Utility of the surgical treatment for severe epistaxis by endoscopic approach of sphenopalatine and ethmoidal arteries

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Abstract: Introduction: We present an intervention (prospective-retrospective) study to evaluate the efficacy and cost-effectiveness of the treatments used for controlling severe posterior epistaxis, and particularly to determine whether surgical endoscopic ligation or cauterization of the sphenopalatine (SP) and anterior ethmoidal (AE) arteries could be a feasible alternative to conventional treatments. Patients and methods: 184 consecutive patients admitted to the ENT ward between the years of 1997 and 2005 were included in the study. They were distributed into three groups depending on the last treatment applied to control their bleeding: AP group.- anterior packing (n=98); PP group.- posterior packing (n=66), and ES group.- endoscopic ligation and/or cauterization of SP or AE (n=20). Results: Highly significant differences were found between the groups, not only regarding the efficacy, (90% for surgical treatment compared with 41.3% for AP and 63.1% for PP), but also the length of post-treatment hospital stay (AP.- 4.92 days; PP.- 6.3 days; ES.- 2.15 days). Discussion and conclusions: the lack of efficacy in conventional treatment and the increasing risk factors that condition nasal bleeding, together with advances in endoscopic and anesthetic procedures mean a surgical solution for these patients is possible. Our results demonstrate the feasibility of these techniques as an alternative to nasal packing in the treatment of posterior epistaxis, and their ethical and economical convenience as a substitute for posterior packing.


INTRODUCTION

Severe epistaxis is a persistent and recurring disorder responsible for a significant proportion of emergency ENT hospitalizations. Despite being well known-particularly within our specialty- the factors that produce and maintain it usually interest other areas more directly (Cardiology, Hematology, etc.). In some cases, epistaxis poses a significant cardiovascular risk, which is why the treatment almost exclusively applied by the ENT doctor should increase in aggressiveness, paying particular attention to the patient's underlying pathologies. However, it is necessary to bear in mind that the need to repeat treatment also implies an increase in morbility and discomfort for the patient.

There is a large number of devices and material in the therapeutic arsenal for anterior and/or posterior nasal packing, each with its own particularities, indications, efficacy and financial cost (which are not always proportional). However, the discomfort caused by the insertion, maintenance and removal of the packing has still not been completely eliminated. All these types of packing, (particularly the posterior ones), involve a significant amount of stress for the patient, not only during its insertion, but also while it remains in place, - given that it is painful and obstructs the patient's ventilation - (as has been demonstrated in different studies).

The advent of Nasal Endoscopy meant a change in the management of this pathology, allowing effective treatment that was much better tolerated by the patient than traditional nasal packing.

Ligation and/or cauterization of the ethmoidal and sphenopalatine arteries has, in different studies, been shown to be more than 80% effective in the resolution of serious epistaxis cases refractory to traditional treatment.

We present a comparative intervention study in which we will try to show the utility and feasibility of surgical treatment for severe posterior epistaxis compared to nasal packing.
PATIENTS AND METHODS

Patients studied

The 184 patients admitted to the ENT ward between January of 1997 and March of 2005 diagnosed with posterior epistaxis were included in the study. They were chosen by means of consecutive sampling.

They were put into three groups, taking the treatments administered as the defining variable. 98 patients, (53.3%), were assigned to group AP (effective anterior packing), 66 patients, (35.9%) to group PP (effective posterior packing) and 20 patients (10.8%), to group ES (endoscopic surgery).

For ethical reasons, treatment, including the possibility of surgery if the previous treatment had failed, was administered sequentially to all the patients (this protocol is represented in Figure 1). Therefore, the patients in the PP group first received anterior packing that had failed, and those from the ES group had received ineffective anterior and posterior packing.

Material and techniques

1. Anterior packing – This was made in most cases with cotton swabs soaked in topical anesthetic and adrenaline.

2. Posterior packing – Except for three cases, a system with a posterior balloon filled with physiological serum was used in combination with anterior packing as described above.

3. Revision endoscopic surgery was used until 2004 in cases of instability of posterior packing, (mobility, persistent anterior dripping, possibility of re-bleeding when the packing is removed), or of it failing, (new posterior bleeding despite treatment). In this intervention, the packing was removed and the bleeding sites, in the event that any were found, were cauterized.

