

# Surgical Approaches to Infratemporal Fossa: A Case Series and Brief Review of Literature

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## Abstract

**Introduction:** Skull base is an intricate region of head and neck in terms of surgical access owing to its well concealed location and complex anatomy.

**Objective:** This study aims to provide findings from 9 patients in whom various approaches were used to access infratemporal fossa.

**Materials and Methods:** it was a case series study conducted at Department of Oral and Maxillofacial Surgery, Rehman Medical Institute Peshawar. From 2016 to 2024 9 patients underwent surgery to access infratemporal fossa using different surgical approaches including superolateral, transmandibular and transmaxillary approach. The patient population included cases of foreign bodies lodged in the infratemporal fossa as well as lesions arising from or encroaching on infratemporal fossa.

**Results:** Superolateral approach was most commonly used (4 cases). combined, inferior and anterior approaches were also employed to access infratemporal fossa.

**Conclusion:** surgical access to infratemporal fossa presents complex challenge. The surgical approach should be chosen on case to case basis after thorough deliberation and planning.

**Keywords:** Surgical Access, Surgical Approaches, Infratemporal Fossa.

## Introduction

Skull base is an intricate region of head and neck in terms of surgical access owing to its well concealed location and complex anatomy.<sup>1</sup> The skull base can be generally divided into three sub regions i.e the anterior, middle and posterior skull base<sup>2</sup>

Infratemporal fossa constitutes an important region of the middle skull base. It is a deep anatomical space bounded anteriorly by maxilla, posteriorly by the tympanic and mastoid portions of the temporal bone, medially by lateral pterygoid plates, pterygopalatine fossa, nasopharynx, laterally by the ramus of the mandible and superiorly by the floor of the middle cranial fossa.<sup>3</sup> Many important structures including the Pterygoid muscles, Maxillary artery, Mandibular nerve, Otic ganglion, Chorda Tympani and Pterygoid venous plexus are housed in this important space.<sup>4</sup>

Diverse group of pathologies including both malignant and benign tumours can arise from infratemporal fossa.<sup>5</sup> Tumours in this region may remain asymptomatic when small until the result in clinically overt mass in lateral upper neck, temporozygomatic region and oropharynx. These tumours may also present with voices changes, cranial nerve deficits and difficulty in swallowing.<sup>6</sup> In addition to tumours, infratemporal fossa is relatively common site for accidentally and iatrogenically displaced foreign bodies.<sup>7</sup>

Over the years many approaches have been used for surgical

access to infratemporal fossa. Transmandibular, transmaxillary, transparotid-transcervical and the transcervical approaches are most commonly used approaches as reported in the literature. In addition to this several other novel approaches have been proposed. All these approaches come with distinct advantages as well as shortcomings. Specific approaches are selected on case to case basis.<sup>6</sup>

This study aims to present findings from cases of infratemporal fossa lesions that were managed with different surgical approaches. It also aims to present a brief review of the literature.

## Materials and Methods

### Patient Population

This is a retrospective study that reports findings from 9 patients who presented to Department of Oral and Maxillofacial Surgery Rehman Medical Institute Peshawar from 2016 to 2024. 7 patients were male and 2 patients were female. The age range was 12 to 72 years. The patients were operated on by a single surgical team lead by a single surgeon under general anesthesia.

### Patient Presentation

Three patients presented with foreign body which were lodged in infratemporal fossa. The first patient (Case 1) presented with history of assault. He was stabbed with a knife that got stuck in his face. Knife was penetrating into ITF through temporal region and only the handle was sticking out. The second patient (Case 2) got accidentally stabbed by pencil. The pencil penetrated through the orbit into right infratemporal fossa. The pencil was subsequently retrieved at other centre but eraser head of pencil was left behind. Attempt was made to remove the foreign body through transantral endoscopic approach but was not successful. Case 3 was 11 years old male who presented with the history discharging sinus at right parotid region. There was history of penetrating trauma.

