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Original Research Article

COMPREHENSIVE STUDY OF ENDOSCOPIC MANAGEMENT OF PRIMARY OR SECONDARY INVOLVEMENT OF PTERYGOPALATINE FOSSA IN HEAD AND NECK PATHOLOGIES

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ABSTRACT

Background: Pterygopalatine fossa involvement is uncommon and poses diagnostic and surgical challenges owing to its complex anatomy and varied pathology. The indications for minimally invasive management have expanded with the advent of endoscopic approaches. This study aimed to evaluate the clinical presentation, imaging patterns, surgical strategies, and histopathological outcomes in patients with pterygopalatine fossa pathology managed endoscopically. **Materials and Methods:** This retrospective observational study included 20 patients who underwent endoscopic surgery for pterygopalatine fossa lesions at the Upgraded Institute of Otorhinolaryngology, Rajiv Gandhi Government General Hospital, Chennai, between October 2020 and September 2021. Demographic data, symptoms, computed tomography and magnetic resonance imaging findings, surgical approaches, histopathology, adjuvant therapy, and outcomes were analysed. **Result:** Twenty patients were analysed; invasive mucormycosis was identified in 14 patients (70%), juvenile nasopharyngeal angiofibroma in five (25%), and inflammatory pseudotumor in one (5%). Males predominated (13, 65%). The most common symptoms were nasal discharge (40%), facial pain (35%), and epistaxis (30%). Pterygopalatine fossa involvement was detected on CECT in 18 patients (90%) and on MRI in all evaluated patients (100%). Paranasal sinus extension was observed in 15 patients (75%). Endoscopic sinus surgery was performed in all patients (100%). Histopathological examination confirmed the diagnosis in all patients. Liposomal amphotericin B was administered to all patients with mucormycosis (70%), with no adjuvant therapy required in the remaining patients (30%). **Conclusion:** Endoscopic management of pterygopalatine fossa lesions enables precise diagnosis, tailored surgical clearance, and effective pathology-directed treatment with acceptable morbidity and favourable clinical outcomes.

INTRODUCTION

The pterygopalatine fossa (PPF) is a small, deep space situated behind the maxillary sinus and in front of the pterygoid plates of the sphenoid bone. It is narrow and compact but contains important neurovascular structures. These include the third part of the internal maxillary artery, the maxillary nerve, the vidian nerve, and the pterygopalatine ganglion.[1] The fossa communicates with the nasal cavity, orbit, infratemporal fossa, nasopharynx, oral cavity, and middle cranial fossa through several foramina and fissures.[2] Because of these multiple connections, disease in this area can spread easily to surrounding regions. Involvement of this space can lead to bleeding, neural symptoms, and extension towards the skull base.[3]

Primary tumours arising directly from the PPF are rare. In routine clinical practice, the fossa is more commonly involved secondarily by lesions from adjacent sites.[4] Benign conditions, such as juvenile nasopharyngeal angiofibroma, inverted papilloma, schwannoma, lipoma, and inflammatory pseudotumor, can extend into this region. Malignant

tumours of epithelial, mesenchymal, neural, salivary, or lymphoid origin may also involve this space by direct extension or perineural spread along the maxillary nerve.[5] The wide range of pathology and the close arrangement of vessels and nerves make surgical access difficult and potentially hazardous.[6] Typically, PPF is approached using open surgical techniques. These include transantral maxillectomy, lateral rhinotomy, midfacial degloving, and infratemporal fossa approaches, among others. These methods provide adequate exposure to the students. However, they involve external incisions and extensive soft tissue dissection.[7] Patients may develop facial scars, infraorbital numbness, dental problems, trismus, and prolonged recovery. In many cases, morbidity is related to the surgical route rather than the pathology itself.[8] This has led surgeons to consider fewer invasive alternatives.

