ORIGINAL ARTICLE

SURGICAL OUTCOME OF PATIENTS UNDERGOING PREOPERATIVE EMBOLIZATION FOR NASOPHARYNGEAL ANGIOFIBROMA

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ABSTRACT

BACKGROUND: Nasopharyngeal angiofibroma is highly vascular and aggressive tumor seen commonly seen in adolescent males. Per-operative bleeding is major concern for surgical treatment of the tumor. There are many methods of preoperative reduction of tumor vascularity, including transarterial embolization. This study was aimed to find out surgical outcome of nasopharyngeal angiofibroma following transarterial embolization. **METHODS:** Retrospective review of medical records of patients who underwent transarterial embolization prior to surgery for nasopharyngeal angiofibroma between April 2013 and August 2017 was done. Demographics, presenting complaints, tumor stage, arteries embolized, embolizing agent used and amount of blood loss were recorded. **RESULTS:** Twelve patients, all male mostly in adolescence underwent preoperative embolization with gelatin sponge particles. More than half of the cases were Fisch stage I with only case being stage IV. Unilateral internal maxillary was embolized in all cases except for in stage IV patient in whom besides bilateral internal maxillary artery, ascending pharyngeal artery was also embolized. Blood loss ranged from 100 ml to 1300 ml with maximum blood loss in stage IV patients. **CONCLUSION:** Preoperative transarterial embolization with particles are safe and efficient method of reducing intraoperative blood loss in patients undergoing surgery for nasopharyngeal angiofibroma.

Keywords: Nasopharyngeal Angiofibroma, Preoperative embolization, Outcome

Introduction

Nasopharyngeal angiofibroma is a common tumor of nasopharynx almost exclusively seen in adolescent males which accounts for nearly 0.05 % to 0.5 % of all head and neck tumors.[1] It is more frequently seen in south east Asia and African countries compared to western world. It is slow growing but locally aggressive and highly vascular tumor.[2] Surgical resection is the mainstay of treatment. However, recurrence risk with surgery alone is 25%-60%. Radiation alone has recurrence risk of 25% but it is not indicated due to long term risk of sarcomatous changes with radiation therapy. Surgical resection alone may not be successful due to high risk of intraoperative hemorrhage and in patients with large tumor size.[3] Various methods of reducing blood loss during surgery have been tried which includes arterial ligation, cryotherapy, electrocoagulation, hormonal therapy, injection of sclerosing agents, hypotensive anesthesia and embolization.[3,4] In this study we reviewed the cases of nasopharyngeal angiofibroma who underwent

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preoperative transarterial embolization with gelfoam and their outcome.

Material and Methods

We retrospectively reviewed and analyzed all medical and imaging records of 12 patients who had undergone preoperative transarterial embolization based on clinical and imaging suspicion of nasopharyngeal angiofibromas between April 2013 and August 2017. The study was approved by institutional review board. These patients were later confirmed to have angiofibroma by histopathology. Preoperative contrast enhanced CT scans (Siemens Somatom Perspective AS) of nasopharynx were obtained to assess the location, size, and extent of tumor (Fig. 1). Using right femoral arterial access diagnostic angiography (Phillips Allura Xper) was performed with selective catheterization of bilateral internal and external carotid arteries to assess the arterial blood supply to the tumor and collaterals to the intracranial circulation. Microcatheter was then introduced into the guiding catheter with a coaxial microcatheter technique. Superselective micro-catheterization of the feeding artery was performed. Embolizing agent was injected after reaching the most distal point of the feeding artery to avoid reflux of the embolizing material. Preoperative embolization was performed within 48 hours prior to surgery. Endoscopic or open surgical technique or combination of two techniques were used in surgery of these patients. Surgeries were performed under general anesthetics and anesthetists involved in surgery quantified and recorded the amount of blood loss. Tumor stage was categorized based on preoperative imaging and peroperative findings. Patient s medical records were reviewed for information regarding demographics, presenting complaints, tumor stage, arteries embolized, embolizing agent used, amount of blood loss and surgical techniques used.