4. Ligation/cauterization endoscopic surgery of the sphenopalatine or anterior ethmoidal arteries. Nasosinusal endoscopic surgery was performed using straight 0° and 30° fiber-optic and basic endoscopic sinus surgery (ESS) material. Under general anesthetic and with orotracheal intubation the following was performed:
   a. The nasal packing was removed and cotton swabs soaked in a 1% tetracaine solution and 2% adrenaline were inserted for 10 minutes.
   b. If there were septal deformities that obstructed access to the middle meatus they were corrected.
   c. The artery to be treated was approached by means of an incision and subperiosteal lifting anteroposteriorly over the palatine bone as far as the sphenopalatine foramen (in the case of the sphenopalatine artery), or an anterior ethmoidectomy to localize the pathway of the anterior ethmoidal artery 1-1.5 cm posteriorly in relation to the caudal end the frontal infundibulum (in the case of the anterior ethmoidal artery).
   d. Once the artery had been dissected, the ligation was performed using hemoclips and/or mono- or bipolar cauterization.

Anterior nasal packing is left for at least 48 hours, posterior packing for at least 72 hours and in the case of ligation/cauterization surgery, packing is not left in and the patient can be discharged 24 hours after the intervention.

The design of the study

Type of study: intervention, prospective-retrospective.

Objective and prior hypothesis: We aim to assess the efficacy of the three types of treatment used, as well as study the possible differences in regard to the number of days spent in hospital for each one. This project was designed based on the following premises:
- Surgical treatment for severe posterior epistaxis is more effective than nasal packing.
- Posterior nasal packing involves a longer stay in hospital than surgical treatment.
- Posterior nasal packing involves a high number of cases of revision surgery due to its failure or instability.
- Surgery can be an alternative to posterior packing in the treatment of severe epistaxis.

Design of the treatment protocol: Described in Figure 1. Inclusion of ligation/cauterization of the
sphenopalatine and anterior ethmoidal arteries took place in 2004, but patients first treated with posterior packing were revised under general anesthetic in the case of failure or instability of the packing. This protocol was sent to the Ethics Committee of our hospital.

Case selection: All the patients admitted to our department with posterior epistaxis, (bleeding whose origin could not be found with anterior rhinoscopy), during the course of the study were included. Ambulatory control of the epistaxis (patients who did not require hospitalization) and the lack of certain data, such as study variables, were cause for exclusion.

Data collected: The following were defined as variables:
- Risk factors
- Nostril and impression of the localization of the bleeding (ethmoidal/sphenopalatine region).
- Packing used (the number and kind).
- Success or failure of each treatment (and the number of failures where applicable).
- Operations performed (the number and type).
- Complications recorded.
- Total length of stay.
- Stay following resolution treatment (packing or surgery).

Statistical analysis – Using the variables indicated above, different comparisons were made (the results of which are given below) and the statistical significance was studied using the following test:
- Kolmogorov-Smirnov test (to normal distribution).
- Student's t-test (for the comparison of two averages with normal distribution).
- Mann-Whitney's U test (to compare two averages).
- The Kruskal Wallis test (to compare more than two averages).
- Chi-squared test (to compare proportions).

Non-parametric tests were used given the poor fit to normality of the variables studied with the Kolmogorov test.

RESULTS

The results obtained for each one of the groups are summarized in Table 1 according to the treatment used. 74.5% of the subjects were men and 25.5% women, aged between 18 and 93 years (an average of 62.78 years). In 41.8% of cases bleeding was observed in the right nostril, in 52.2% in the left nostril and in 6% there was bleeding from both nostrils without it being possible to determine the origin.

Statistically significant differences were not found for any of the variables studied, except for those of efficacy, days spent in hospital for treatment and post-treatment, and age.

In order to assess the possible influence of age as a confusion factor on the rest of the comparisons, a study was first conducted in which we checked that age did not affect the proportion of packing failures. An inverse non-significant tendency was even observed (an average of 62.5 years) in patients in whom the first posterior packing was effective as opposed to 54.97 in which it failed at least once; p>0.06). Neither was there a connection between the number of days spent in hospital (nor the average, nor post-treatment). Therefore, taking into account that the cases of surgery were not selected for any factor other than those described in the protocol given in Figure 1, (that is to say, the age of the patient was not considered when making the decision regarding surgery), the external validity of the study remains safe-guarded.

