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Original Research Article

Transoral endoscopic approach versus transcervical with or without mandibular swing approach to parapharyngeal space- a retrospective cohort study in a tertiary care center in Tamil Nadu

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ABSTRACT

Background: The objective of this study was to evaluate and compare patient outcomes and advantages of endoscopic transoral approach to parapharyngeal space with other approaches like transcervical with or without mandibular swing approach.
Methods: In this retrospective cohort study, we have reviewed 13 cases of parapharyngeal space tumors resected with either trans oral endoscopic assisted approach or external approaches such as trans cervical and mandibular swing approach during the period of June 1, 2015 to May 31, 2020.
Results: A total of 13 cases were included in the study. Among 13 cases, 9 were operated by transoral endoscopic approach, 2 by transcervical approach and 2 by transcervical with mandibular swing approach. Operative time (p=0.048), blood loss (p=0.028), hospital days (p=0.02) and postoperative patient satisfaction (p=0.008) were more in transoral route compared to transcervical route.
Conclusions: Transoral endoscopic route is a safe route of surgery with less morbidity, less complications, less chance of neurovascular injury and cosmetically more acceptable for the patient when compared to open procedures for smaller size tumors without vascularization, present in the upper part of the parapharyngeal space and without attachment to any neurovascular structures.

Keywords: Head and neck neoplasms, Parapharyngeal space, Skull base

INTRODUCTION

Parapharyngeal space is an anatomic region in the depth of neck obscured by impervious structures like internal carotid artery, internal jugular vein, cranial nerves IX to XII and stymied to access by mandible and oral cavity.[1,2] Parapharyngeal space tumors are uncommon. It can be pre-styloid or post-styloid based on styloid diaphragm and styloid muscles. Less than 0.5% of tumors of head and neck are parapharyngeal tumors. Among that 80% are benign and 20% are malignant.[3] These tumors can be pleomorphic adenoma from minor salivary gland or parotid gland (40%) or can be neurogenic tumors like schwannomas (14%) or paragangliomas (20%), malignant salivary tumors (13%), miscellaneous malignant tumors (7%) and miscellaneous benign tumors (6%).[4,5] These tumors should be surgically excised for symptomatic relief from mass effect and to avoid malignant transformation in case of benign tumors like pleomorphic adenomas. Complex anatomy of parapharyngeal space makes any approach challenging. There are no clear guidelines showing which approach is best for each tumor in parapharyngeal space. Accessibility of the tumor, visualization of important structures and the complications makes this space challenging for any surgeon. Here we try to analyze and find the appropriate approach according to the location

and size of the tumor and its relation to neurovascular structures. These tumors are usually resected by transcervical approach. The main disadvantage of transcervical approach is blind dissection of tumor leading to tumor spillage resulting in recurrence, injury to cranial nerves and major blood vessels resulting in bleeding. Very large tumors are resected by combined approaches like lip-splitting mandibulotomy, transmandibular, transparotid, infratemporal approach or combined endonasal transcervical approach. These have wide exposure but may lead to considerable morbidity.[6] Here we highlight upon endoscopic assisted transoral approach to parapharyngeal space and compare it with other traditional methods.

Transoral approach was first described by Goodwin in 1988.[7] The endoscopic assisted transoral approach is done in highly selected cases depending on size and location of the tumor and its relation to vascular structures. It is a minimally invasive approach with no skin incision or scar, less tissue damage, less speech disruption and less chance of damage to major neurovascular structures.[8] It is currently not known how endoscopic transoral approach compares with other approaches to parapharyngeal space as direct comparisons of these procedures are lacking. The aim of this study was to evaluate and compare patient outcomes and advantages of endoscopic transoral approach to parapharyngeal space with other approaches.

METHODS

Participants

This retrospective cohort study was done in an academic tertiary care private institution in Kanchipuram district, Tamil Nadu, India. Here we have retrospectively reviewed 13 cases of parapharyngeal space tumors resected with either trans oral endoscopic assisted approach or external approaches such as trans cervical and mandibular swing approach during the period of June 1, 2015 to July 31, 2020.

This study was approved by the institutional ethical committee (IEC Ref. No: KIMS/F/2019/14) and the study was registered in clinical trials registry India (CTRI/2020/01/022953). All the treated patients were informed about the procedure and written consent was taken for the usage of findings and photographs in the study.

