Case report

Surgical approach of juvenile nasopharyngeal angiofibroma

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ABSTRACT

Background: Juvenile nasopharyngeal angiofibroma (JNA) is a histologically benign tumor of blood vessels but clinically malignant, with distinctive growth patterns, and required various surgical approaches. The tumor arises from superior posterior sphenopalatine foramen with nasal obstruction and recurrent epistaxis symptoms. **Purpose:** To discuss the best surgical approach regarding the JNA stage. **Case Report:** A 13-year-old boy came complaining of recurrent unilateral epistaxis, unilateral nasal obstruction, and swelling of the right cheek. Tumor had expanded from nasopharynx to anterior maxillary region and intracranial. **Clinical Question:** Is open surgery with a lateral approach the best choice for clearing up the tumor mass and preventing recurrency in JNA which had expanded to anterior maxillary area and intracranial? **Method:** Literature search was conducted through PubMed, ClinicalKey, Cochrane, and Google Scholar using keywords which were "juvenile nasopharyngeal angiofibroma", "open surgery", and "tumor recurrence", obtained 71 papers which were screened using the inclusion and exclusion criteria. **Result:** The primary treatment for JNA is surgery, and the surgical approaches vary from anterior, lateral, and inferior. The literature search obtained one retrospective cohort study complied with this case, which reported 33 patients with JNA. Interventions on 25 patients with lateral surgical approaches and 8 patients with other approaches. There were 3 patients with lateral approach intervention and 2 patients with other approaches, had JNA tumor recurrence. **Conclusion:** The lateral approach is the best approach for clearing up the entire tumor mass and preventing recurrency in JNA cases with expansion to anterior maxillary region and intracranial.

Keywords: juvenile nasopharyngeal angiofibroma, surgical technique, Weber Ferguson

ABSTRAK

Latar belakang: *Angiofibroma nasofaring belia (ANB) adalah tumor pembuluh darah yang secara histologis jinak tetapi klinis ganas, dengan pola pertumbuhan beragam dan membutuhkan teknik pendekatan pembedahan yang berbeda. Tumor berasal dari area superoposterior foramen sfenopalatina, mempunyai gejala klinik berupa sumbatan hidung dan epistaksis berulang.* ***Tujuan:*** *Menentukan tatalaksana pendekatan terbaik pembedahan ANB sesuai perluasan tumor.* ***Laporan Kasus:*** *Pasien laki-laki berusia 13 tahun dengan keluhan epistaksis berulang dari hidung kanan, hidung tersumbat, dan bengkak di daerah pipi kanan. Tumor sudah meluas ke nasofaring sampai ke intrakranial.* ***Pertanyaan Klinis:*** *Apakah pembedahan terbuka dengan pendekatan lateral merupakan pilihan terbaik untuk mengangkat seluruh massa tumor serta mencegah rekurensi, pada kasus ANB dengan perluasan ke area anterior maksila serta ke intrakranial?* ***Metode:*** *Pencarian literature menelusuri* Pubmed, Clinical Key, Cochrane, *dan* Google Scholar *menggunakan kata kunci "juvenile nasopharyngeal angiofibroma", "open surgery", dan "tumor recurrence" diperoleh 71 naskah yang selanjutnya disaring dengan kriteria inklusi dan eksklusi.* ***Hasil:*** *Terapi utama ANB adalah pembedahan dengan arah pendekatan yang bervariasi tergantung dari lokasi massa tumor, yaitu pendekatan dari anterior, lateral, atau inferior. Dari pencarian literatur diperoleh satu penelitian retrospektif yang*

melaporkan 33 kasus ANB, dimana 25 kasus dilakukan intervensi pendekatan lateral dan 8 pasien dengan cara pendekatan lainnya, dan didapati 3 kasus dengan pendekatan lateral dan 2 kasus dengan pendekatan lain mengalami rekurensi. ***Kesimpulan:*** *Pembedahan dengan pendekatan lateral merupakan cara pendekatan terbaik untuk mengangkat massa tumor sebersih mungkin dan mencegah terjadinya rekurensi pada kasus ANB dengan perluasan ke anterior maksila serta ke intrakranial.*

