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ORIGINAL RESEARCH

# Exclusively endoscopic surgery for juvenile nasopharyngeal angiofibroma

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**OBJECTIVE:** To present the indications of nasal endoscopic surgery for treating juvenile nasopharyngeal angiofibroma (JNA).
**STUDY DESIGN:** Chart review.
**MATERIALS AND METHODS:** Twelve patients underwent nasal endoscopic surgery exclusively to resect JNA from January 2001 to June 2004. According to the classification of Andrews et al, eight patients were stage I and four patients were stage II.
**RESULTS:** The follow-up was between five and 42 months, and no patient has shown a residual tumor or recurrence to date.
**CONCLUSION:** In JNA stages I and II, the endoscopic approach was effective without preoperative arterial embolization. There were no residual tumors or recurrence in this study.
**SIGNIFICANCE:** It seems to be appropriate to reevaluate the surgical limits of endoscopic surgery for resecting JNA.


Juvenile nasopharyngeal angiofibroma (JNA) is a relatively unusual vascular neoplasia, which has benign histology but is locally invasive; it occurs almost exclusively in male adolescents, representing less than 5 percent of all head and neck tumors.[1]

Juvenile nasopharyngeal angiofibroma arises at the upper margin of the sphenopalatine foramen and is shaped by the trifurcation of the palatine bone, the horizontal wing of the vomer, and the root of the pterygoid process of the sphenoid bone. It grows backwards into the nasal cavity and maxillary sinus, upwards into the sphenoid, laterally toward the pterygopalatine fossa, and toward the infratemporal fossa, via the pterygomaxillary fissure.[1-3]

In most series,[2] intracranial invasion ranges from 4.3 percent to 11 percent, and the most frequent invasion routes are the infratemporal fossa, through the floor of the medium cranial fossa; the pterygomaxillary fissure, through the foramen rotundum into the cavernous sinus; the sphenoid upper wall, toward the cavernous sinus and the sella turcica; and the pterygopalatine fossa, through the pterygoid canal.[4] The tumor usually remains extrameningeal.[2,3]

The most usual symptom is unilateral nasal obstruction evolving to total nasal obstruction, with recurrent epistaxis varying in frequency and intensity. The otolaryngological examination reveals a mass with a smooth, hard, reddish-gray surface, usually filling the nasal fossa and nasopharynx. In the most advanced cases, deformity of the nasal dorsum, facial asymmetry, and proptosis, either with or without ophthalmoplegia, can be observed.[2]

The epidemiological history and otolaryngological examination, along with imaging examinations such as computed tomography (CT) (highlighting the enlargement of the sphenopalatine foramen)[1] and magnetic resonance imaging (MRI), usually enable a correct diagnosis, preventing exposure of the patient to the unnecessary risk of severe hemorrhage during biopsy.[5]

Angiography will confirm vascularization of this tumor. The main arterial supply comes from the ipsilateral internal maxillary artery, a branch of the external carotid artery, with occasional additional supply from branches of either the ipsilateral internal carotid artery or contralateral external carotid artery.[6]

Some authors have classified JNA on the basis of its location and extension. Currently, the standard classification is that of Andrews et al[7] (Table 1).

Surgery is the currently accepted treatment for JNA. Formerly, other methods were used, including hormone therapy, chemotherapy, and radiation. Today, these modalities are used only as occasional complementary treatment.[1,2,6]

The surgical approach depends on the tumor location and extension, as well as on the experience of the surgical team. The approaches include transpalatine, medial maxillotomy (via degloving or lateral rhinotomy), Le Fort 1, infratemporal, and more recently, video-assisted nasal endoscopic surgery.[1,2,4-6,8-12]

Most authors limit nasal endoscopic resection to those tumors restricted to the nasal cavity and paranasal sinuses,

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**Table 1**
**Staging system for juvenile nasopharyngeal angiofibroma according to Andrews et al[7]**

| Stage | Description |
|---|---|
| I | Tumor limited to the nasopharynx and nasal cavity, bone destruction is negligible or limited to the sphenopalatine foramen. |
| II | Tumor invading the pterygopalatine fossa or maxillary, ethmoidal and sphenoid sinuses; with bone destruction |
| III | Tumor invading the infratemporal fossa or orbital region: (a) without intracranial involvement and (b) with extradural intracranial involvement (parasellar) |
| IV | Tumor with intradural intracranial involvement: (a) without or (b) with infiltration of cavernous sinus, pituitary fossa, or optic chiasma |

with minimal extension toward the pterygopalatine fossa (stage II).[8] However, Carrau et al[9] observed that when the pterygopalatine or infratemporal fossae are involved, the tumor may be treated exclusively via nasal endoscopy.

