ORIGINAL ARTICLE

Endoscopic Sublabial Transmaxillary approach to Lateral Middle Skull Base

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ABSTRACT

Lateral middle skull base is a complex territory and varies in their pathology. Surgery of the skull base is a challenging to neurosurgeon and ENT surgeon. The improvement of endoscopy has expanded the reach of sublabial transmaxillary approach. This approach can be an alternative method to remove the lesion with less morbidity, improved cosmetic outcomes. A study of 11 cases of lateral middle skull base which presented at our tertiary care hospital . Data of their examination, radiology (digital substraction angiography (DSA), computerized tomography (CT) and magnetic resonance imaging (MRI)), postoperative complications and definitive histopathology. All of patients underwent endoscopic sublabial transmaxillary approach and were followed for 1 year. The tumors composed of meningoma (n=2), ossifying fibroma (n=1), chondrosarcoma (n=1), soft tissue sarcoma (n = 2), plasmacytoma (n=2), non-hodgkin lymphoma B cells (n=1), inflammatory tissues (n = 2). Postoperative complications were facial numbness, trismus in two cases. No CSF leakage was detected. Endoscopic sublabial transmaxillary approach (ESTA) is an attractive alternative route for the treatment of lateral middle skull base tumor. This provides an excellent exposure, good surgical freedom and obviates the morbidity, mortality.

Keywords: Skull base surgery, Endoscopic sublabial transmaxillary approach, infratemporal fossa, pterygopalatine fossa, maxillofacial surgery

INTRODUCTION

Skull base is the floor of the cranial cavity that separated the brain from other structures of the head and neck. Lateral middle skull base used to be considered as mystery and inaccessible clinically. Tumors of lateral middle skull base is rare and varies in their pathology. Creating surgical access to these lesions is challenging because of its intricate anatomy, difficult access, and proximity to critical neurovascular and intracranial structures. Many different approaches have been described. Open surgical approaches provide adequate corridors to access tumor. However, this disruption might associate with a significant morbidities and mortalities.

With the advancement of endoscopy technologies, endoscopic sublabial surgery offers a direct route to infratemporal fossa and pterygoid fossa. It provides excellent exposure, ease of access and low rate of morbidity. The experience of lateral middle skull base tumor via sublabial endoscopic surgery is highlighted in this study.

MATERIALS AND METHODS

This study was approved by the board of ethics committee of the hospital. A retrospective study of 11 patients (table 1) were diagnosed as lateral middle skull base tumor, which located at IFT and pterygopalatine fossa. All of the patients underwent excision via sublabial endoscopic surgery approach from 09/2018 to 09/2021 at our hospital. Preoperative assessment of the patients included a physical examination, imaging study were carried out. All medical records were reviewed on basis of clinical details, presenting symptoms, imaging characteristics, surgical approach, postoperative complications and follow-up for 6 months. All patients were treated by multidisciplinary team.

Endoscopic sublabial transmaxillary approach: All patients underwent general anesthesia by tracheal intubation. On the side of the operation, injecting lidocaine with epinephrine into buccogingival sulcus. The gingival sublabial incision is made from the canine to the second molar. Both of the lip and mucosal are retracted by modified automatic retractor (figure 4). Therefore, we do not need an extra assistant to hold retractor (figure 5). The mucosa is elevated, exposing the anterior surface of maxillary sinus, preserving the infraorbital neurovascular bundle.

Extended Caldwell – luc antrostomy: The antrum is opened by using osteotomes and can be enlarged with Kerrison punches. The size of the antrum depends on the surgeon's preference. However, the zygomatic maxillary buttress can be removed until it is flush with the posterior wall of maxillary sinus.

Posterior wall of maxillary sinus is removed. Internal maxillary artery is dissected and cauterized by bipolar forceps and the infratemporal fossa is entered. The medial and lateral pterygoid muscle and lateral pterygoid muscle is reflected inferiorly or removed.

Open the pterygopalatine fossa (PPF): If the tumor invaded PPF, transpterygoid approach should be proceeded to gain access. The pterygoid process is drilled out by high – speed drill. During dissection, care should be taken to identify maxillary nerve (V3) that exits the foramen ovale and middle meningeal artery exits foramen rotundum. The vidian nerve can be mobilized or sacrificed. The bleeding from pterygoid plexus should be controlled during dissection. The tumor was dissected from its surrounding attachments. In case the tumors adhere or compress a cervical internal carotid artery, careful dissection should be done. Enucleation was done in case of chondrosarcoma which were difficult to approach superiorly and medially.

RESULTS

The study group had 7 males (60%) and 4 females (40%) with the mean age was 39.4 years. The most common symptom is facial pain and headache, followed by proptosis, trismus and nasal obstruction. One patient had a decreased vision in both eyes because the tumor compressed both optic nerve. The pathology included meningioma, ossifying fibroma, recurrent chondrosarcoma,

soft tissue sarcoma, extramedullary plasmacytoma, non-hodgkin lymphoma B (figure 2), inflammatory tissues.