Patients presenting with oropharyngeal mass with or without neck mass with CT scan and MRI scan showing a mass in the parapharyngeal space were included. Patients with previous history of surgery for oropharyngeal mass, secreting paraganglioma and those unfit for surgery due to other comorbidities were excluded. Patients underwent a preoperative evaluation including history, physical examination, blood investigations, CT scan and MRI scan and Fine needle aspiration cytology. They were classified as pre-styloid or post-styloid by the styloid process and a fascia extending from styloid to tensor veli palatini. Prestyloid space contains fat, retromandibular portion of deep lobe of parotid laterally, auriculotemporal nerve, ascending pharyngeal artery, internal maxillary artery and ectopic salivary glands. Post styloid space contains internal carotid artery, jugular vein, cranial nerves IX to XII, lymph nodes draining paranasal sinuses and superior and medial aspects of oropharynx, sympathetic chain and glomus tissue.[2] MRI was used to classify the tumors as prestyloid or poststyloid and to assess involvement of major vessels. CT scan showed any involvement of skull base. None of our patients had neurological problems or other comorbidities. The choice of surgical technique was determined based on the size of the tumor, location of the tumor and its relation to major vessels. Tumors which were suspected to be malignant or posterior to internal carotid artery or with size more than 8 cm with prominent neck mass were resected by transcervical approach with or without mandibular swing depending on location. Mass involving the oropharynx, in the upper part of the parapharyngeal space mainly in pre-styloid compartment or small size tumors with size less than 5 cm in post-styloid compartment and not extending to neck and without any adhesions to neurovascular structures were operated through transoral route.

Surgical technique- transoral endoscopic approach

All surgeries were performed by senior surgeons with experience in operating various head and neck tumors. The procedure was done in general anesthesia with nasotracheal intubation. 0 and 45 degree 4 mm rigid Hopkins endoscope and suction were held by the assistant surgeon for visualising hidden areas while the surgery was performed. Routine unilateral tonsillectomy was done first after applying Boyle Davis mouth gag. Using a coblator or monopolar cautery mucosal incision was made from the soft palate and anterior pillar to the lower pole of tonsil. The submucosa, loose connective tissue and superior constrictor were dissected and retracted. The thin lining of the capsule was identified over the tumor. The tumor, which was firm in consistency, was gently dissected along with its capsule from the surrounding structures starting from medial aspect to deeper lateral aspect using artery forceps. Blunt dissection was done on the bed of the tumor meticulously to avoid injuring the major neurovascular structures present deep to the tumor and also to avoid tumor rupture and spillage. Endoscope was used to identify the underlying major vessels and nerves during dissection. Inadvertent injury to any of these can lead to severe uncontrolled bleeding or neural injury. Small vessels or feeding vessels were ligated or cauterised using bipolar diathermy. Tumor was removed en bloc through the oral cavity in 6 cases. In 2 cases, the tumors were large in size, so debulked from the inferior pole and removed piecemeal through same route. 45-degree endoscope was used after tumor removal to check for residual tumor or bleeding. The wound was irrigated with saline and closed in layers using 3-0 absorbable

sutures. Post operatively antibiotics and steroids were given to all patients for 3 days to prevent infection and edema.

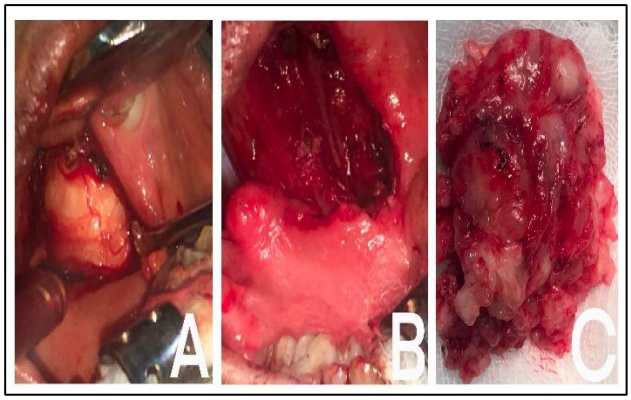

Figure 1: Transoral Endoscopic Approach. (A) Transoral exposure of the parapharyngeal space tumor; (B) Endoscopic view showing glossopharyngeal nerve in the parapharyngeal fossa; (C) Mass from the parapharyngeal space.