Kata kunci: *angiofibroma nasofaring belia, teknik operasi, Weber Ferguson*

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INTRODUCTION

Juvenile nasopharyngeal angiofibroma (JNA) is a tumor located in the area of the sphenopalatine foramen, commonly found in adolescent boys. JNA is a tumor with a frequency of 0.05% of all head and neck tumors, exclusively in male between the ages of 7-19 years and rarely more than 25 years.[1]

The etiology of JNA is not clearly understood. However, it is suspected to be associated with sex hormones. Observations showed tumor typically appears in adolescent boys and that the lesion often regresses after complete development of secondary sex characteristics. Some literatures suggested the possibility of tumors growth under the influence of circulation and sexual hormonal fluctuations during puberty.[1–6]

The triads of symptoms are nasal obstruction, nasopharyngeal mass, and epistaxis. Upon physical examination grayish red tumor lesion with smooth surface, sessile or polypoid, irregular and lobulated could be visible. Serous fluid or tympanic membrane retraction could be found on the ear examination.[1,7]

The most common tumor site is superior and lateral to the sphenopalatine foramen. Diagnosis is based on the location of the tumor and its growth pattern which could be seen using a CT scan with contrast. The superiority of MRI with contrast compared with CT scan is the ability to differentiate between tumors and surrounding tissue and the sensitivity to identify the invasion to intracranial region. Staging of tumor is based on CT scan results. There are four classification systems based on Session, Fisch, Chandler and Redkowski.[8–10]

These tumors are histologically benign, but has locally invasive growth patterns that can expand and cause destruction to the surrounding tissue and bone. The main treatment of JNA is surgery, which could be approached through anterior with lateral rhinotomy and midfacial degloving, lateral via fossa infratemporal, and inferior with trans palatal. The approach technique used depends on the location and size of the tumor. Preoperative embolization needs to be implemented to avoid bleeding complications during surgery.[1,11,12]

This case report aims to discuss the best possible surgical approaches regarding the JNA stages.

CASE REPORT

A 13-year-old boy came with a complain of recurrent nose bleed from the right nose for five months before admission. He also had painless lumps on the right cheek. The right nose was blocked with no secretions. He complained of blurring on the right eye for 3 months. There were no complaints of headache, postnasal drip, and hearing loss. There was no family history of similar

complaints. History of consuming alcohol and cigarettes were denied.

On physical examination, there was a mass filling the right nasal cavity. The face looked asymmetrical, the right side of the face seemed swollen. There were no lumps in the neck.

MRI of the head and neck showed an aggressive hypervascular solid mass filling the right nasal cavity, choana, nasopharynx, right maxilla, and right retroorbital sinus. It had extended into the intracranial-extra-axial in the right temporal fossa, right parasellar, intrasellar and suprasellar, and right prepontine cisterna, destructing bones in the regions mentioned above. There was encasement of the right internal carotid artery and obliteration of the right optic nerve, causing right eye proptosis.

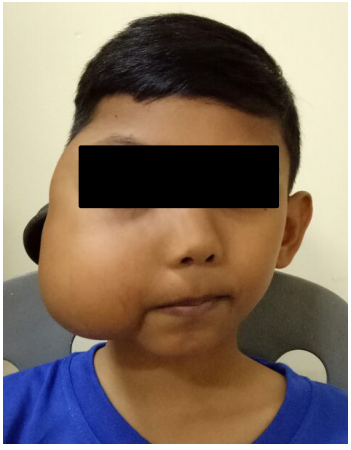

Figure 1. Patient with JNA before the extirpation procedure

The patient was diagnosed as stage IIIB JNA according to Radkowski classification, and was planned to be treated with embolization, followed by mass extirpation in collaboration with neurosurgeon.

