The Push-Pull Technique in the Management of Giant JNAs

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Abstract
Objectives: This communication describes a technique for endoscopic excision of juvenile nasopharyngeal angiofibroma (JNA) with very large infratemporal and parapharyngeal extensions without resorting to open surgery. Our experience, results and pitfalls are discussed.

Study design: A prospective study in which a new surgical technique was used in 8 cases with large JNAs.

Methods: An incision approximately 1 inch long is made in the upper gingivo-buccal sulcus. An assistant introduces the index finger through this incision to ‘push’ the tumour towards the nasal cavity while the operating surgeon applies a simultaneous ‘pull’ on the extension endoscopically. This facilitates delivery of the extension into the nose for final removal.

Results: Five patients are completely free of tumour and three patients (Fisch IV B) have a residual tumour in the cavernous sinus/orbit alone.

Conclusion: Giant JNAs with large lateral extensions can be excised endoscopically with significantly less post-operative morbidity.

Introduction
Endoscopic excision of juvenile nasopharyngeal angiofibroma (JNA) is now emerging as a viable alternative to open surgery in many centres the world over.1-8 Dissection of the tumour under direct vision, using the rigid Hopkins rod lens endoscope minimizes blood loss and in experienced hands complete tumour removal can be accomplished reliably and predictably, thereby decreasing recurrence rates. There is minimum post-operative morbidity with the endoscopic technique and unsightly incisions can be avoided. These are now well recognized advantages of the endoscopic technique.9-11

Pre-operative embolisation of the tumour performed by a competent interventional neuroradiologist is paramount and contributes significantly to a successful surgical outcome12-14 while minimizing blood loss.

We present the “push-pull” technique for excising very large extensions in the infratemporal fossa (ITF) and parapharyngeal region without resorting to an open approach such as the Weber-Fergusson or Mid-facial degloving approach (Casson-Bonanno-Converse).15,16

The “Push-Pull” technique has evolved gradually over 7 years of our experience with endoscopic excision of JNA.2 It must be emphasized that the technique though simple in its conception should be attempted by surgeons with experience in endoscopic excision of the tumour. A thorough understanding of the anatomy is the key to the successful performance of this operation.
Material and Methods

Sixty three cases of JNA were treated surgically at the Lokmanya Tilak Municipal Medical College and General Hospital between 1999 and 2006. 38 patients had extension of the tumour into the infratemporal fossa. Eight patients with very large JNA that extended into the infratemporal fossa were managed by the “push-pull” technique. All patients were males. Three of these patients had a Fisch Stage IV B tumour. All of them had very large lateral extensions through the pterygopalatine fossa (PPF), into the infratemporal fossa extending into the cheek. Two of the patients had an extension into the parapharyngeal region as well. These eight cases are the subject of this communication.

The patients have been followed up according to a standardized schedule for 14 months to 34 months, the mean duration of follow-up being 23 months (Table 1).

Surgical anatomy and technique

The advent of the Hopkins rod lens telescope has been a great asset in the surgical management of nasal and nasopharyngeal tumours which initially would require an open approach resulting in unsightly scars. With increasing expertise in endoscopic surgery, it is now possible to manage infratemporal and parapharyngeal extensions of such tumours without resorting to open techniques.

The infratemporal fossa is a potential space bounded laterally by the ramus of the mandible, superiorly by the greater wing of the sphenoid bone, anteriorly by the posterolateral wall of the maxilla and the pterygoid muscles and medially by the lateral pterygoid plate. Medially the ITF communicates with the pterygopalatine fossa via the pterygomaxillary fissure. The PPF is contiguous with the inferior orbital fissure and thus, the orbit.

The approach to the ITF has been described by various surgeons, the earliest being the one by Fairbanks-Barbosa in 1961. This was followed by the Fisch C and D lateral approaches, anterior approaches like the facial translocation, midfacial degloving, lateral rhinotomy and transantral maxillectomy approaches. However, these approaches are associated with numerous adverse effects like dental malocclusion, facial nerve dysfunctions, hearing loss, facial deformity, infraorbital nerve and lacrimal dysfunction.