With the development of nasal endoscopy, better imaging, and improved instruments, endoscopic endonasal access to the PPF has become increasingly feasible. The trans pterygoid approach allows entry through the nasal cavity and maxillary sinus to reach the fossa directly. This route provides a magnified visualisation of the vessels and nerves. It also avoids external scars.[9] Careful identification of the sphenopalatine foramen, internal maxillary artery branches, vidian nerve, and maxillary nerve is essential during the dissection. Success depends on sound anatomical knowledge and accurate preoperative imaging.[10]

There are only limited consolidated clinical data evaluating the endoscopic management of both primary and secondary PPF involvement in a single centre. Many reports have focused on selected tumour types or anatomical studies. The correlation between radiological findings and intraoperative anatomy has not been consistently reported.

Therefore, this study aimed to evaluate the endoscopic endonasal management of PPF involvement in head and neck disease by correlating CT/MRI with operative anatomy, obtaining biopsy diagnosis, and performing excision when feasible.

MATERIALS AND METHODS

This observational cross-sectional study included 20 patients and was conducted at the Upgraded Institute of Otorhinolaryngology, Rajiv Gandhi Government General Hospital, Chennai, from October 2020 to September 2021. Ethical committee approval was obtained, and informed consent was obtained from all patients.

Inclusion and exclusion criteria

Patients aged 12–70 years of either sex with CT or MRI evidence of a PPF soft tissue mass, fat obliteration, or widened sphenopalatine foramen/PPF, and without intracranial or intradural involvement were included in the study.

Patients aged <12 or >70 years, those with regional or systemic spread to the temporal fossa, upper pharyngeal space with or without carotid encasement, orbit, cavernous sinus, middle cranial fossa, or hard palate, and those unfit or unwilling to undergo surgery were excluded.

Methods: All patients underwent an endoscopic endonasal approach (EEA) to access the PPF. The procedure was performed with the patient in the supine position with 15° head-end elevation under general anaesthesia. Nasal cavity preparation was performed using cottonoids soaked in 4% lignocaine with adrenaline (1:10,000), followed by local infiltration with 2% lignocaine and adrenaline. Surgery was initiated with an uncinectomy and wide middle meatal antrostomy. This was followed by complete ethmoidectomy and sphenoidotomy, when indicated. The posterior wall of the maxillary sinus was removed to expose the PPF site. Feeding vessels, including sphenopalatine or internal maxillary artery branches, were identified and secured by clipping, ligation, or cauterisation, and the lesion was excised under direct endoscopic visualisation.

Based on the extent and pathology, different endonasal approaches were employed after basic endoscopic sinus surgery were employed. Mega-antrostomy was performed in cases of inflammatory pseudotumor and invasive mucormycosis. The endoscopic modified Denker approach was used in all cases of juvenile nasopharyngeal angiofibroma and selected cases of invasive mucormycosis and premaxillary/anterior maxillary wall involvement. The pre-lacrimal approach was used in cases with infratemporal fossa extension. Posterior septectomy was performed when a four-handed technique or nasopharyngeal access was required for surgery. All resected specimens were sent for histopathological examination for definitive diagnosis and correlation with preoperative clinical and radiological findings. Postoperatively, patients were followed up with diagnostic nasal endoscopy to assess healing, residual disease, recurrence, and complications. Adjuvant therapy was administered when indicated, based on the final histopathological diagnosis. Data were analysed using SPSS v29. Data are presented as frequencies and percentages.

RESULTS

Among the 20 patients, invasive mucormycosis was the predominant pathology, accounting for 14 cases (70%), followed by juvenile nasopharyngeal angiofibroma in five cases (25%) and inflammatory pseudotumor in one case (5%). Males constituted the majority of the study population (13 [65 %]). The most frequent presenting symptoms were nasal discharge (8, 40%), facial pain (7, 35%), and epistaxis (6, 30). Imaging demonstrated PPF involvement in 18 patients (90%) on CECT PNS and in all patients who underwent MRI (20, 100%), with paranasal sinus extension in 15 patients (75%). Endoscopic sinus surgery was performed in all cases (20, 100%), with pathology-specific approaches used

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as needed. Histopathology confirmed the preoperative diagnoses in all patients, and adjuvant liposomal amphotericin B was administered to all patients with invasive mucormycosis (14, 70%), while no adjuvant therapy was required in the remaining patients. All patients were followed up for at least 6 months. No recurrence occurred in the JNA or inflammatory pseudotumor cases. Recurrence was noted in two of 14 mucormycosis patients, involving the sphenoid sinus or infratemporal fossa. No PPF recurrence or mortality was observed [Table 1].