The patient was treated with preoperative embolization and digital subtraction angiography (DSA) with the following results: successful embolization of hypervascular lesions with feeding artery from the left-right maxillary artery branches as well as superficial temporalis artery branches, medial meningeal arteries, accessory meningeal arteries, internal maxillary arteries, facial arteries, and right lingual arteries. Embolization of the right and left ascending pharyngeal artery was unsuccessful. Arterial feeding was still present from the sphenoid branch of the bilateral carotid artery, dominant from the right side. After embolization, there was no image of hypervascular lesions of most branches of the left and right external carotid artery. Hypervascular lesions were still present from the left-right carotid artery branches and from the branches of the right ascending pharyngeal artery.

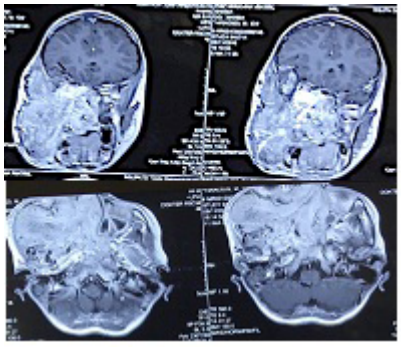

Figure 2. Head MRI

Surgery was performed with Weber Fergusson's incision approach. There was a tumor mass destroying the anterior wall of the maxilla; then a subtotal maxillectomy was performed to remove the tumor in the maxillary sinus and the right nasal cavity. From the evaluation, there were residual tumors infiltrating the intracranium, therefore we did intraoperative neurosurgeon consultation. The surgery was stopped because the bleeding had reached 3500 ml. Three pieces of roll tamponade were installed. After surgery, the patient was observed in the pediatric intensive care unit (PICU) with the following laboratory testing results: hemoglobin 2.8 mg/dL, hematocrit 8.5 mg/dL, leucocytes 19.120/uL, platelets 21,000/uL, prothrombin time 17.3 seconds (control 11 seconds), activated thromboplastin time 129.8 seconds (control 33.4 seconds), albumin 1.6 g/dL. Transfusion of 2000 mL PRC, 600 mL FFP, 20 units TC,

and 2 units albumin were given. Laboratory results post-transfusion showed the levels of hemoglobin 11.9 mg/dL, hematocrit 34 mg/dL, leucocytes 12,800/uL, platelets 269,000/uL, and albumin 3.74 g/dL. The results of anatomical pathology examination were histologically in accordance with JNA.

Eight days later, a second surgery was performed in collaboration with a neurosurgeon. The residual mass was visible on the medial and lateral walls of the nasopharynx that destroyed the sphenoid sinus wall and infiltrated the cranial base. Then, a mass extirpation was performed, and bleeding from the lateral wall of the nasopharynx was controlled with Surgicel and Spongostan. Four rolls sterile nasal pack were inserted. Intraoperative haemorrhage was 4500 mL. After surgery, the patient was observed in the PICU with laboratory results of hemoglobin 7.66 mg/dL, hematocrit 23.7 mg/dL, leucocyte 8.690/uL, platelets 40,000/uL. Transfusion of 2000 mL PRC and 15 units TC was given. Laboratory results post-transfusion showed hemoglobin 11.2 mg/dL, hematocrit 34.3 mg/dL, leucocytes 10,700/uL, platelet 140,000/u.