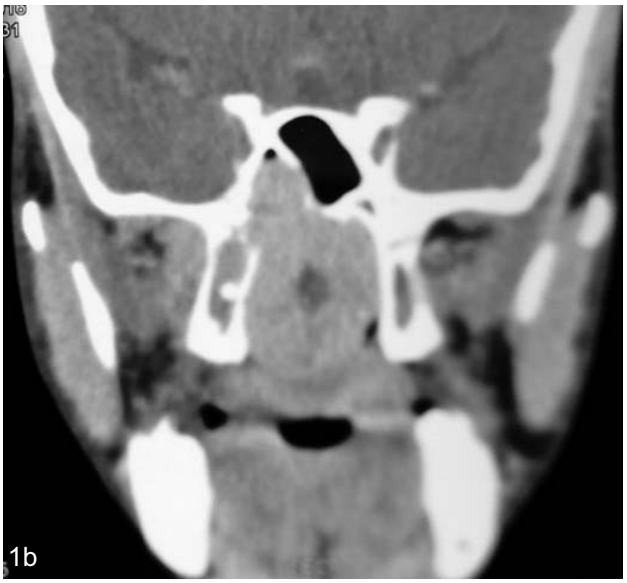


Figure 1a,b: Axial **(a)** and coronal **(b)** contrast enhanced CT images showing enhancing soft tissue mass in nasal cavity extending into nasopharynx, pterygopalatine fossa and infratemporal fossa. The mass is causing deviation of nasal septum to the right.

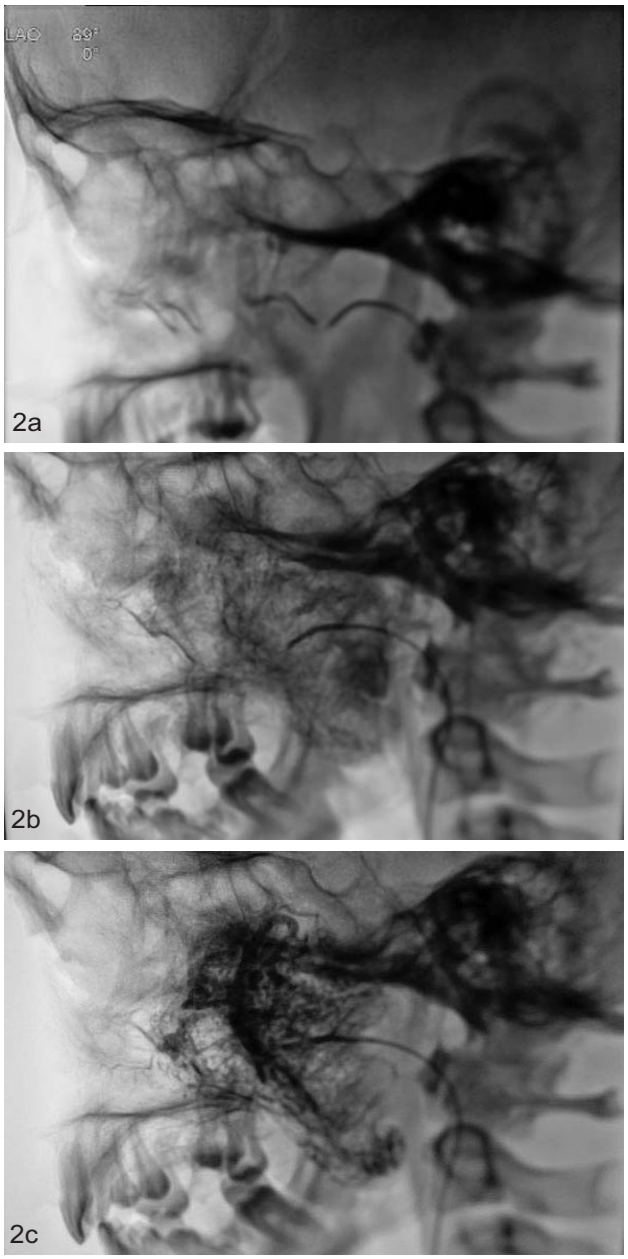
Results

Our study included twelve male patients most (75 %) were below 20 years (range 10-44). Nasal obstruction and epistaxis were the most common symptoms with nearly 83% of patients presenting with one of these two symptoms (Tab. 1). Eight of the lesions were on right side and nearly 83% of the patients were either stage I or II (58 % stage I and 25 % stage II). All patients were embolized using gelatin particles. Ipsilateral internal maxillary artery was embolized in all cases except for one in whom bilateral internal maxillary artery as well as right ascending pharyngeal artery was embolized (stage IV lesion). All the lesions showed tumor blush initially and after embolization

Presenting complaint	Number of patients (Percentage)
Nasal obstruction	10 (83%)
Epistaxis	10 (83%)
Nasal discharge	3 (25%)
Snoring	1 (8.3%)
Proptosis	1 (8.3%)

Table 1: Presenting complaint

tumor blush was absent in all the case (Fig. 2). No significant complications observed in any of these patients.



