Effect of embolisation on endoscopic resection of angiofibroma

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Abstract

Objective: To determine the effect of embolisation on endoscopic resection of angiofibroma.

Subjects and method: A partially blinded trial was undertaken. Twenty-three patients with angiofibroma (nine embolised and 14 not embolised) underwent endoscopic resection between January 2007 and August 2008 in two tertiary referral centres. Demographic data were collected, the pre-operative tumour extent was assessed by computed tomography, and tumours were staged according to their computed tomography appearance (Radkowski scale). In addition, we evaluated the duration of surgery, amount of haemorrhage, blood pressure during surgery, duration of hospitalisation, complications of surgery and embolisation, cost of treatment, and number of post-operative recurrences, as well as the angiographic characteristics in the embolisation group.

Results: There was no significant difference between the general characteristics of both groups. At the end of the study period, we could find no significant difference between the two groups regarding haemorrhage, number of recurrences or complications. The only significant difference was cost of treatment, which was significantly higher in the embolisation group.

Conclusion: Endoscopic resection is a feasible and safe method for angiofibroma surgery. The current evidence does not support obligatory embolisation in every case of endoscopic angiofibroma resection.

Key words: Angiofibroma; Nasopharynx; Embolisation; Nasal Cavity Neoplasms

Introduction

Juvenile angiofibroma is a rare, hypervascular, locally aggressive, benign tumour which is exclusively found in the nose and sinuses of male adolescents. This tumour usually originates from around the sphenopalatine fossa, and can extend to adjacent structures such as the pterygoid process, sphenoid sinus, nasal cavity, nasopharynx and infratemporal fossa.[1–3]

The definitive treatment for this tumour is complete surgical excision. Different surgical approaches are used for tumour resection. The safety and efficacy of endoscopic resection has been confirmed in many studies.[1,3–7] Successful tumour treatment is impeded by high recurrence rates and difficulties in accessing some parts of the tumour.[4]

To reduce peri-operative haemorrhage, some authors have recommended pre-operative embolisation.[3,4,8–11] It has also been claimed that the use of embolisation in angiofibroma treatment reduces the cost of treatment, the need for blood transfusion and the duration of hospitalisation.[3,8,12,13] However, some studies have reported contrasting findings on the effect of embolisation.[14,15] Also, most studies have not been randomised or prospective, and/or resections have not been purely endoscopic.[13]

Therefore, considering the complications of embolisation and the controversy over pre-operative embolisation,[12] the current study was conducted to evaluate prospectively the effects of embolisation on endoscopic resection of angiofibroma.

Subjects and methods

Subjects

Twenty-three consecutive patients with angiofibroma underwent endoscopic resection performed by the senior author and using the same technique, between January 2007 and August 2008, in the otolaryngology wards of two tertiary referral centres (the Amir Alam Hospital and the Imam Khomeini Hospital). Patients were excluded as candidates for endoscopic resection if they were revision cases, had contraindications for embolisation, were allergic to polyvinyl alcohol or refused to participate in follow up. Diagnosis was based on history and physical examination, computed tomography (CT), and endoscopic findings; we performed no pre-operative biopsy for diagnosis. None of the patients in this study underwent radiotherapy or chemotherapy pre- or post-operatively.

Ethical approval

The study protocol was approved by the institutional review board of the Tehran University of Medical Sciences. Detailed information about the study was given to the participants, and written, informed consent was obtained from each one. All aspects of the study were conducted according to the Declaration of Helsinki. The safety and efficacy of endoscopic resection and embolisation of angiofibroma were confirmed as standard tools of treatment.[16–22]

Subjects' variables and follow up

Patients' demographic data were collected, the pre-operative tumour extent was assessed by CT, and tumours were staged according to their CT appearance (Radkowski scale). In addition, we evaluated the duration of surgery, amount of haemorrhage, blood pressure during surgery, duration of hospitalisation, complications of surgery and embolisation, cost of treatment, and number of post-operative recurrences, and also the angiographic characteristics in the embolisation group. The amount of haemorrhage was calculated by measuring the quantity of suctioned blood and counting the number of blood-impregnated surgical swabs.