Trans cervical approach

This procedure was done under general anesthesia with nasotracheal or orotracheal intubation. 2.5 cm below the lower border of mandible, a horizontal skin crease incision was made. Subplatysmal skin flap raised. Sternocleidomastoid muscle retracted. Great vessels of neck were identified and secured after incising cervical fascia. Posterior belly of digastric muscle was retracted. Facial vessels and lower cranial nerves were identified. Tumor was dissected extracapsularly and removed en bloc. Hemostasis was achieved. Drain was kept and wound closed in layers with 3-0 vicryl and 3-0 ethilon interrupted sutures.

Trans cervical with mandibulotomy approach

This procedure was done under general anesthesia with nasotracheal intubation. Initial steps of transcervicel approach was performed. The incision was extended to the chin and lower lips. Lip split was done in midline. Anterior mandible was exposed and divided in midline in stair step pattern after separating digastric tendon from hyoid. Intraoral incision was made from the floor of the mouth to anterior pillar. Mylohyoid muscle was divided after identifying hypoglossal nerve. Mandible retracted laterally. Tongue was retracted medially, styloglossus and stylopharyngeus muscles were divided and parapharyngeal and retropharyngeal spaces were opened lateral to the constrictor muscles. Tumor dissected and removed en bloc. Intraoral incision was closed in layers using 3-0 vicryl and 3-0 catgut. Mandibulotomy was closed with wires. Feeding nasogastric tube inserted. Neck drain was placed and incision closed in layers using 3-0 vicryl. Skin was closed with 3-0 ethilon interrupted sutures.

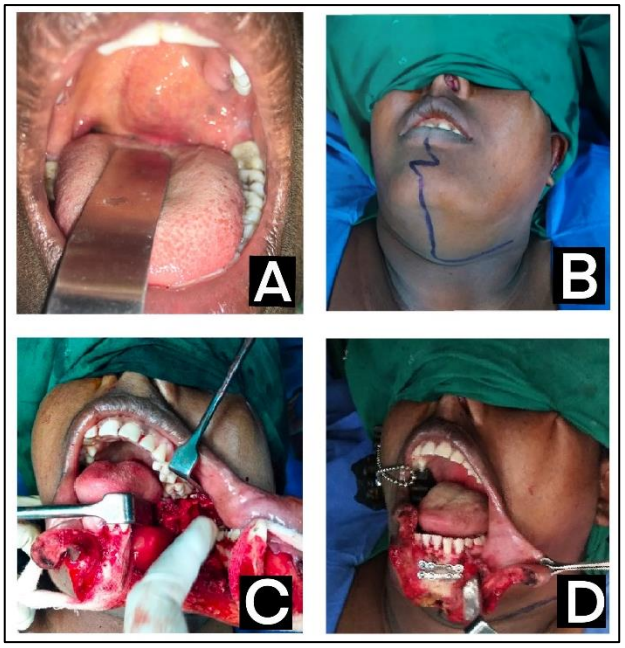

Figure 2: Transcervical Mandibulotomy Approach. (A) Intraoral examination showing parapharyngeal mass extending superiorly into soft palate; (B) Midline step ladder incision; (C) Exposure of the parapharyngeal space after lip splitting procedure; (D) Lip splitting transcervical mandibulotomy with plating.

Measurements and statistical analysis

In each patient, age, location of tumor weather pre-styloid or post-styloid, approach, size of tumor, average blood loss, operative time, postop or intraoperative complications, number of hospital days, postoperative patient satisfaction, FNAC report and final diagnosis were noted. Size of the tumor was measured by CT or MRI scan, blood loss was measured by amount of fluid in the suction jar minus the amount of fluid used, gauze count; postoperative patient satisfaction was measured using visual analogue scale with 1 showing least satisfaction and 10 showing complete satisfaction. Categorical comparisons between transoral endoscopic approach and transcervical approach with or without mandibulotomy were evaluated. Mean, standard deviation and mean (95% CI) were calculated and evaluated. Statistical analysis was done using GraphPad Prism, Version 8.1.2.