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Imaging revealed a piece of wood measuring about 3 cm was stuck deep in the infratemporal fossa. Three cases were of extensive ameloblastoma two of mandible (case 7 and 9) and one of maxilla (case 5) were extending into infratemporal fossa. Case 8 presented with large carotid body tumour that necessitated wide dissection into infratemporal for exposure of carotid vessel and subsequent repair. Patient with biopsy proven SSC of right maxilla (case 4) that was extending to infratemporal fossa also required surgical access for complete excision. The last patient (case 6) was a case of extensive AVM of right mandible region. The patient had several episodes of accidental exsanguination. His Hb was low. He underwent pre surgical embolization of the feeding arteries followed by excision.

### Investigation/imaging

All patients underwent CECT scan for assessment of the lesion and localization of the foreign body. Three patients underwent CT angiogram in addition to CT scan. In one patient it was done to assess the relation of foreign body(knife) with vessels in the infratemporal fossa.

The other patient was a case of arterio venous malformation of mandible that was encroaching on the infratemporal fossa and CT angiogram was done for presurgical embolization.

### Surgical Approaches

#### Superiolateral access.

Three patients (case 1,2 and 3) were approached using superiolateral access. A preauricular question mark incision in Bramely Alkayat fashion was used with elevation of the skin flap while leaving the pericranium, elevation of the temporalis muscle, and osteotomy of the zygomatic arch for improved access. In one patient (case 1) strip of bone from zygoma was removed corresponding to part of knife that was lodged in the ITF. Part of this zygomatic bone was small and not replaced after retrieval of the foreign body. Once the zygomatic arch was reached, periosteum was incised and reflected, plates were adapted to the arch with two screws, across the planned osteotomy site. The plates were then removed and osteotomy was done and the arch was raised with the flap to allow access to the ITF. After retrieval of the foreign body the arch was fixed using the preadapting plates. And the flap was closed in layers.

#### Anterior Access

The anterior access was used in a case (case 4) of extensive squamous cell carcinoma of maxilla and ameloblastoma of midface (case 5), extending to infratemporal space. The Weber-Ferguson incision with infraorbital extension (deiffenbach variant) was used.

The incision starts with midline lip split with chevron. The incision then follows then nasal sill and alar base and extends upward in the lateral nasal wall and then extended into infraorbital crease. Intraorally the incision extended in the ipsilateral labio buccal vestibule. The full thickness flap was reflected. The lesion was exposed and incised enblock with osteotomy in the infraorbital rim region and hard palate

#### Inferior Access

In two cases, arterio venous malformation of mandible (case 6) and carotid body tumour (case 8) inferior access was used. In these trans cervical- transmandibular approach a lip splitting incision extended posteriorly along a neck skin crease between mandibular first and second premolar on the left side. The mandibular segment was rotated laterally. The lesion was

exposed upto skull base. The internal carotid artery was clamped. The tumor was excised enblock and internal carotid was reconstituted using graft.

In the case of arteriovenous malformation after exposure through trans cervical approach with lip split, the lesion was excised resulting in hemimandibular defect.

#### Combined Access

In the two cases of ameloblastoma of left mandible extending into infra temporal fossa, combined inferior and superiolateral access were used to excise the lesion.

### Results

	AGE	GENDER	DIAGNOSIS	ACCESS	COMPLICATION	Morbidity	Other
1	71	Male	Foreign body (knife) infratemporal fossa	Superiolateral	Temporal nerve palsy	Zygomatic arch was osteotomised	
2	12	Male	Foreign body (pencil tip) infratemporal fossa	Superiolateral	None	Zygomatic osteotomy + coronoidectomy	Failed attempt with anterior approach
3	11	Male	Foreign body(wood) in infratemporal fossa	Superiolateral	None		
4	56	Female	OSCC maxillary alveolus	Anterior	Numbness ION region, trismus		
5	65	Female	Ameloblastoma	Superolateral			
6	9	Male	AVM	Inferior			Spontaneous mandibular regeneration
7	61	Male	Ameloblastoma	Combined			
8	21	Male	Carotid body tumor	Inferior	Vagal nerve palsy + injury mandibular premolar		
9	42	Male	Ameloblastoma	combined	Facial nerve injury+ partial wound dehiscence		history of segmental resection and reconstruction with iliac crest graft

### DISCUSSION

Infratemporal fossa is unique in a sense that it lies at the cross roads of several surgical domains including neurosurgery, ENT, ophthalmology and maxillofacial surgery. Consequently, the surgical access to this region is of interest to several specialities.<sup>7</sup>