Patients were followed up three, six and 12 months after the surgery, undergoing endoscopic evaluation and CT scanning. Any symptomatic recurrence was treated.

Procedures and techniques

The procedure was very similar in all patients, comprising embolisation followed by endonasal, endoscopic tumour resection.

Embolisation was performed either one or three days before surgery. An external carotid artery was catheterised super-selectively using micro-catheters. Then, feeding vessels of the tumour were completely occluded by particles of polyvinyl alcohol ranging in size from 150 to 500 μm. All embolisations were performed by the same radiologist using the same method. The effectiveness of embolisation was evaluated by the absence of tumour blushing following embolisation.

Every patient was transfused with two units of autologous blood before surgery to reduce the need for homologous transfusion.

Hypotensive general anaesthesia was used for all patients. Patients were placed in the reversed Trendelenburg position in all cases.

Prior to surgery, all patients were vasoconstricted, using cottonoid pledgets soaked in phenylephrine placed in the nose for at least 15 minutes, and also using injection of lidocaine with 1:100 000 adrenaline at the level of the root of the middle turbinate and uncinate process.

The technique of tumour resection slightly differed according to tumour extension, but the mainstay of treatment was to acquire maximal exposure through uncinectomy, wide antrostomy, partial resection of the middle turbinate, definitive exposure of the pterygopalatine fossa and gentle dissection of the tumour, prior to ultimate resection. Before resection of the tumour, the internal maxillary artery was found and cauterised. In large tumours, the internal maxillary artery was located during tumour dissection; in smaller ones, location and cauterisation of the maxillary artery were performed as the first step. After complete dissection of the tumour from the surrounding tissues, using cottonoid pledgets in most cases, tumours were resected en bloc. Haemostasis of other tumour feeding vessels was conducted in a similar fashion to that of the internal maxillary artery.

Blinding and allocation

Enrolled patients were selected from consecutive patients referred to our wards and then randomly divided into two groups. However, at the end of the study three patients were added to the non-embolised group to make both groups homogeneous. The surgeon and one of the researchers who collected patients' data were blinded regarding tumour embolisation.

Statistical method

Data were analysed using the Statistical Package for the Social Sciences version 15.0 for Windows software program. The paired t test was used to evaluate the mean of variables in each group, and the chi-square test was used to compare ratios. The multiple regression method was used to analyse descriptive data. The sample size was calculated as follows: $\alpha = 5\%$; $\mu1 = 1136 \pm 450$ cc; $\mu2 = 677 \pm 255$ cc (blood loss amounts).[13] The values were evaluated using descriptive statistical methods (mean $\pm$ standard deviation), and results were expressed at a significance level of $p < 0.05$.

Results

Twenty-three patients with a diagnosis of angiofibroma were entered into the study. Of these, nine patients underwent pre-operative embolisation; in the remainder, the tumour was resected without embolisation.

In order to use parametric statistic methods for data analysis, we used the Kolomogorov–Smirnov test; the results showed that quantitative variables had a normal distribution.

All of the patients were male. The mean age was 16 ± 2.5 years in the embolisation group and 17 ± 2.7 years in the control group; this difference was not statistically significant ($p = 0.341$).

The tumour staging did not differ significantly between the two groups ($p = 0.138$). The distribution of tumour staging is summarised in Table I.

The peri-operative mean blood pressure did not differ significantly between the two groups ($p = 0.355$), being 82.1 ± 2.6 mmHg in the embolised group and 80.7 ± 6.1 mmHg in the control group.