<table>
<thead>
<tr>
<th>Table 1: Description of the groups studied</th>
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<tbody>
<tr>
<td><strong>AP Group</strong></td>
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<tr>
<td>N</td>
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<tr>
<td>AVERAGE AGE (years)</td>
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<tr>
<td>Sex (%)</td>
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<tr>
<td>Feminine</td>
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<td>Masculine</td>
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<td>Side (%)</td>
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<tr>
<td>Right</td>
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<td>Left</td>
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<tr>
<td>Both</td>
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<tr>
<td>Location (%)</td>
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<tr>
<td>Sphenopalatine</td>
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<tr>
<td>Ethmoidal</td>
</tr>
<tr>
<td>Not determined/specific</td>
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<tr>
<td>Risk factors (%)</td>
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<tr>
<td>Yes</td>
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<tr>
<td>No</td>
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Risk factors

As can be seen from Figure 2, high blood pressure was the most common risk factor found in the three groups. It was present in 48.4% of patients and, in 33.2% of cases it was the only risk factor identified. 63.6% of the patients presented at least one known risk factor and 15.2% had two or more. The difference between the three groups in the study was not statistically significant. However, we can see in Figure 3 that by comparing the overall incidence of risk factors (63.6%) with that observed among the cases of multiple anterior packing failure (70%) and especially with that recorded in patients who needed various anterior packings and more than one posterior one, (78.6%) a significant difference emerges. This is indicative of the implication that systemic alterations have in the maintenance and the recurrence of bleeding and of the importance of its adequate control in combination with local control.

Efficacy of each technique

In a patient undergoing a treatment that at the very least is uncomfortable (and is usually painful), the efficacy of the first intervention is of great importance, and even more so if the patient has cardiovascular risk factors. However, experience tells us that epistaxis has a recurring nature and often requires various treatments. In figures 4 and 5, the results obtained with each technique are given. Anterior packing was effective in 41.3% of cases, posterior packing in 63.2% and surgery in 90% of cases.

Furthermore, in the case of anterior packing, 16.3% of patients suffered at least 2 failures and this occurred in 4.8% of cases with posterior packing. In regard to surgery, we did not find a case of multiple failures. The two patients that bled following surgery were managed with more ESS. The first case proved to be a bleed coming from the anterior ethmoidal region, (the sphenopalatine artery had been ligated), and in the second case one of the hemoclips that had been put in place had been lost.

The differences found were statistically significant (p<0.001) for the Chi squared test.

In regard to surgery failures, we found 100% efficacy in the 4 patients treated with cauterization of the anterior ethmoidal artery and 2 failures among those treated with ligation and/or cauterization of the sphenopalatine. The first surgical failure occurred in a hypertensive patient whose condition had not been well controlled, and who, 10 days after the intervention, bled again profusely from the same nostril. The patient underwent a second operation and it was found that one of the hemoclips previously applied had disappeared, which is why the artery was cauterized, without there being any further complications.

The second case deserves special attention, which will be given in the discussion part of this paper. In this patient the origin of the bleeding was recorded as being in the sphenopalatine region (and that artery was therefore cauterized). However, it was in fact the ethmoidal artery that was the origin of the bleeding, which is why it was necessary to perform a second operation to cauterize the anterior ethmoidal artery. Evolution was good following the intervention.

Results from the average stay

Summarized in Figures 6 and 7. We can see that the average hospital stay increases with the successive failures of each technique and also with the greater complexity of the treatment used, in such a way that statistically significant differences were found between the groups studied using the Mann-Whitney U test.
However, taking into account that, for ethical reasons, these treatments are applied sequentially, it is more interesting to compare what happens following the last treatment the patient receives (that is to say, the definitive treatment) to appreciate whether or not surgery can mean a saving in the days spent in hospital in cases of severe epistaxis. As can be seen in Figure 7, there is an average difference of 2.77 days between the patients who received anterior packing (1.88 days if the first one was effective) and those operated on using ESS, and 4.15 days between the posterior packing group and that of ESS (3.78 if the first posterior packing was effective). These differences were significant (p>0.001) for the Mann-Whitney U test.

Complications

Complications derived from surgery were not found in any of the 20 patients in the ES group. In all the cases a systematic revision was conducted of the nostril a week after surgery to detect possible complications.

DISCUSSION

Despite being the most common cause for consultation in the emergency ward attended to by the
ENT department\textsuperscript{1}, the majority of nosebleed cases, particularly the most serious ones, are without a doubt a symptom of a systemic pathology, as the results of our study show.

The use of different types of surgery in the treatment of uncontrollable epistaxis is not new\textsuperscript{2-4}, but the advance in nasal endoscopic surgery techniques has meant that surgery has climbed up the ladder in the last few years in the protocol indications list for these patients, even to the point where surgery has become the first choice for many patients.