Table 1: Summary of clinical, radiological, surgical, and histopathological findings

Variable	Parameter	N(%)
Clinical provisional diagnosis	Inflammatory pseudotumour	1 (5%)
	Juvenile nasopharyngeal angiofibroma	5 (25%)
	Invasive mucormycosis	14 (70%)
Sex distribution	Male	13 (65%)
	Female	7 (35%)
Clinical presentation	Facial pain	7 (35%)
	Facial numbness	3 (15%)
	Epistaxis	6 (30%)
	Nasal discharge	8 (40%)
	Nasal obstruction	4 (20%)
	Diplopia	4 (20%)
	Trismus	2 (10%)
	Cheek swelling	1 (5%)
Imaging findings	PPF involvement in CECT PNS	18 (90%)
	PPF involvement in MRI PNS	20 (100%)
	Nasal cavity involvement (CT)	1 (5%)
	Nasal cavity involvement (MRI)	2 (10%)
	Nasopharyngeal involvement (CT/MRI)	5 (25%)
	Paranasal sinus involvement (CT)	15 (75%)
	Paranasal sinus involvement (MRI)	9 (45%)
	Anterior maxillary wall erosion (CT)	1 (5%)
	Infratemporal fossa involvement (CT)	1 (5%)
	Premaxillary involvement (MRI)	1 (5%)
	Infratemporal fossa involvement (MRI)	2 (10%)
Surgical procedures performed	Endoscopic sinus surgery	20 (100%)
	Modified Denker's approach (JNA)	5 (25%)
	Mega antrostomy (IPT + mucormycosis)	11 (55%)
	Prelacrimal approach (mucormycosis)	2 (10%)
	Modified Denker's approach (mucormycosis)	1 (5%)
Histopathological diagnosis	Inflammatory pseudotumour	1 (5%)
	Juvenile nasopharyngeal angiofibroma	5 (25%)
	Invasive mucormycosis	14 (70%)
Adjuvant therapy	Liposomal Amphotericin B	14 (70%)
	No adjuvant therapy required	6 (30%)
Follow-up outcomes	Minimum follow-up ≥ 6 months	20 (100%)
	Recurrence – JNA/IPT	0
	Recurrence – mucormycosis (outside PPF)	2 (10%)
	Mortality	0

DISCUSSION

This study showed that invasive mucormycosis was the predominant pathology, with male predominance. Nasal discharge, facial pain, and epistaxis are common symptoms. Imaging demonstrated PPF involvement with frequent sinus extensions. All patients underwent personalised endoscopic surgery, and histopathology confirmed the diagnosis. Liposomal amphotericin B was administered in all cases of mucormycosis.

In our study, invasive mucormycosis predominated, followed by juvenile nasopharyngeal angiofibroma and inflammatory pseudotumor, with a male predominance. Similarly, in the study by Darla et al., all 39 patients (100%) with PPF involvement had invasive mucormycosis, with male predominance (28, 71.8%), supporting the predominance of mucormycosis seen in the present study.[11] Felippuin et al. reported a series of 96 juvenile nasopharyngeal angiofibroma patients, all of whom were male with a mean age of 17 years, and most tumours were stage II (50, 52.1%), supporting JNA as a significant but less frequent PPF-related pathology.[12] These studies support our findings by showing that PPF disease commonly affects males, with invasive mucormycosis being the most frequent pathology, while juvenile nasopharyngeal angiofibroma occurs less often but remains clinically important.