In our opinion, it is pertinent to review our experience and to define the limitations of the endoscopic technique for JNA resection.

## MATERIALS AND METHODS

### Patients

Twelve patients underwent JNA removal by nasal endoscopic surgery exclusively, between January 2001 and May 2004. After approval by the Santa Izabel Hospital Institutional Review Board, the medical records of these patients were reviewed to analyze the operative course and outcome.

### Surgical Technique

All patients underwent general anesthesia. Cotton pledgets soaked in 1:2000 Xylocaine with adrenaline were placed inside the nasal cavity for 15 minutes to obtain vasoconstriction of the nasal structures and tumor (Fig 1).

After removing the cotton pledgets, both nasal cavities were inspected carefully by means of a 30° telescope. Then a partial medium turbinectomy was performed to better expose the tumor. For stage I tumors, the posterior fontanel was identified, with subperiosteal dissection up to the sphenopalatine foramen, followed by medial traction on the tumor from its origin at this foramen and either cauterization or clipping of the sphenopalatine artery. For stage II tumors, after partial medium turbinectomy, the following procedures were performed: uncinectomy, ethmoidal bulla removal, and posterior ethmoidectomy as necessary; maxillary antrostomy; removal of the posterior wall of the maxillary sinus; and identification and dissection of either the sphenopalatine artery or internal maxillary artery as necessary, with cauterization or clipping. These procedures were followed by the subperiosteal detachment of the tumor from its insertions into the posterior septum, nasopharyngeal walls, and sphenoid sinus, along with cauterization of the additional blood supply. Whenever necessary, the anterior wall of the sphenoid sinus was removed to better expose the tumor for dissection. The lesions were pushed downwards toward the oropharynx and, with a mouth gag in place, were removed through the oral cavity (Fig 2).

Finally, the nasal cavity was reexamined to both remove any residual tumor and cauterize bleeding sites. Whenever appropriate, anterior or anteroposterior nasal packing was used or the bloody area was filled with Surgicel (Johnson & Johnson Gateway).

## RESULTS

The patients ranged in age from 9 to 22 years old. Eight patients were stage I, and four patients were stage II. The main symptoms were nasal obstruction and recurrent epistaxis (Fig 3).

The operating time ranged from 1.5 to 2.5 hours (mean operating time two hours). The intraoperative blood loss varied from 100 to 300 mL (mean blood loss 200 mL). No intraoperative or perioperative complications arose.

During the surgical procedures, no blood transfusion was necessary for the stage I patients. Three patients required

**Table 2**
**Patient characteristics**

| Stage | Number of patients | Blood transfusion | Nasal packing | Hospitalization period (mean) | Residual tumor | Recurrence |
|---|---|---|---|---|---|---|
| I | 8 | 0 | 3 | 33 hours | 0 | 0 |
| II | 4 | 1 | 4 | 54 hours | 0 | 0 |

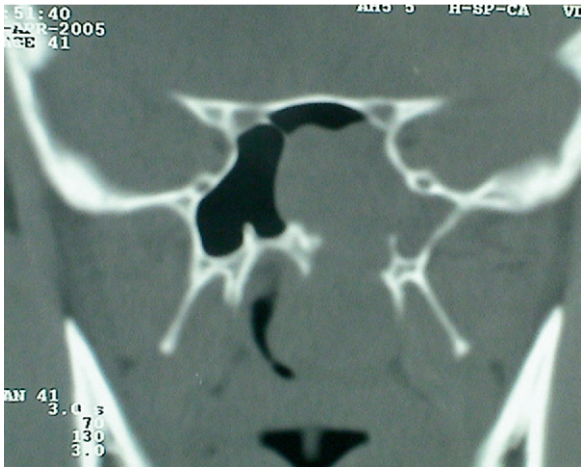

**Figure 1** CT scan in the coronal view showing opacification of part of the nasal cavity and the sphenoid sinus.

anterior nasal packing, which was removed after 48 hours, when they were released from the hospital. Five patients did not require nasal packing, although the bloody area was covered with Surgicel. They were released from the hospital after 24 hours (Fig 4).