The angiographic characteristics of the embolised group indicated that the major tumour feeding vessel was the internal maxillary artery in nine cases (100 per cent), the ascending pharyngeal artery in two (22.22 per cent), the internal carotid

TABLE I
TUMOUR STAGE BY GROUP

Group	Ia	Ib	IIa	IIb	IIc	IIIa	IIIb
Embolised	0	3 (33.3)	0	1 (11.1)	2 (22.2)	0	3 (33.3)
Non-embolised	2 (14.3)	1 (7.1)	2 (14.3)	2 (14.3)	2 (14.3)	4 (28.6)	1 (7.1)
Total	2 (8.7)	4 (17.4)	2 (8.7)	3 (13.3)	4 (17.4)	4 (17.4)	4 (17.4)

Data represent patient numbers (percentages).

artery in two (22.22 per cent) and the contralateral internal maxillary artery in two (22.22 per cent).

The amount of haemorrhage was 1260 ± 1060 ml in the embolised group and 1625 ± 1140 ml in the control group; this difference was not statistically significant ($p = 0.472$; t test). The amount of haemorrhage according to tumour stage is summarised in Table II for the two groups. Because of the small sample size, statistical analysis was performed on patients with tumours of three stages: I, II and III.

The mean duration of surgery was 257.8 ± 97 minutes in the embolised group and 276.4 ± 83.4 minutes in the control group ($p = 0.629$).

The mean amount of blood used in transfusion was 1.6 ± 1.5 units in the embolised group and 3.1 ± 2.6 units in the control group ($p = 0.369$).

The mean duration of hospitalisation was 9.2 ± 5 days in the embolised group and 6.2 ± 1.9 days in the control group; this difference was not significant ($p = 0.104$).

However, there was a significant difference in mean cost of treatment between two groups, being $\$1700 \pm 380$ in the embolised group and US$\$970 \pm 340$ in the control group ($p = 0.001$; t test).

The association between blood pressure and haemorrhage was not significant in the embolised group ($r = 0.443$; $p = 0.102$) but was significant in the control group ($r = 0.635$; $p = 0.026$).

In the follow-up period, one recurrence was seen in each group; this did not represent a significant difference ($p = 0.742$). The characteristics of these two patients are summarised in Tables II and III.

Complications of surgery comprised a buccal haematoma in one patient in the non-embolised group (in a stage IIc tumour), and cerebrospinal fluid leakage during surgery (Also in non embolized group which was repaired using a middle turbinate flap). The embolisation procedure had no complications in our series.

TABLE II
INTRA-OPERATIVE HAEMORRHAGE BY GROUP AND TUMOUR STAGE

Group	Haemorrhage (mean $\pm$ SD; ml)	p
T stage I		
Embolised*	616 ± 548	0.382
Non-embolised*	816 ± 700	
T stage II		
Embolised*	1233 ± 115	0.542
Non-embolised[†]	1312 ± 837	
T stage III		
Embolised group*	1950 ± 1688	0.241
Non-embolised[‡]	2360 ± 1244	

*$n = 3$; [†]$n = 6$; [‡]$n = 5$. SD = standard deviation; T = tumour

Discussion

Surgical removal of angiofibroma is a challenging task, as with other vascular tumours, because of tumour aggressiveness and peri-operative haemorrhage. The procedure is made more difficult still by the location of the tumour around the sphenopalatine foramen and pterygoid region, with frequent extension to the skull base and infratemporal fossa.

To facilitate tumour resection, some authors have recommended routine pre-operative embolisation.[1,3,4,12,15,23]

However, some reports state that embolisation does not affect peri-operative bleeding and may cause recurrence.[12,24,25] Moreover, increasing use of endoscopic angiofibroma resection necessitates studies which focus only on endoscopic resection. To the best of our knowledge, and after searches of the PubMed and ISI indexed literature, no previous study has compared the outcome of endoscopic surgery in embolised and non-embolised angiofibroma patients. After considering the complications of embolisation[4,8,12,26] and the lack of evidence supporting embolisation in angiofibroma resection, we designed the current study.

The safety and efficacy of endoscopic angiofibroma resection has been confirmed in many reports.[1,3,7] However, the advantages of this resection method, such as better visualisation[5] and avoidance of scars and interference with facial growth, are countered by its disadvantages, including limited exposure, lack of free space and the risk of massive bleeding. Therefore, most surgeons seek a way to further facilitate such surgery. Embolisation is a good suggestion to solve these problems; however, in most advanced tumours the pattern of feeding vessels is irregular[10] and direct endoscopic access to the tumour may cause opposite results. Another dissimilarity between the two methods is better finding and ligation of internal maxillary artery in the endoscopic approach which makes the effect of embolisation a debatable topic.