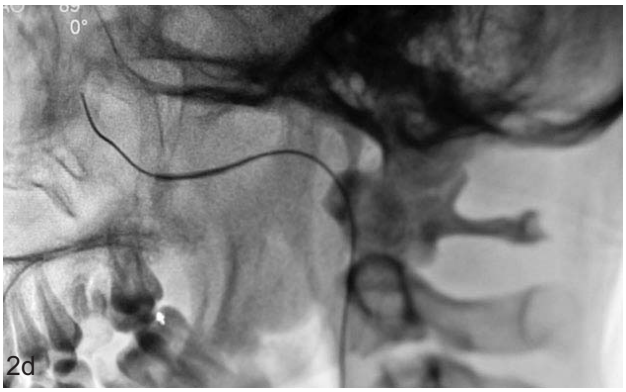


Figure 2a,b,c,d: Conventional angiographic images. **(a)** Showing catheter in internal maxillary artery, **(b, c)** showing tumor blush after contrast injection **(d)** post embolization of nasopharyngeal angiofibroma with gelatin sponge shows absence of tumor blush.

During post-embolization surgery of the angiofibromas, mean blood loss was found to be 583 ml (range 100-1300 ml). Mean blood loss was seen to be higher in patients who underwent open surgery or combined open and endoscopic surgery compared to those who underwent endoscopic surgery alone (644 ml vs 400 ml) (Tab. 2). Lowest blood loss during surgery was seen in stage II patients with maximum blood loss in stage IV patient (Tab. 3). Excessive bleeding in stage IV lesion was due to profuse bleeding from feeder branches of internal carotid artery, which were not appreciated pre-operatively.

Surgical approach	Number of patients (%)	Mean operative blood loss (range) in ml
Endoscopic surgery	3 (25%)	400 (100-800)
Lateral rhinotomy	7 (58.3%)	629 (100-1300)
Combined endoscopic surgery and lateral rhinotomy	2 (16.7%)	700 (600-800)

Table 2: Surgical approach and blood loss

Fisch Stage	Number of patients (%)	Mean operative blood loss (range) in ml
I	7 (58.4%)	621 (100-850)
II	3 (25%)	183 (100-300)
III	1 (8.3%)	800
IV	1 (8.3 %)	1300

Table 3: FISCH stage and mean blood loss

Discussion

Surgery is treatment of choice for angiofibroma, as radiotherapy, another treatment option, is not be the preferred treatment because of its late effect. Radio-

therapy is reserved for advanced lesions with intracranial extension these days. Angiofibroma is a highly vascular tumor, thus intraoperative bleeding is the major complication, more with the higher stages. Patients who are at high risk of bleeding often undergo various measures for blood loss reduction like hypotensive anesthesia, transantral ligation of the internal maxillary artery, use of cryoprobe, hormonal therapy and pre-operative embolization (direct or transarterial).[4]

Common surgical approaches for conventional techniques include transpalatal, transmaxillary and lateral rhinotomy. Minimally invasive endoscopic surgery is preferred when the lesion is confined to the nasopharynx, nasal cavity, and sphenoid sinus with minimal extension into the pterygopalatine fossa.[5] Retrospective study by Huang et. al. (n=162) showed significant reduction in intraoperative mean blood loss with use of endoscopic techniques compared to open surgery (1,100 vs. 800 ml, p=0.017) without significant difference in their recurrence rate (28.3% vs 33.3%, p=0.513) for 6 months.[6] Duration of surgery and amount of blood loss is markedly reduced in endoscopic surgery due to accurate anatomical assessment of the space occupied by the tumor and better control of bleeding.[5] Although strong conclusion cannot be derived from our study due to small sample size, but higher mean blood loss was seen in patients who underwent either open surgery or combined endoscopic as well open surgery compared to those who underwent endoscopic surgery (644 ml vs 400 ml). Except for stage I, in our study also mean blood loss during surgery was seen higher in higher stages of angiofibroma. Higher blood loss was seen in stage I patients compared to stage II patients, as most of these patients in stage I underwent open surgery while most patients in stage II underwent endoscopic surgery. In one of the patients with stage I disease, tumor was adherent to nasal cavity wall and endoscopic surgery had to be combined with open surgery. The tumor could be resected only piece meal. So besides stage, type of surgery and other characteristics of tumor can also influence the amount of blood loss.