Our study showed that nasal discharge, facial pain, and epistaxis were common presentations, whereas nasal obstruction, diplopia, facial numbness, trismus, and cheek swelling were less frequent. Similarly, Arian et al. in a 97-patient cohort with mucormycosis reported nasal discharge in 43 patients (44.3%), facial pain in 48 (49.5%), nasal congestion in 44 (45.4%), decreased facial sensation in 34 (35.1%), and epistaxis in 2 (2.1%).[13] Gökdoğan et al. reported epistaxis and nasal obstruction as key presenting

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symptoms of JNA.[14] These studies support our symptom profile by demonstrating the similar predominance of nasal discharge, facial pain, and epistaxis in mucormycosis and JNA, confirming consistent clinical presentation across different patient populations.

In the present study, imaging demonstrated PPF involvement with frequent paranasal sinus extension and occasional nasopharyngeal and adjacent space involvement. Similarly, in a 50-patient CA-ROCM imaging study, Yadav et al. observed PPF involvement in 34 patients (68%), infratemporal fossa involvement in 33 (66%), and paranasal sinus involvement in over 90%.[15] In a 50-patient mucormycosis series, Gopishankar et al. observed PPF involvement in 29 patients (58%); MRI detected PPF disease with 100% sensitivity versus 68.9% on CT, with frequent infratemporal and extrasinus extension.[16] These studies support our findings by confirming frequent PPF involvement, common paranasal sinus extension, and reliable detection of extrasinus spread on imaging, particularly with MRI, across mucormycosis cohorts.

Our study showed that all patients underwent endoscopic surgery with tailored approaches, and histopathology confirmed diagnoses consistent with preoperative clinical assessment. Plzák et al. found that in a 13-patient PPF tumour series, all patients (100%) underwent endoscopic endonasal surgery; 10 had juvenile nasopharyngeal angiofibroma with PPF ± infratemporal extension, achieving complete resection in 12 cases (92.3%).[17] In Darla et al.'s series, all 39 patients (100%) had histopathological confirmation of invasive mucormycosis with broad aseptate hyphae and obtuse-angled branching, while no cases of juvenile nasopharyngeal angiofibroma or inflammatory pseudotumour were identified.[11] Plzák et al. reported that in a 12-patient endoscopic PPF tumour series, histopathology revealed malignant tumours in 6 patients (50%) and benign tumours in 6 (50%), with biopsy reserved for malignant lesions and gross total resection or debulking performed for benign, non-infiltrative tumours.[17] These studies support our findings by showing the universal use of endoscopic surgery, pathology-guided surgical decision-making, and consistent histopathological confirmation, validating tailored endoscopic approaches and strong clinicopathological correlation in PPF disease management.

In this study, all patients with invasive mucormycosis received liposomal amphotericin B (14, 70%), whereas no adjuvant therapy was required in the remaining six patients (30%). Similarly, in the study by Emaran Sheikh Ismail et al. (57 patients), liposomal amphotericin B was administered to 25 patients (44%); complete recovery occurred in 40 patients (70%), predominantly among those receiving liposomal amphotericin B, with no fatalities reported in this group.[18] This study supports our findings by demonstrating the preferential use of liposomal amphotericin B and superior recovery outcomes.

In our study, patients were followed up for six months; recurrence occurred only in mucormycosis, with none in JNA, IPT, or PPF. Similarly, El Sharkawy found that in 18 patients with stage IA–IIA JNA managed endoscopically, complete resection was achieved in 16 patients. Two patients developed residual or recurrent disease in the sphenoid sinus and pterygopalatine fossa. Follow-up ranged from 14–72 months, with no mortality reported.[19] These findings show effective endoscopic management with low recurrence, site-limited failures, and absence of mortality following adequate surgical clearance

Limitations: This study is limited by its small sample size, single-centre design, and retrospective nature, which restricts generalizability, limits statistical power, and precludes definitive causal inferences regarding outcomes and management strategies.

CONCLUSION

Endoscopic management of PPF pathology enables accurate diagnosis, effective disease clearance, and pathology-guided treatment with favourable outcomes. Invasive mucormycosis predominated, requiring aggressive surgery and antifungal therapy. Future studies should involve multicenter prospective cohorts, standardised imaging protocols, long-term outcomes, and comparative surgical approaches to refine indications, optimise timing, and improve survival. Early referral and multidisciplinary care are recommended.

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