Three stage II patients required anterior nasal packing, which was removed after 48 hours, when they were released from the hospital. The fourth patient required a blood transfusion during surgery owing to bleeding from the pharyngeal ascending artery; he required anteroposterior nasal packing, which was removed after 72 hours, when he was released from the hospital.

The mean hospital stay was 33 hours in stage I patients and 54 hours in stage II patients (Table 2). The pathology examination confirmed the diagnosis of JNA in all patients.

The follow-up period after surgery ranged from 12 to 60 months (mean follow-up 24 months). Otolaryngological and fiberoptic endoscopy examinations of the nose were performed at each visit, and CT was carried out at six and 24 months postoperatively. Six patients have

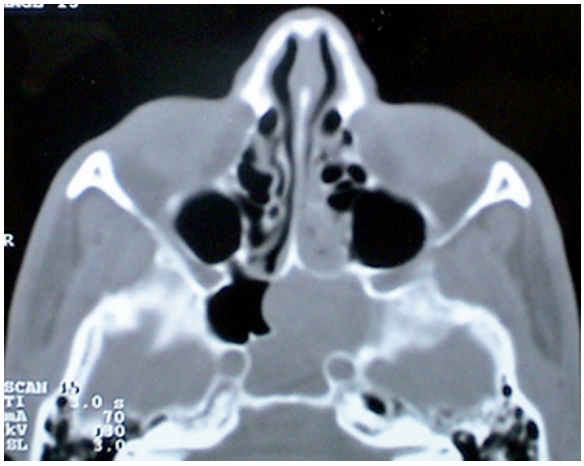

**Figure 2** Axial CT scan showing a JNA in the sphenoid sinus.

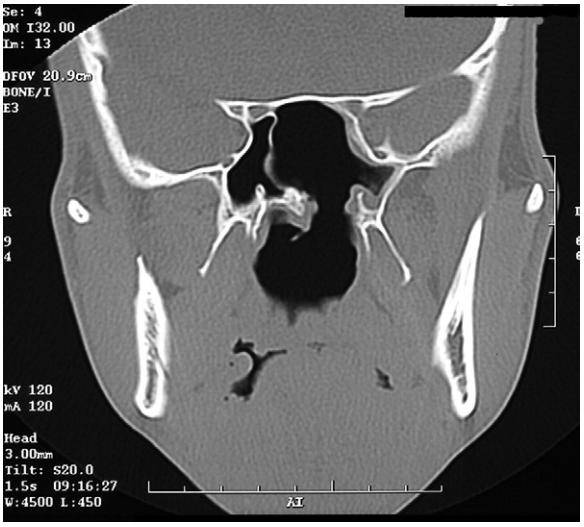


**Figure 3** Postoperative CT scan showing total resection of the tumor.

undergone two postoperative CT scans, and six patients have undergone one scan. No residual tumor or recurrence has been detected.

## DISCUSSION

Despite its benign nature, JNA grows aggressively, leading to bone destruction and invasion of the adjacent structures. It has a well-defined capsule, which enables manipulation and traction during dissection.[10] Currently, advances in technology, improvements in endonasal technique, and knowledge of the intranasal anatomy enable the use of nasal

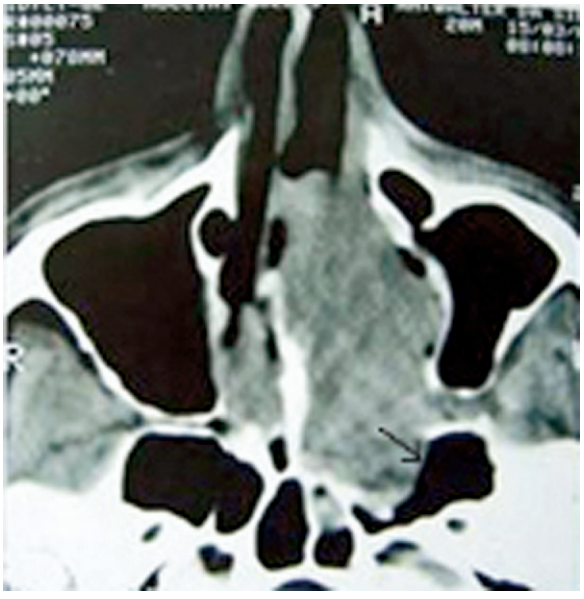

**Figure 4** Axial CT scan showing an angiofibroma in the nose and pterygopalatine fossa.

endoscopic surgery to remove some tumors that would traditionally have been extracted by using an external approach.