The basic surgical steps in the endoscopic

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age(years)/Stage</th>
<th>Primary/Recurrent</th>
<th>Blood loss</th>
<th>Blood Transfusion</th>
<th>Follow up</th>
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</thead>
<tbody>
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<td>10 / M III A</td>
<td>Primary</td>
<td>450 cc</td>
<td>—</td>
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<td>2</td>
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<td>Recurrent*</td>
<td>800 cc</td>
<td>2 units</td>
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</tr>
<tr>
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<td>Primary</td>
<td>550 cc</td>
<td>—</td>
<td>27 months</td>
</tr>
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<td>14 / M III A</td>
<td>Primary</td>
<td>1200 cc</td>
<td>2 units</td>
<td>26 months</td>
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<tr>
<td>5</td>
<td>14 / M IV B</td>
<td>Recurrent*</td>
<td>2200cc</td>
<td>6 units</td>
<td>24 months</td>
</tr>
<tr>
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<td>8 / M IV B</td>
<td>Primary</td>
<td>1000cc</td>
<td>2 units</td>
<td>16 months</td>
</tr>
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<td>7</td>
<td>14 / M IV B</td>
<td>Primary</td>
<td>350 cc</td>
<td>—</td>
<td>16 months</td>
</tr>
<tr>
<td>8</td>
<td>20 / M III A</td>
<td>Primary</td>
<td>600cc</td>
<td>—</td>
<td>14 months</td>
</tr>
</tbody>
</table>

* No dissection in the infratemporal fossa had been done in the previous surgery.
Excision of JNA include cautery and subperiosteal dissection of the adhesions of the tumour to surrounding structures. This is done in the nose, nasopharynx, sphenoid and infratemporal fossa to free the tumour from all its extensions. The infratemporal extension can be accessed with a 0º telescope after the medial and posterolateral walls of the maxillary sinus are removed. Once the tumour is completely free of all its adhesions it is delivered transorally in one piece. These basic steps of surgery remain the same, irrespective of the size of the tumour.

Endoscopic excision of JNA: Surgical Technique

- Diagnostic endoscopy to review extensions and adhesions of the tumour.
- Cauterization and dissection of the adhesions to the middle and superior turbinate.
- Partial trimming of the middle turbinate for improved access.
- Opening the maxillary sinus and removing the medial and posterolateral walls to gain access to the infratemporal fossa.
- Cauterization and incision of the infratemporal fossa periosteum to release the tumour.
- Dissection of the infratemporal extension starting at its most lateral boundary.
- Cauterization or clipping of the maxillary artery.
- Clearance of the ethmoid cells and opening the sphenoid by the lateral approach.
- Floor and anterior wall of the sphenoid removed and tumour gradually delivered out of sphenoid sinus.
- Tumour adhesions to septum and nasopharynx cauterized and dissected.
- Tumour delivered transorally once all its extensions have been dissected and it is free of any adhesions.

The author has detailed these surgical steps in a previous publication. However, very large extensions in the infratemporal region cannot be accessed through the nose alone and we feel that an assisted procedure is required in these cases. Once most of the tumour has been dissected endoscopically, a small incision approximately 1 inch in length is made in the upper gingivobuccal sulcus next to the last molar tooth (Fig. 1). It should be large enough to admit the index finger of the assistant surgeon. Dissection of the infratemporal extension is done by the operating surgeon who applies gentle and sustained traction to “pull” the tumour towards the nasal cavity. This manoeuvre is greatly assisted by a simultaneous “push” applied by the assistant surgeon on the infratemporal extension (Figs. 2a and 2b). Although the assistant helps to push the tumour medially, all dissection is done under direct vision endoscopically. The assistant’s finger also prevents the tumour extension from slipping back out of sight into the lateral recess of the infratemporal fossa.

This simultaneous and controlled “push-
pull” action allows the tumour to be gradually delivered into the nasal cavity (Fig. 3). At some point during this dissection, the maxillary artery will be seen tethered to the tumour. The artery is tortuous, and redundancy in its length permits considerable stretching. It therefore does not avulse easily. It requires a skilled assistant to apply just the adequate pushing action to help deliver the tumour without avulsing the artery. Should the embolised artery be avulsed, it can be cauterized with a bipolar forceps to achieve haemostasis. Traction on the tumour in the region of the inferior orbital fissure often brings the infraorbital nerve into view. The nerve needs to be dissected meticulously off the tumour in order to avoid post-operative hypoaesthesia of the cheek.

Once the tumour is detached from the artery and all other adhesions, it is delivered transorally. Haemostasis is achieved by temporary pressure packs, removal of any suspicious residual tags of tissue and cauterization of any bleeders. If the procedure has been done correctly, then the post operative surgical field should be relatively bloodless. Anterior nasal packs are inserted for 24 to 48 hours post operatively. A post nasal pack was not required in any of these patients.

We have a standard protocol of follow-up in all cases of JNA operated endoscopically. All patients are assessed with a check nasal endoscopy done 1 month, 3 months, 6 months and 1 year post-operatively. The patient is then followed up at 6 monthly intervals for a minimum period of 4 years. A CT scan and / or MRI are done 1 year post-operatively (Figs. 4 and 5) or earlier if we feel that there is any concern about complete removal of the
tumour. All patients undergo an MRI scan 4 years post-operatively prior to being discharged from care.