Total resection was achieved in 2 cases of inflammation. Partial resection was performed for 2 cases of meningioma (figure 3) and 2 cases of soft tissue sarcoma, 2 cases of recurrent sarcoma because of intracranial and cavernous sinus involvement. Patients 3,6 and 7 underwent biopsy and debulking procedures for tissue diagnosis and symptom palliation. Mean intraoperative time was 160 minutes and mean blood loss was 550 ml. Intraoperatively, only patient 3 needed 1 units of red blood cells for transfusion. There was no vascular or or neural intraoperative complications. No postoperative infections, systemic complications or CSF leakage occurred. Postoperative complications included facial numbness in 2 case and trismus in 1 case. Most of the patients with malignant tumors received chemotherapy, radiotherapy and under controlled. Only 1 case of chondrosarcoma suffered local disease progression after being treated with radiotherapy and chemotherapy.

Figure 1 : preoperative image of meningioma locates at right intracranial cavity and right infratemporal fossa

Figure 2: postoperative image after resection of the tumor.

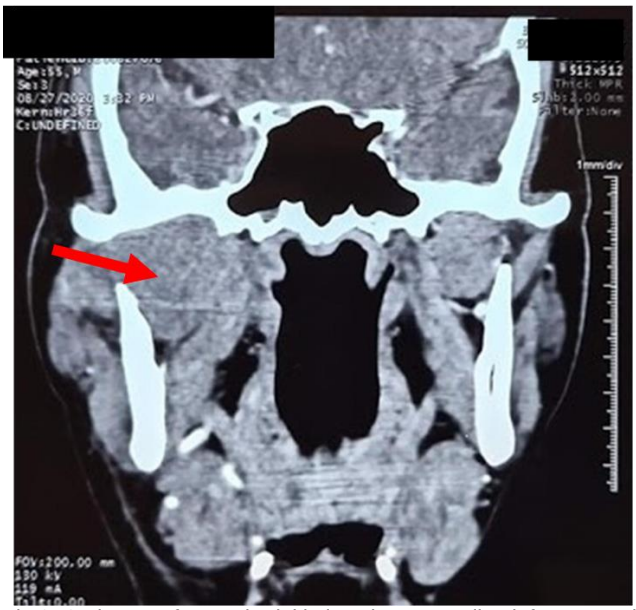

Fig 3: CT image of non – hodgkin lymphoma B cell at infratemporal fossa

Fig 4: modified automatic retractor

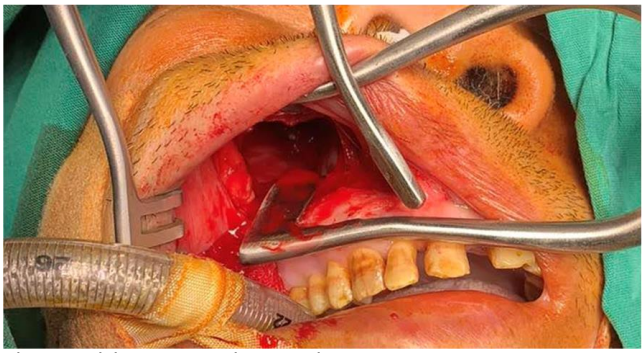

Fig 5: applying retractor in operation

Table 1: List of 11 patients of lateral middle skull base tumors

No.	Age	Presenting complaint	Imaging	Pathology	Postoperative complication	Adjuvant therapy
1	42/ M	Headache,	CT + MRI	meningioma	none	Gamma knife radiosurgery
2	39/M	headache	CT + MRI	meningoma	Trismus	Gamma knife radiosurgery
3	9/M	Vision decreased in both eyes	CT + MRI + CTA	ossifying fibroma	none	Observation
4	28/F	Nasal obstruction, facial pain, proptosis	CT + MRI	Recurrent chondrosarcoma	Facial numbness	Radiation therapy + chemotherapy
5	63/M	Facial paralysis, drooping eyelid, decreased vision in right eye	CT + MRI	Soft tissue sarcoma	none	Radiation therapy + chemotherapy
6	45/F	Facial pain, nasal obstruction	CT + MRI	soft tissue sarcoma	Cheek ecchymosis	Radiation therapy
7	44/M	Facial pain	CT	Extramedullary plasmacytoma	none	chemotherapy
8	46/M	Facial pain	CT	Extramedullary plasmacytoma	Cheek ecchymosis	chemotherapy
9	52/M	Facial pain	CT + MRI	non-hodgkin lymphoma B cells	none	chemotherapy
10	54/F	Headache, facial pain	CT + MRI	inflammatory tissues	none	Observation
11	35/F	Facial pain	CT + MRI	inflammatory tissues	none	Observation

DISCUSSION

This is a retrospective review of 11 cases in which lateral middle skull base tumors were operated by using ESTA. Infratemporal fossa and pterygopalatine fossa which can be grouped together as lateral middle skull base, form a relatively small, hard to reach area posterior to the maxillary sinus and below middle skull base. Pathology of these region is varied and rare [3]. Given their rarity, most of the patients are treated in large tertiary hospital. Skull base connected with the brain through foramina of the skull base, the tumors in these regions could spread into the brain through foramina ovale and foramen spinosum.