TABLE III
CHARACTERISTICS OF PATIENTS WITH RECURRENCE

Patient no	Group	Recurrence	
		Time post-op	Location
1	Emb	3.5 mths	Retro-pterygoid
2	Non-emb	4 mths	Retro-pterygoid

No = number; time post-op = post-operative time point; emb = embolised; mths = months

As in other reports, all of our angiofibroma patients were young males. We selected two relatively similar groups and attempted to use the same surgical techniques in both, to facilitate comparison of the results of embolisation. However, complete randomisation was not possible due to different tumour stages in consecutive referred patients; thus, we added three patients to the non-embolised group to make the two groups more similar.

Despite the rarity of angiofibromas compared with other head and neck tumours, our centres (the Amir Alam Hospital and the Imam Khomeini Hospital) receive a relatively large number of angiofibroma referrals because of our high level of experience with these tumours. Therefore, endoscopic resection of angiofibroma is not an unusual procedure in our centres. However, we do not have precise data on the incidence of this tumour in Iran, nor are we able to compare its incidence with that in other countries.

We found no significant difference in the mean blood loss encountered in the embolised versus non-embolised groups, similar to some other reports.[12,24] This finding may be explained by our study sample size; the rarity of angiofibroma makes collection of larger series impossible in most settings. The presence of advanced tumours in our series was another issue; 52.2 per cent ($n = 12$) of our patients had tumours of stage IIc or higher, which may have affected the final results. We found similar reports of patients with higher-staged angiofibromas undergoing resection.[14] This issue confirmed in evaluation relation of haemorrhage and tumour stage which showed significant relationship.

Our patients' recurrence rate was low, and showed no significant difference between the two groups, suggesting that meticulous dissection may prevent angiofibroma recurrence. However, due to our limited follow-up period, our results may differ from those of other studies.

In this study, because of in-patient embolisation, the duration of hospitalisation of embolised patients was longer than that of non-embolised patients; however, the difference was insignificant in comparison to the significant difference reported in some other studies.[8,27]

This difference in embolisation effectiveness be due to different study methods (prospective versus retrospective), surgical methods (endoscopic versus conventional), tumour stages, research duration and surgeon experience, and to the small sample size of most studies.

The different response of angiofibroma to embolisation in endoscopic versus conventional procedures may be explained by the former's direct exposure, better location of feeding vessels and resulting improved haemostasis.[27]

Pre-operative embolisation is not routine in our centre prior to endoscopic angiofibroma resection. Furthermore, other centres have reported that most such procedures have an acceptable outcome without pre-operative embolisation.[28]

The only statistically significant inter-group difference noted in our study related to cost of treatment, which was significantly greater in the embolised group. However, in other countries this difference may be affected by varying treatment costs, health insurance policies and general socio-economic status.

The rarity of angiofibroma makes collection of larger series difficult, and it is therefore difficult to propose preferred treatment methods based on current evidence.

- **Use of embolisation prior to angiofibroma treatment has been claimed to reduce treatment costs, blood transfusion requirements and hospitalisation duration**
- **Endoscopic resection is a feasible and safe method for angiofibroma surgery**
- **This study's findings do not support obligatory embolisation in every case of endoscopic angiofibroma resection, even more advanced cases**

Despite the aforementioned issues, this study confirmed the value of endoscopy in the treatment of angiofibroma, even in the non-embolised group. The superiority of endoscopic angiofibroma resection over conventional surgery may be suggested by the former's low rates of complications and recurrence, and avoidance of visible scars.

Conclusion

Endoscopic resection is a feasible and safe treatment for angiofibroma. Current evidence does not support obligatory embolisation in every case of endoscopic angiofibroma resection, even for higher-staged tumours.

Acknowledgements

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