Results

Of the 8 patients operated by the “push-pull” technique, complete tumour removal could be achieved at the first operation in 5 patients, all of whom are currently tumour-free. One patient (patient 5 – Stage IV B) has a small residual tumour in the cavernous sinus close to the internal carotid artery (ICA). Two patients (patients 6 and 7 – Stage IV B) have residual tumours in the inferior orbital fissure / orbit and cavernous sinus. None of the other patients (i.e. Stage III A) have any residual or recurrent tumour. The period of follow up ranges from 14 months to 34 months (average- 23 months). All patients continue being followed up both endoscopically and by imaging in accordance with our previously described protocol. Despite embolization and meticulous surgical technique considerable blood loss can occur in these large tumours. Our estimated blood loss ranged from between 350 ml to 2200 ml.

Discussion

The criteria for case selection in endoscopic excision of JNA are in a state of evolution. As expertise in endoscopic surgery has increased and instrumentation has improved, many tumours which hitherto would have required an open approach can now be excised endoscopically. The “push-pull” technique is one more step in the evolution of endoscopic surgery for JNA. The major advantage of this technique is that it is now possible to excise tumours with large lateral extensions in the infratemporal and parapharyngeal regions without resorting to an open approach. The severe post-operative morbidity which is associated with open procedures such as facial oedema, tight nasal packs and facial scars can thus be avoided. However intracranial and intraorbital extensions of the tumour continue to remain a therapeutic challenge.

Four patients needed blood transfusions (Table 1). None of the patients suffered from trismus, facial nerve palsy, anaesthesia or hypoaesthesia over the distribution of maxillary or mandibular nerve. All intraoral incisions healed well. There were no deaths in this series.
and the assistant have a clear three-dimensional understanding of the extension of the tumour along the base-skull. A preoperative planning session during which the CT and MRI images\textsuperscript{21} of the patient are discussed and correlated, if necessary with a dry skull is of prime importance. Three-dimensional reconstructions have now become available to us and their use is valuable in understanding the complex anatomy of the region. It is also important for the surgeon to study pre and post embolization arteriography. This helps anticipate the source of potentially severe haemorrhage if a feeder has not been embolised.

There are certain difficulties that we have encountered. Revision cases where surgery has been done previously in the infratemporal fossa are more difficult to operate with this technique. This is because the fibrosis in the region tethers the tumour and does not allow the assistant’s palpating finger to differentiate clearly between the lateral margin of the tumour and the surrounding tissue. This demarcation between the tumour and surrounding tissues is very easily identified in primary tumours and is a key factor in complete removal of the tumour. Therefore, in revision cases with extensive fibrosis in the infratemporal fossa, we suggest that an open approach with direct dissection of the tumour is a better option. We use either the mid-facial degloving or Weber-Fergusson approach. In such cases we have also used the microscope or endoscope to help differentiate between tissues which may not be easily discerned by the naked eye. In our experience we have found that an endoscope serves this purpose better than the microscope. We have supplemented these open approaches with endoscopic dissection of deeper extensions like those in the sphenoid sinus and those eroding the vidian canal.

The other possible disadvantage is that severe intra-operative haemorrhage may also be more difficult to control in a closed endoscopic procedure. However, an experienced surgeon can achieve haemostasis with the judicious use of pressure packs and suction bipolar forceps.

Since JNA has a fairly high incidence of residual or recurrent tumours, a regular and long term follow-up as detailed previously is essential in all these patients.\textsuperscript{22} We believe that true recurrent tumours are rare and that residual tumours are far more common. These residual tumours are occasionally those that have been intentionally left behind in selective areas e.g. close to the ICA, but are much more often a “missed” tumour extension because the surgeon failed to estimate the three-dimensional mode of spread of the tumour at the initial surgery. The more frequent use of intraoperative image guidance systems\textsuperscript{23} will probably help in decreasing the incidence of residual disease.

**Conclusion**

We have based our conclusions on experience garnered from 63 cases of JNA managed over the last 7 years. Of these, 8 patients have been operated successfully by the “push-pull” technique. Giant JNAs with large infratemporal and parapharyngeal extensions which hitherto required an open approach can now be excised endoscopically using this technique. The morbidity with this technique is significantly less, as there is only a small incision of about 1 inch in the upper bucco-gingival sulcus. This technique is suitable for primary tumours or those in which no dissection was done in the ITF during the first surgery. Recurrent tumours with extensive fibrosis in the infratemporal fossa are currently being managed by an open
approach at our institution.

We feel that this technique should be used by those surgeons who have considerable experience in resecting tumours endoscopically, because though it is elegantly simple to use, it finds application mainly for giant JNAs.

References