

## Surgery for juvenile nasopharyngeal angiofibroma with lateral extension to the infratemporal fossa



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### ABSTRACT

**Objective:** The study aimed to assess the usefulness of skull base surgery for large juvenile nasopharyngeal angiofibroma (JNA) with lateral extension to the infratemporal fossa.

**Materials and methods:** Eleven cases were enrolled for this study, and the mean age was 17.7 years old (range: 8–32). Six out of 11 cases underwent surgery as an initial treatment, and the other five underwent secondary surgery after initial surgery or radiotherapy in other institutions. The range of extension of tumor, feeding arteries, surgical approach, and treatment outcome were estimated.

**Results:** All tumors originated from the sphenopalatine foramen. Based on the imaging study, there was extension to the cavernous sinus observed in eight cases, as well as to the middle cranial fossa (8), orbit (4), and anterior cranial fossa (1). These tumors were diagnosed as Andrews' Stage IVa (3) and IVb (8). However, infiltration into the cavernous sinus was observed in one case only during surgery. Ten tumors were separated carefully from the cavernous sinus or dura and were accurately diagnosed as Stage IIIb. In all cases, the main arterial feeders of the JNAs were branches of the external carotid artery, which were embolized prior to surgery. However, 10 cases were also fed by branches of the internal carotid artery (branches of the ophthalmic artery), in which these arteries could not be embolized. Coronal skin incision (1) and a facial dismasking flap (9) were used, and in one case, wide lateral skin incision with temporary incision of the facial nerve was applied. The orbito-zygomatic approach and its modification was applied to all the cases. Fronto-lateral craniotomy was applied in four cases and lateral craniotomy in seven cases. Total resection was achieved in 10 cases and subtotal resection in one case. No mortality was noted in this series. Temporal trismus was observed in all cases which subsided gradually. Cheek numbness and facial palsy were observed in three and two cases, respectively.

**Conclusion:** Coupled with craniotomy, tumor removal was successfully carried out in 11 patients with JNAs, which showed large lateral extension. Our surgical strategy is a safe and effective approach for the removal of JNAs with infratemporal fossa extension.

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### 1. Introduction

Juvenile nasopharyngeal angiofibroma (JNA) is a rare benign tumor that primarily occurs in adolescents and young adults. It represents 0.05–0.5% of all head and neck tumors [1–3]. JNA grows

aggressively with a huge blood supply. The initial therapy is a surgery, and complete removal of the tumor is required.

Currently, endonasal endoscopic resection of JNA has become popular due to its low morbidity. However, surgical resection of a large JNA remains a formidable challenge for the surgeon because of its infiltrative nature and hypervascularity. Removal of JNAs with wide lateral extension is especially difficult by endonasal endoscopic surgery alone. Therefore, safe and total removal of such tumors still requires an extended skull base surgery using a wide surgical field. Moreover, JNAs usually affect adolescent males, so the surgeon must pay attention to cosmetic and developmental problems, such as facial deformities.

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**Table 1**  
Case series of this study.

| Case No | Age | Initial/secondary | Extension |    |          |    |          |    |    |         |          |    |    | Preoperative staging |     |
|---------|-----|-------------------|-----------|----|----------|----|----------|----|----|---------|----------|----|----|----------------------|-----|
|         |     |                   | Medial    |    | Anterior |    | Superior |    |    | Lateral | Inferior |    |    |                      |     |
|         |     |                   | NP        | ES | SS       | MS | OB       | AF | MF |         |          | CS | CV |                      | PPF |
| 1       | 12  | Secondary         | +         | +  | +        | +  | –        | –  | –  | +       | –        | +  | –  | –                    | IVb |
| 2       | 20  | Initial           | +         | +  | +        | +  | –        | –  | –  | +       | –        | +  | –  | +                    | IVb |
| 3       | 17  | Secondary         | +         | +  | +        | +  | –        | –  | –  | +       | –        | +  | –  | –                    | IVb |
| 4       | 8   | Initial           | +         | +  | +        | –  | –        | –  | –  | +       | –        | +  | –  | –                    | IVa |
| 5       | 13  | Secondary         | +         | +  | +        | –  | –        | –  | –  | +       | –        | +  | –  | –                    | IVa |
| 6       | 27  | Initial           | +         | +  | +        | +  | +        | –  | –  | +       | –        | +  | –  | +                    | IVb |
| 7       | 32  | Initial           | +         | –  | +        | –  | –        | –  | –  | +       | +        | +  | –  | –                    | IVb |
| 8       | 15  | Initial           | +         | +  | –        | –  | –        | –  | –  | +       | –        | –  | –  | –                    | IVa |
| 9       | 17  | Secondary         | +         | +  | +        | +  | +        | –  | –  | +       | –        | +  | –  | –                    | IVb |
| 10      | 15  | Initial           | +         | –  | +        | –  | –        | –  | –  | –       | –        | +  | –  | –                    | IVb |
| 11      | 19  | Secondary         | +         | +  | +        | –  | –        | –  | –  | –       | +        | –  | –  | –                    | IVb |

We performed surgery on 11 cases of large JNAs with wide extension to the infratemporal fossa. The purpose of this study was to evaluate the treatment outcome of our surgery for such large JNAs.