Arterial ligation is another method employed to reduce blood loss. Internal maxillary artery is most frequently providing vascular supply to the tumor with additional vascular supply from blood vessels originating in the ascending pharyngeal artery or internal carotid artery. External carotid clamping can help in intraoperative control of bleeding during the resection of nasopharyngeal angiofibromas.[5] Still, the amount of intraoperative blood loss can be unpredictable with arterial ligation as previously unapparent vessels open up supplying the lesion and thus negating the effect of ligation. There was significantly higher blood loss in angiofibroma patients undergoing ligation compared to those undergoing preoperative embolization in a study done by Economou et al.[7] Hypotensive anesthesia has also been used to reduce intraoperative blood loss.[4]

With advent of transarterial embolization, preoperative embolization rapidly gained its usefulness in preoperative embolization of vascular tumors. Embolizing agents frequently used for transarterial embolization include particles like gelatin sponge and polyvinyl alcohol while for direct tumoral embolization liquid embolizing agents are frequently used like ethylene vinyl alcohol and cyanoacrylate glue. Case reports of use of microfibrillar collagen powder as embolizing agent for transarterial embolization of angiofibroma has also been published. However, gelatin and polyvinyl alcohol particles are most commonly used agent for transarterial embolization.[8,9,10] Preoperative embolization procedure should be carried out 24 - 72 hours prior to embolization. Another school of thought is embolization should be reserved only for larger tumors. Some studies have shown similar volume of intraoperative bleeding in patients with and without embolization with higher tendency to relapse in patients undergoing embolization. Increased risk of relapse may occur due difficulty in identification of the complete extent of surgical margins due to reduced tumor size.[5] However, the volume of median estimated blood loss was significantly lower in the embolization group compared to non-embolization group (675 ml vs. 1775 ml, p = .0124) in a study done by ungkanont et al which is comparable to our study (560 ml).[11] This is much lower compared to patients who underwent surgery without embolization in study by Siniluoto et al.[12] In a retrospective study (n=74), outcome of 32 patients who went preoperative transarterial embolization with gelatin and/or polyvinyl alcohol particles when compared with 42 patients who underwent endoscopic surgery without preoperative embolization also showed significantly lower blood

loss with preoperative embolization in higher stages of angiofibroma.[13] In another small retrospective study (n=10), surgical outcome between five patients who underwent preoperative embolization with gelatin sponge particles and five patients who did not undergo preoperative embolization for nasopharyngeal angiofibroma, was compared in terms of intraoperative blood loss and recurrence. It showed that embolization reduced the intraoperative mean blood loss at primary surgery (1510 ml vs. 510 ml). Seven reoperations were performed on four patients in non-embolization group due to tumor recurrence with mean blood loss of 4065 ml during reoperations while no recurrence was seen in the pre-operatively embolized patients.[12] The results indicate that embolization is effective in reducing intraoperative blood loss and contribute to improved surgical results. However, retrospective single center study by Punj et al. (n=56) showed trend towards higher mean blood loss with increasing stage of the disease. No significant difference in blood loss was seen between patients who underwent preoperative embolization and those who didn t (1,580.43 vs. 1,002.42 ml, p=.0771). Although most patients with higher stage underwent preoperative embolization, no significant difference was also seen in intragroup analysis.[14] The sample size of the patients was too small to see the difference between the two groups even if any significant difference existed. Although most studies show usefulness of preoperative embolization particularly in angiofibromas of advanced stages, larger studies are needed to better evaluate its role in patients undergoing surgery for angiofibroma.

In a study (n=50) comparing transarterial embolization using particulate material (n=39) with direct tumoral embolization using liquid embolic agent comprised of ethylene vinyl alcohol copolymer (n=11), direct tumoral embolization group showed significantly lower blood loss.[9] Though transarterial embolization can reduce intraoperative bleeding, shorten surgical duration, maximize the rate of excision ultimately decreasing morbidity and mortality, complete devascularization of advanced angiofibroma is difficult to achieve with transarterial embolization alone. Large complex and advanced angiofibroma can be operated with little intraoperative blood loss by using combined transarterial and direct tumoral embolization. Embolizing feeding vessels of internal carotid artery supply using particles by traditional techniques can lead to serious consequences due to reflux of particles into the intracranial circulation. The intratumor injection of glue can provide reliable higher degrees of devascularization than transarterial particulate embolization alone.[13]

The most important risk of embolization is occlusion of the ophthalmic or middle cerebral artery through the collateral circulation.[5] Thromboembolic complications such as central retinal artery occlusion leading to loss of vision,[15] cerebral infarction leading to hemiplegia, aphasia[16] and cranial nerve palsies[17] and radiation induced alopecia[18] have been reported. No such complications was seen in our study.

Conclusions

Angiofibroma is a very vascular tumor with amount of intraoperative blood loss making its surgery challenging. This can be greatly minimized with preoperative embolization. Although preoperative, direct tumor embolization and combination of transarterial and direct tumor embolization has been shown to be superior in controlling intraoperative blood loss in patients undergoing surgery for angiofibroma, transarterial embolization is still a safe and effective method. Amount of blood loss, besides use of preoperative embolization also depends upon stage as well as surgical technique employed in resection of the tumor.

Conflict of Interest: None declared by Authors

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