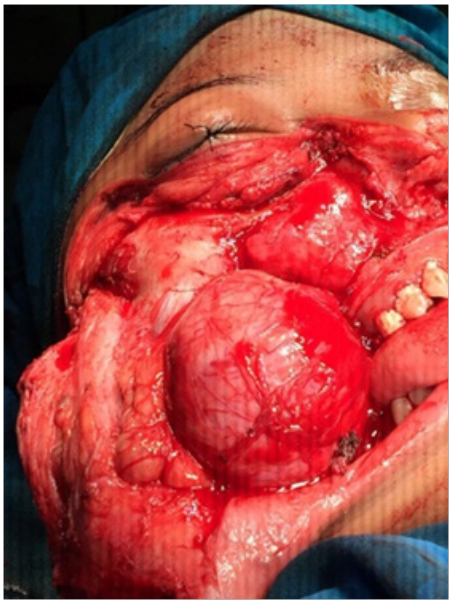

Figure 3. Weber Ferguson incision

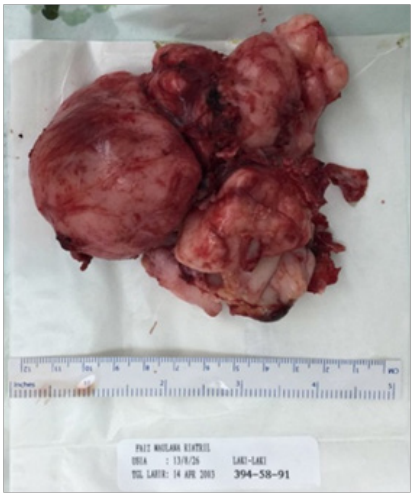

Figure 4. Tumor mass

In the ward, there was still blood oozing from the surgical site. Postoperative nasopharyngeal CT scan were performed with the following result: Postoperative nasopharyngeal status, compared with previous head MRI, there was still visible hypervascular solid mass filled the nasal cavity, choana, nasopharynx, oropharynx, maxillary right-ethmoid-sphenoid sinus, right retroorbital causing proptosis of the right ocular bulb, extending into the intracranial in the right temporal fossa, parasellar, intrasellar, suprasellar, to the right prepontine cisterna, destroying the right maxillary sinus wall, ethmoid sinus, sphenoid sinus, right orbital cavity wall, right-wing sphenoid, right temporal bone, and right clivus.

Tampon was extracted on day 7th, but there was still blood oozing. Tracheostomy was performed to maintain upper airway patency and to anticipate possible difficult extubation. The surgery was continued with ligation of the right external carotid artery. From observation there was still blood seeping. The neurosurgeon covered the bleeding site with Surgicell Fibrillar and Beriplast.

Patient was treated with radiation with a dose of 41Gy for 19 times. After the radiation, there was no more bleeding.

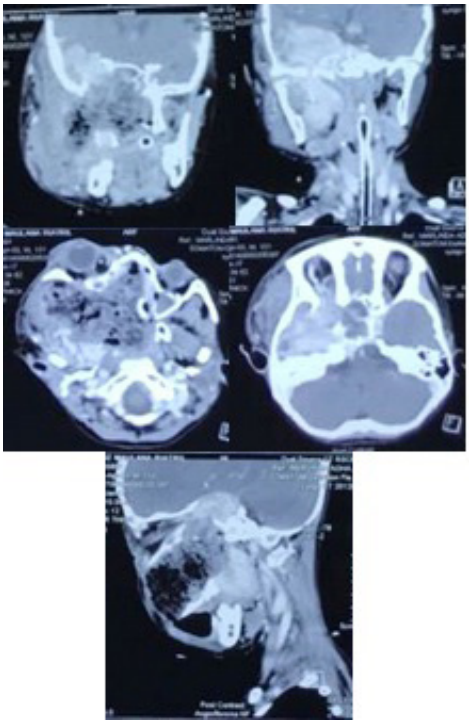

Figure 5. CT scan of nasopharynx post extirpartion

CLINICAL QUESTION

Is open surgery with a lateral approach the best choice for clearing up the tumor mass and preventing recurrency in JNA which had expanded to anterior maxillary area and intracranial?

METHOD

A literature search was conducted through 4 search engines: Pubmed, Clinical Key, Cochrane, and Google Scholar with keywords "juvenile nasopharyngeal angiofibroma" AND, "open surgery", AND tumor recurrence.

We found 71 papers after searching with the keywords. We screened the papers using the inclusion and exclusion criteria. The inclusion criteria were: clinical study, suitable to clinical questions, therapeutic study, and a thorough follow-up for tumor recurrence. The exclusion criteria were studies that inconsistent with the study design.