The symptoms and clinical signs are not specific, presented as facial pain, headache, trismus, facial palsy, dyaesthesia [2],[9]. Physical examination is not adequate to evaluate the lateral middle skull base tumors, so the diagnosis is commonly delayed. Imaging is the keystone for the clinical evaluation [2]. Both CT and MRI could be used as the first option. CT – scan provides bony details, erosive patterns of bone, sclerosis, ossification, and calcification. MRI supplies us more information about tissue characterization, differentiation between inflammation and tumor, and detect dural invasion. If the tumor adheres or encroach ICA, CT angiography should be done to examine the circle of Willis, and collateral blood flow.

Multiple approaches have been described for accessing tumors located at lateral middle skull base. Many opening approach have been used for the management of lateral skull base tumor because it provides adequate visualization and surgical freedom. However, it meets these requirements by resecting large volumes of tissues causing a great trauma and deformity.

Recently, endoscopy is preferred by surgeons, and it is a valuable tool in skull base surgery. Endoscopic approaches are currently favored for surgical treatment because they avoid the facial incisions, deformity, facial nerve retraction, malocclusion. Many endoscopic techniques have been reported, endoscopic prelacrimal approach is commonly used to access the lateral portion of infratemporal fossa. However, the surgical freedom is limited. Endoscopic transnasal transmaxillary approaches (ETTA) can be used to access the medial portion of infratemporal fossa and pterygopalatine fossa, not sufficient to access far lateral infratemporal fossa. Lateral exposure can be enhanced with several techniques such as posterior septectomy, extensive medial maxillectomy. Each technique is associated with nasal morbidities and technical challenges. Alfieri et al. reported that 45- and 70-degree endoscopes are required for appropriate exposure of this region [1]. With the 30-degree endoscope, the degree of lateral angulation is restricted, we might have to mobilize the pterygopalatine fossa and its contents to gain access to the lateral middle skull base.

In this study, we proposed that the ESTA is a feasible alternative method for lesions of pterygopalatine fossa and infratemporal fossa. This approach could be used independently to address lesions in the lateral middle skull base allowing two surgeons to work. Couldwell et al. used the sublabial transmaxillary microsurgical approach coupled with pterygoid plate osteotomy to access the anterior cavernous sinus [4]. With the aid of endoscope, we could expose entire lateral middle skull base through sublabial transmaxillary approach without the need for the transnasal middle meatal exposure. These spare postoperative complications of nasal cavity, including adhension, nasal dryness, crusting, or nasal ozena. Cavity. If the tumor invaded the nasal cavity, medial wall of maxillary sinus, or middle and inferior turbinates, the maxillary antrum is opened into the nasal cavity.

This approach provides direct anterior posterior direction of attack, so we could use straight endoscope and instrument angled beyond 30 degrees might not be required. This will decrease surgical frustration and technical difficulty. Compared to ETTA, ETSA not only enhances exposure but also increase surgeon's comfort [7]. Furthermore, the bony opening is almost perpendicular to the angle of attack that give a good hemorrhage control from vascular tumor and bleeding from maxillary artery. Theodosopoulous showed that they were able to show cervical carotid artery and maxillary nerve, middle

meningeal artery by using sublabial transmaxillary approach [10]. According to study of Wilson et al the mean surgical freedom of ESTA was significantly higher than ETTA [11]. Elhadi et al reported that the maximal surgical freedom was obtained with sublabial approach when compared ESTA with ETTA and the transeptal approach [6].

Denker approach also provides excellent exposure but it is not popular. Loss of lateral alar support and nasal ala retraction due to disruption of the medial maxillary buttress has not gained wide acceptance. Regarding to the pediatric population, this technique may cause disruption of growth with subsequent midfacial deformity.

Most common complications of ESTA include facial numbness and cheek ecchymosis from traction to the infraorbital nerve. DeFreitas and Lucente reported the rates on long-term complications such as facial (infraorbital) numbness or paresthesias (9%), facial asymmetry (0.6%), oroantral fistula (1%), and tooth devitalization (0.4%) [5]. In contrast, Matheny and Duncavage found no long-term complications in patients who underwent the Caldwell-luc operation [8]. In our study, patients had cheek ecchymosis and trismus after the surgery, but it is temporary and get better after physical therapy. All of the patients found these complications acceptable.

CONCLUSION

Endoscopic sublabial transmaxillary approach is an alternative and effective method for accessing lesions of lateral middle skull base. This approach offers wide exposure and good control of bleeding. The surgeons don't need a steep learning curve, and have a large corridor for the working space. This approach could combine with other techniques such as craniotomy to solve the lesions of lateral middle skull base invade into intracranial cavity.

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