## 2. Materials and methods

From 2007 to 2012, we performed surgery on 11 cases of JNAs with wide extension to the infratemporal fossa (Table 1). All cases were male, and their mean age was 17.7 years (range: 8–32). Preoperative imaging, including contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI), was performed. In accordance with the study of Vasily et al., tumor extension other than lateral extension, that is, to the infratemporal fossa, was carefully assessed (Fig. 1; Table 1) [4]. The patients' profiles and their preoperative staging are shown in Table 1. Based on the imaging study, extension to the cavernous sinus was suspected in eight cases, middle cranial fossa in eight, anterior fossa in one, clivus in one, orbit in four, and infratemporal fossa in 11 cases. Therefore, three cases were diagnosed as Andrews' Stage IVa and eight cases as IVb (Tables 1 and 2).

Angiography showed all tumors being supplied by the internal maxillary artery. In addition, six tumors were supplied by the ascending pharyngeal artery, six by the facial artery, and 10 by the branches of the internal carotid artery (mainly from the ophthalmic artery). Embolization of the feeding arteries from the external carotid artery was carried out in all 11 cases at 24–72 h prior to

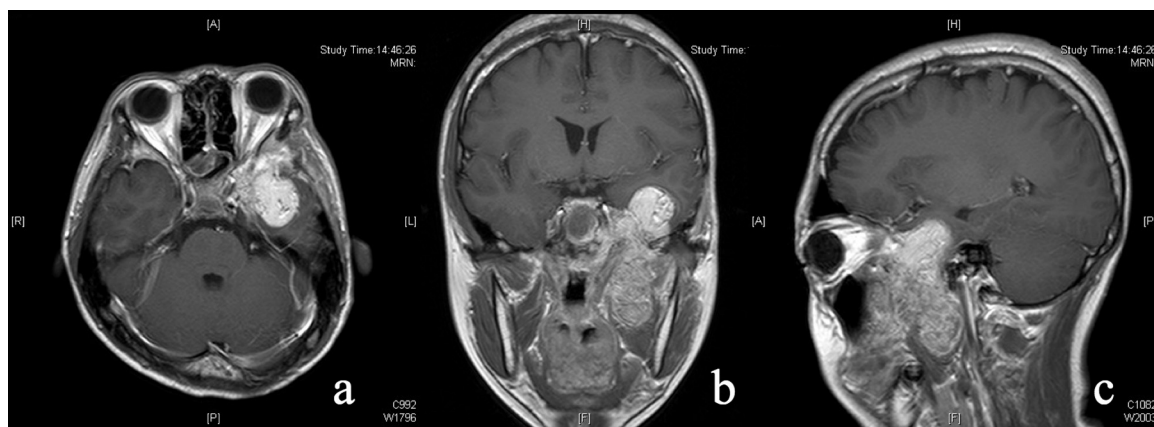
**Table 2**  
Staging of JNA (Andrews).

| Stage | Description  |
|-------|--|
| I     | Tumor limited to the nasopharynx and nasal cavity  |
| II    | Tumor invading the pterygopalatine fossa or sinuses  |
| III   | Tumor invading the infratemporal fossa or orbital region<br>(a) without intracranial involvement and (b) with extradural intracranial involvement  |
| IV    | Tumor with intradural intracranial involvement<br>(a) without infiltration of cavernous sinus, pituitary fossa or optic chiasma (b) with infiltration of cavernous sinus, pituitary fossa or optic chiasma |

surgery. The branches of the internal carotid artery were not embolized.

## 3. Results

All the patients underwent surgery using a wide surgical field (Table 3). In all the 11 cases, coronal incision was applied and a facial dismasking flap was added to nine cases (unilateral 8, bilateral 1). Because of wide extension to the base of the maxillary sinus and alveolar bone, temporary section of the facial nerve and wide lateral skin incision were performed in Case 6. Thus, a wide surgical field was obtained, and the nerve was sutured after tumor removal. The external auditory canal was kept intact in all cases. Regarding osteotomy of the facial skull, the orbito-zygomatic approach was basically applied. In Case 4, Le Fort I osteotomy



**Fig. 1.** A case of JNA with wide lateral extension developed in a 17-year-old boy (Case 9). (a) axial, (b) coronal, (c) sagittal image. The tumor originated from the sphenopalatine foramen and extended to the infratemporal fossa, as well as the inferior orbital fissure, orbit, foramen rotundum, internal carotid artery, cavernous sinus, and sphenoid sinus. The tumor also protruded into the middle cranial fossa and extended intracranially. Therefore, this case was diagnosed as IVb according to Andrews' classification.

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