RESULT

The result obtained after screening and searching full texts was one study by Muhammad et al.[11] with a retrospective cohort study design. They conducted a study with 34 male patients with JNA. Surgical interventions were performed on 25 patients with lateral surgical approaches and 8 patients with other approaches, and one patient was treated by radiotherapy. The duration of follow-up was one year. There were 5 patients, which 3 patients with lateral approach intervention and 2 patients with other approaches, had tumor recurrence. The absolute risk reduction value was 0.13. The number needed to treat (NNT) score obtained from this study was 7.7.

They concluded that lateral approach decreased tumor recurrence rates in patients with JNA compared to other approaches.[11]

DISCUSSION

The diagnosis of JNA is based on history, physical examination and supporting investigations. From the history, our 13-year-old male patient, complained of recurrent nosebleed from right nose for five months prior to admission with congestion on right nose and swelling of the right cheek. On physical examination, the right nasal cavity was found obstructed by tumor mass. The face looked asymmetrical, and the right side gravely swollen.

Head MRI examination revealed JNA stage IIIB according to Radkowski classification (extensive intracranial extension with or without extension into the cavernous sinus).[1,10]

Nicolai et al.[1] stated that preoperative embolization is recommended as a standard procedure to reduce blood loss during surgery, thereby allowing total excision, reducing complications and minimizing tumor residues. The aim is to reduce the blood supply to the

tumor. Huang et al.[13] conducted a study with the mean blood volume lost during surgery in patients who underwent preoperative embolization of 200-870 mL, while without preoperative embolization of 500-2500 mL. The embolic material might be temporary or permanent. Temporary embolization usually used an autologous blood clot, gelatin foam, or collagen which can be maintained within the body for 24 hours for autologous blood clot, and 3-6 weeks for gelatin foam. For permanent embolization, it can be found in various forms such as liquids, particulates, coils and balloons. The aim of temporary embolization is to reduce the amount of intraoperative bleeding.

Surgery was the treatment of choice for this patient. Nicolai P et al.[1] suggested surgical approach to reduce morbidity and recurrence rates in patients.

Determination of the surgical approach is based on tumor stage and size. Small tumors (stage IA, IB, IIA, IIC) can be treated with a transnasal or a transpalatal approach. Larger tumors (stage IIIA and IIIB) can be treated with lateral or midfacial degloving rhinotomy approach. More extensive tumor size is associated with high morbidity. However, limited removal of tumor could lead to high recurrence.[11]

Yi et al.[18] (2013) described a simplified classification system and management option for juvenile nasopharyngeal angiofibroma, into 3 types: Type I: Tumor localized in the nasal cavity, paranasal sinus, nasopharynx, or pterygopalatine fossa. The transnasal cavity approach with endoscopic guidance is suitable for this type. Type II: The lesion extends into the infratemporal fossa, cheek region, or orbital cavity, with anterior and/or minimal middle cranial fossa extension but dura mater is still intact. The transantral-infratemporal fossa-nasal cavity combined approach is the treatment of choice for this type. Type III: is a calabashlike, the complete removal is challenging because massive tumor lobe in the middle of cranial fossa. A combined extracranial and intracranial approach is often needed. Radiotherapy is useful for treating the residual intracranial part.

The surgical approach used on this patient was Weber Ferguson's approach because the mass has extended anteriorly (nasopharynx and nasal cavity), superiorly (right sphenoid sinus, extra axial intracranial - in the right temporal fossa), medially (right retro orbital), and laterally (posterior wall of right maxillary sinus); since this surgical approach could expose the masses more extensively.

JNA cases with intracranial extension could be treated with adjuvant treatment: hormonal, flutamide, and radiation therapy. This patient was treated surgically to remove the tumor mass in the nasopharynx and to reduce tumor mass volume. The treatment was followed with radiation because there was residual mass of the intracranial tumor left.[11]

A study by Thakar et al.[14] showed that giving preoperative flutamide as adjuvant therapy was useful in reducing mass volume in JNA. Flutamide is a nonsteroidal androgen antagonist, with no side effects of suppressing testosterone hormone secretion. Giving flutamide to 20 patients (15 post-pubertal patients and 5 prepubertal patients) with advanced stage of JNA (Radkowski stage IIB - IIIB) for 6 weeks was found to reduce the mass volume up to a maximum of 40% in post-pubertal patients so that the differences in prepuberty and post-pubertal patients were significant in this study.