Nobody doubts the efficacy of conservative treatment in cases of anterior epistaxis, nor the efficacy of surgical techniques in the case of posterior bleeding, both in the ethmoidal region\textsuperscript{5,6} as well as the sphenopalatine\textsuperscript{6-15}, but there have not been many studies which have compared the efficacy and especially the costs in our environment that a health service like ours generates with each treatment\textsuperscript{16}.

The results obtained in our series coincide with previous studies and include the following possibility noted by some authors\textsuperscript{17,19} which should be kept in mind when taking a patient with nosebleeds to surgery: the origin of the bleeding determines the technique to be used, and surgery can fail (if the technique is not correctly applied). In our experience, 18\% of posterior epistaxis originated in the ethmoidal region and in one of the cases where surgical treatment failed this was because the origin had not been correctly identified. Therefore, if in doubt, we recommend acting on both arteries, something we did in two cases with excellent results (one due to failure as has been commented, and the other because it was impossible to determine the origin of the bleeding).

The same goes for cases of bilateral bleeding in which both sides can be worked on\textsuperscript{22}, (in our series, this occurred in one case).

**Economic study and justification**

According to the data from our hospital, one day spent in the ENT ward by a patient who does not require special techniques or medication costs 303 euros, which is why, used as a first option in cases of nose-bleeding that is not controllable with anterior packing, surgery represents a saving of 1145.34 euros on the average stay in our hospital (of the Spanish public health system). If we made this comparison with cases of anterior packing, the saving would be 569.64 euros.

The convenience of using surgery as the first option, taking into account that 41.3\% of patients with posterior epistaxis are controlled with the first anterior packing and 83.7\% with the second one, can generate ethical or economical problems, (derived from the expense of using the operating theater), that require more extensive series.

However, when we compare posterior packing with surgery, we find undeniable advantages that justify its substitution.

From the studies of Cvetnic et al.\textsuperscript{20,21}, we are familiar with the alterations that nasal packing means for the oxygenation of the patients and how these alterations can be aggravated or, on the other hand, can aggravate underlying pathologies, which are common in these cases. Through surgery we save the patient at least 3 days (3.78) of discomfort from nasal obstruction and collateral medication (antibiotics, analgesics, anxiolytics), on account of their not requiring post-surgical packing.

The only doubt that may arise from the substitutive use of surgery for posterior plugging concerns the fear of general anesthetic, post-surgical complications and the expense of the operation. To check whether these aspects outweigh the advantages of efficacy, hospital stay and the patient's comfort, we analyzed the last few years in our department.

As can be seen from Figure 8, 64.4\% of the patients who underwent posterior packing between the years of 2003 and 2005 were revised under general anesthetic due to the failure or instability of the packing. That is to say, more than two thirds of patients ended up in the operating theater one way or another, which is why proposing the possibility of surgery as the first choice of treatment is clearly justified.

Other studies will be needed to establish reasons why the efficacy of nasal packing appears to have declined over the last few years, but possibly the development of therapeutic advances that have managed to prolong the lives of cardiac patients who would have otherwise died, but who now suffer the secondary effects of these drugs (anticoagulants, anti-clotting drugs), has a lot to do with it.

![Figure 8. Evolution of the revision surgery of patients who underwent posterior packing. These patients underwent endoscopic surgery to cauterize the bleeding sites (prior to 2004) or the sphenopalatine and/or anterior ethmoidal arteries (post-2004) because of the failure or instability of the packing.](image-url)
CONCLUSIONS

The advances in anesthetic and endoscopic techniques have enabled this substitution to take place safely, even for elderly patients (20% of the patients who underwent surgery in this study were over 75 years of age and the eldest was 83), and those with cardiovascular risk factors (70%), as the insertion and the maintenance of posterior packing, along with prolonged immobilization, could be even more damaging than surgery itself. In any case, further studies will be necessary to prove this affirmation.

The data analysis of this study demonstrates the utility and safety of surgical techniques, in accordance with earlier studies, as well as the economic convenience of its application as an alternative or even substitution for conventional non-surgical techniques. However, we found the correct identification of the bleeding point to be of vital importance, or should it be necessary, surgery on both arteries in patients in whom the origin could not be identified or when there are uncertainties. Furthermore, acting on both sides can be done if the bleeding nostril has not been identified (this only occurred in one case in our cohort).

The existence of a consensus protocol in the staggered application of the treatments described above, along with the fact that these treatments (both surgical and non-surgical) have been given in the same way in all the cases, provide this study with added value. The existence of a consensus protocol in the staggered application of the treatments described above, along with the fact that these treatments (both surgical and non-surgical) have been given in the same way in all the cases, provide this study with added value.

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