the posterior end of the inferior turbinate<sup>3,38</sup>.

An embolization process is therefore carried out using angiography/arteriography, with the introduction of an arterial catheter as the route of administration for the embolizing material<sup>19,27</sup>. The materials used are diverse: nBCA, Onyx, PVA and, the gelatine-soaked trisacryl matrix, as well as metal springs or associations<sup>2,11-13,20,23,24,26,29,30</sup> and Gelatin sponge, which has been mentioned in the literature since 1987 by Schilstra and Marsman, and is still considered an ideal substance that can be used alone or in combination with other embolic products like the springs<sup>39</sup>.

The embolizing material should be selected according to several criteria, including particle size, where the ideal range is between 200 and 700  $\mu\text{m}$ , as particles smaller than 100  $\mu\text{m}$  can result in tissue necrosis as a harmful effect. Other causes of post-embolization complications may be related to the number of structures embolized, the period of nasal packing and habits that compromise vascularity, such as smoking<sup>2</sup>. The gold method of treatment of intractable epistaxis still debated. A research study recently concluded that endovascular embolization proved to be both safe and effective in treating intractable epistaxis carrying a low risk of post-operative stroke<sup>40</sup>.

Regarding the most appropriate material for embolization in epistaxis cases, an analysis of its properties and their indications are fundamental. In our studies, PVA (350-550  $\mu\text{m}$ /250-355 $\mu\text{m}$ ) was used, without complications, as it is a permanent embolization sealant particle and is used frequently<sup>41</sup>. Despite the recommendations in the literature, PVA particles of 200 $\mu\text{m}$  are effective and have a low risk of complications<sup>42</sup>.

In severe epistaxis and when methods how external pressure for several minutes<sup>43</sup>, topical agents, cauterization, nasal packing, surgical methods, in combination or not, have failed or are contraindicated, endovascular treatment is applied, but despite these complications. Depending on the condition of the patient and on resources and professionals available<sup>44</sup>.

The limitations of this study include selection bias in the standard of reference for endovascular therapy, as often the most traditional methods are preferred, such as packing or the use of a local technique. Nevertheless, a decision to use a secure and effective method can be the key to a better outcome for the patient; reducing hospital stay and minimizing exposure to other illnesses.

One other limitation may be linked to the absence of comparative data in the long term, given the difficulties in getting a follow-up of the patients using only the previous medical reports, as they are not usually aware of the necessity of a subsequent outpatient visit.

## CONCLUSION

These cases, which were conducted by specialists with acknowledged experience in emergency surgery and trauma care, showed that artery embolization should be part of the list of emergency procedures in Oral and Maxillofacial Surgery and Traumatology, in spite of the rare incidence of refractory epistaxis in trauma to the face. It is an efficient therapy in cases in which anterior and/or posterior nasal packing are ineffective, providing a fast and minimally invasive method of treatment that gives hemodynamic stability to the patient.

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