Surgical access to infratemporal fossa presents a complex challenge. The complex surgical anatomy, varied clinical presentation, concealed location and diversity of pathologies all add to the surgical difficulty. The available surgical approaches are complex, carry high risk of morbidity and often require combined approach for adequate access and visualization.<sup>8,9</sup>

Since 1961 when Fairbanks-Barbosa first reported infratemporal fossa approach for advance maxillary tumors, there has been considerable development in the surgical approaches to infratemporal fossa lesions. Improved imaging technologies, advances in endoscopes and robotic surgeries have contributed to these developments.<sup>10</sup>

Tumour of ITF may remain asymptomatic and ultimately present as painless expansile mass or may present with non-suggestive symptoms like neuralgias, headache, facial paresthesia and otological symptoms. Hence diagnosis is often delayed, consequently many tumours in this region tend to be relatively extensive at presentation and hence present surgical challenge.<sup>9</sup> Foreign bodies in this region often present with vague pain, recurrent swelling of face or as draining sinus.

Unless a tumour secondarily extends to ITF from adjacent region, deciphering the nature of lesion is difficult. Often surgeons have to rely on the radiological characteristics of the lesion to have a clue about the nature of the lesion. Incisional biopsy is inadvisable in most cases. However, it is recommended in cases where the tumours encroaches near the surface. FNAC/FNAB can be done but they are frequently inconclusive and sometimes misleading. CT or MRI is usually done. CT or MR angiography is sometimes advised to ascertain the relationship of the lesion with vital vasculature of neck. Various surgical approaches can be employed to access the infratemporal fossa, each with its advantages and limitations. Commonly used surgical approaches include endoscopic,

transzygomatic, orbitozygomatic, transmandibular, transmaxillary, approaches.<sup>12-13</sup>

Superior access through the transzygomatic approach provides a versatile access to the infratemporal fossa. This approach usually results in cosmetically acceptable scar and it can be combined with transmaxillary and transmandibular approaches to further improve access. The access tends to be very good to the lateral part of infratemporal fossa and this approach puts temporal branch of facial nerve at risk.<sup>14</sup>

Anterior transfacial approaches are well suited for tumours extending from ITF to maxilla or nasopharynx. Anterior access using the weber-ferguson incision with or without maxillary swing is frequently employed for tumours of infratemporal fossa. This approach involves inferior extension of the lateral rhinotomy incision to include lip split. It provides good access to both the lateral and medial part of infratemporal fossa. Unsightly scar may result from this approach and in addition lower lid ectropion, oronasal fistulas, velopharyngeal disorder and injury to teeth are also possible.<sup>15</sup>

For inferolateral tumours of infratemporal fossa especially when they are extending to parapharyngeal and masticator space transmandibular access is thought to provide good exposure. This approach approach combines a cervical incision with lower lip split. Median or paramedian osteotomy of mandible is done allowing lateral swing of the mandibular

segment. It allows good control of major neck vessels and also accommodates incisions for neck dissection. Possible complications include scar and deformity of lower lip, lip paresthesia, lingual and hypoglossal nerve injury, injury to teeth, malunion and non union.<sup>16</sup>

Although open surgical approaches provide good access, recently endoscopic approaches have received renewed interest from head and neck surgeons. Endoscopic approaches promise good cosmetic outcome and less surgical morbidity however they are more ideally suited for benign tumours and retrieval of foreign bodies.<sup>17</sup>

## Conclusion

Surgical access to infratemporal fossa varies from case to case basis and requires detailed planning.

In general, superior-lateral access is suited for retrieval of foreign body especially after failed endoscopic approach and superior-lateral lesions of infratemporal fossa. Anterior approach is employed in cases where the lesion is involving the posterior maxilla. Inferio-lateral approach provides excellent access and used for inferior lesion of the ITF. In more extensive lesions combined access may be employed to get better access.

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**Author Contributions**

1. Taj Uddin – Conceptualization, Study Design, Case Documentation, Draft Writing
2. Alaf Khan – Methodology, Literature Review, Data Interpretation
3. Zubair Durani – Supervision, Critical Review, Final Approval of Manuscript