Chee YE et al.[15] described the importance of bleeding control during surgery to avoid possible side effects such as hypothermia, hypotension, and hypovolemic shock. They stated that an intraoperative transfusion is required if the intraoperative hemoglobin reaches 7 mg/dL. Surgery should be discontinued when hemoglobin is 3.5 mg/dL as it may cause hypoxia in the brain and

tissues. When our patient was on surgery, and the bleeding reached 3500 mL, and his hemoglobin during the operation was down to 4 mg/dL, the surgery was discontinued. The injuries then were treated with guiding suture, then three rolls of nose pack were placed on the patient's right nose.

Cryosurgery treatment also becomes an option for JNA management. From the case reports by Smith et al.[17] they used cryosurgery with hypotensive anesthesia on 2 similar cases with bleeding of 80 ml. The cryosurgery could be a procedure that prevented the massive intra-operative bleeding.

Gomaa et al.[8] stated that CT scans or MRI with contrast could be performed three to five days postoperatively to identify of possible recurrence. In this patient, a CT scan of the nasopharynx was performed by contrast five days postoperatively for evaluation; there was still a visible hypervascular solid mass filling the nasal cavity, choana, nasopharynx, oropharynx, right maxillary-ethmoid-sphenoid sinus, right retroorbital causing right ocular bulb proptosis, extending into intracranial in right temporal fossa, parasellar, intrasellar, suprasellar, until right prepontine cisterna, which destroyed the right maxillary sinus wall, ethmoid sinus, sphenoid sinus, right orbital cavity wall, right sphenoid wing, right temporal bone, and right clivus.

Nicolai et al.[1] recommended radiation as an adjuvant treatment in unresectable tumors, residual tumor or extension into intracranium. Garca et al.[16] proposed that adjuvant radiation therapy should be performed in the case of non-resectable intracranial lesions, at a dose of 35-45 Gy. In tumors with intracranial extension, the radiation should be done with a dose of 41 Gy 19 times.

In this case, the patient did a routine follow-up to the ENT oncology clinic every month after the mass extirpation. Examination to assess recurrence was done by MRI examination every 6-8 months for at least 3 years after extirpation.[9]

There are 3 goals of surgery for JNA: (1) resect the tumor completely, with preservation of major neurovascular structures; (2) minimize morbidity; and (3) avoid the need for radiation therapy. A good planning and best approach based on imaging and vascularity should be attempted to accomplish these goals. This is especially important in large tumors with extension into multiple areas.[19]

JNA is histologically benign but clinically malignant tumors, with diverse growth patterns and requiring various surgical approach techniques. JNA's primary treatment is surgery, including anterior, lateral, and inferior approaches. At an advanced stage of JNA with a large tumor mass, surgical approach that can expose the tumor is necessary to clear up the tumor mass and to prevent recurrency.

Table 1. Critical Appraisal[2]

Category	Questions	Answer
Validity	Was the assignment of patients to treatments randomised?	No
	Were the groups similar at the start of the trial?	No
	Aside from the allocated treatment, were groups treated equally?	Not clearly stated
	Were all patients who entered the trial accounted for? – and were they analysed in the groups to which they were randomised?	No
	Were measures objective or were the patients and clinicians kept "blind" to which treatment was being received?	No

Importance	How large was the treatment effect?				RRR:0.52 ARR:0.13 NNT:7.7
	Yes		Tumor recurrence		
			No		
	Open surgery lateral approach	Yes	3	22	25
		No	2	6	8
			5	28	33
Applicability	Is my patient so different to those in the study that the results cannot apply?				No
	Is the treatment feasible in my setting?				Yes
	Will the potential benefits of treatment outweigh the potential harms of treatment for my patient?				Yes

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