The surgical treatment of JNA is associated with a number of problems, including the trans-surgical risk of hemorrhage, difficulty with dissection, morbidity related to the involvement of certain anatomical sites, and risk of recurrence.[8] The main advantage of the endoscopic approach is the possibility of obtaining a magnified view of the lesion and related anatomical structures from multiple angles, enabling better identification of the interface between the lesion and soft tissues or adjacent bone structures, thus allowing a more accurate and complete dissection and better control of bleeding.[5]

These tumors occur almost exclusively in male adolescents, and about 40 percent of the maxillary vertical growth takes place after the age of 12 years.[13] Some of the factors that might limit the growth of the medium third of the face are detachment of both the soft tissues and periosteum at the medium third of the face, dissection of the palate mucoperiosteum, trauma affecting the nasal septum, facial osteotomies, and fixation with metal plates.[13] Therefore, a second advantage of endoscopic surgery is that it renders skin or mucous incisions, soft tissue detachment from the anterior wall of the maxilla, facial osteotomies, and bone removal unnecessary, causing less alteration in the growth of the medium third of the adolescent's face.[5] Experiments in rabbits[14] and observations of adolescent patients have shown the long-term effects of facial osteotomies on maxillary growth and dental sensation.[15] The endoscopic technique might prevent facial growth disturbance because no osteotomies are performed during the juvenile phase of facial growth.

Other advantages include a reduction in the duration of surgery owing to the absence of incisions and sutures, a reduction in the length of hospitalization (most patients are released from the hospital 48 hours after surgery), and the prevention of complications such as epiphora, dysesthesia, trismus, pain, and scars, which would occur with only some external approaches.[8,9,16,17]

One inconvenience of the endoscopic procedure is that only one hand can be used for tumor dissection. Our experience has shown that a skillful assistant surgeon is necessary; at times during the procedure, the surgeon must place traction on the tissue to be dissected and assist with vessel aspiration and cauterization. This so-called two-handed technique was described by May et al in 1990.[11]

Many studies have demonstrated a reduction in the estimated blood loss when embolization of the ipsilateral internal maxillary artery was performed 48 hours preoperatively.[1-6,8] However, Lloyd et al[16] verified that embolization increases the risk of incomplete excision, as a result of the reduced definition of the tumor border, especially when there is deep invasion of the sphenoid bone. They also believed that the use of preoperative embolization contributed to recurrence.[16] We do not use routine embolization, even in advanced stage III and IV tumors, because this procedure can obscure the tumor border, making complete resection more difficult. For good local control of the disease, bleeding must be controlled by precise exposure of the vascular borders of the tumor and its collateral vessels, and the multiangled view of the tumor using the endoscopic technique enables adequate dissection for bleeding control. However, most, but not all, experts embolize to minimize blood loss.

In Lloyd et al's report,[16] the time to recurrence ranged from four months to three years. Of the recurrences, 46.5 percent presented within 12 months of the initial surgery.[9,16]

The low recurrence rate (mean follow-up 24 months) with the endoscopic approach is attributable to the advantage of a multiangled view of the anatomical structures, making possible the effective, atraumatic dissection using a bipolar coagulation with very delicate manipulation of the tumor. Minimizing bleeding allows more precise tumor resection, thus minimizing the possibility of residual tumor. Our patients are still being followed.

More advanced tumors are more properly treated by using external approaches.[5] Nevertheless, combining endoscopic surgery with external approaches is another interesting possibility, which would allow better visualization of the lesion borders and facilitate total removal.[8,10]

## CONCLUSION

Our results confirm the effectiveness of nasal endoscopic surgery for removing juvenile nasopharyngeal angiofibroma when the tumor is restricted to the nasal cavity, rhinopharynx, and facial sinus, with minimal invasion of the pterygopalatine fossa. Although preoperative arterial embolization was not used, no residual tumor or recurrence was detected. We believe that it is appropriate to reevaluate the limits of endoscopic surgery for JNA resection.

## AUTHOR INFORMATION

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## FINANCIAL DISCLOSURE

None.

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