RESULTS

A total of 13 cases meeting the inclusion criteria were included in the study. Of these, 9 (69.3%) were women and 4 (30.7%) were men; mean (SD) age was 35.8 (12.9) years. Demographic details are given in Table 1. 10 (76.9%) were in prestyloid region and 3 (23.1%) were in poststyloid region. Among 13 cases, 9 were operated by transoral endoscopic approach, 2 by transcervical approach and 2 by transcervical with mandibular swing approach. Mean (SD) tumor size in transoral endoscopic

approach was 5.4 × 5 × 4.8 cm (1.7 × 1.9 × 2.4) and mean (SD) tumor size in transcervical approach was 8.7 × 9 × 7.5 cm (3.4 × 3.7 × 2.7). Operative time was less in transoral endoscopic route (103.9 minutes; 95% CI, 78.85 to 128.9 minutes) compared with transcervical route (168.8 minutes; 95% CI, 109.8 to 227.7 minutes). Blood loss was less in transoral endoscopic route (32.22 ml; 95% CI, 20.52 to 43.93 ml) compared with trancervical route (131.3 ml; 95% CI, 32.22 to 230.3 ml). Hospital days was less in transoral endoscopic approach (3 days; 95% CI, 2.3 to 3.6 days) compared to transcervical route (6.5 days; 95% CI, 3.7 to 9.3 days). Postoperative patient satisfaction was more in transoral route (8.9; 95% CI 8.3 to 9.5) compared to transcervical route (5.5; 95% CI 3.4 to 7.5) (Table 2). Histopathological examination revealed pleomorphic adenoma in 8 (61.5%) cases, schwannoma in 3 (23%) cases, metastatic cervical lymphadenopathy in 1 (7.7%) and Non Hodgkins lymphoma in 1 (7.7%) case.

Table 1: Demographic characteristics.

	Transoral endoscopic	Transcervical with or without mandibulotomy	Total
Age, years (mean±SD)	35.22±11.56	37±17.61	35.77±12.94
Male (%)	4 (44.44%)	0 (0%)	4 (30.77%)
Female (%)	5 (55.56%)	4 (100%)	9 (69.23%)
Symptom			
Oropharyngeal mass (%)	6 (66.67%)	0	6 (46.15%)
Oropharyngeal and neck mass (%)	3 (33.33%)	1 (25%)	4 (30.77%)
Neck mass (%)	0	3 (75%)	3 (23.08%)
Tumor size (l×b×h) (mean±SD)	5.44 × 4.98 × 4.81 (1.74 × 1.91 × 2.36)	8.75 × 9 × 7.5 (3.4 × 3.74 × 2.74)	6.46 × 6.21 × 5.64 (2.73 × 3.11 × 2.69)
Tumor location			
Prestyloid (%)	8 (88.89%)	2 (50%)	10 (76.92%)
Poststyloid (%)	1 (11.11)	2 (50%)	3 (23.08%)
Diagnosis			
Pleomorphic adenoma (%)	7 (77.78%)	1 (25%)	8 (61.54%)
Schwannoma (%)	1 (11.11%)	2 (50%)	3 (23.98%)
Non Hodgkin's lymphoma (%)	1 (11.11%)	0	1 (7.69%)
Metastatic cervical lymphadenopathy (%)	0	1 (25%)	1 (7.69%)

Table 2: Perioperative and postoperative data.

	Transoral endoscopic	Transcervical with or without mandibulotomy	P value
Operation time (minutes±SD)	103.9 ± 32.57	168.8 ± 37.05	0.03
Blood loss (mL ± SD)	32.22 ± 15.23	131.3 ± 62.23	0.04
Hospital days ± SD	3 ± 0.87	6.5 ± 1.73	0.02
Postoperative patient satisfaction	8.89 ± 0.78	5.5 ± 1.29	0.008
Complications			
Seroma (%)	1 (11%)	0	
Malocclusion (%)	0	1 (25%)	

Complications and recurrence

All patients were followed for 1-3 years. There were no major complications intraoperatively or postoperatively in both the groups. In one case of transcervical approach with mandibular swing, malocclusion was seen postoperatively. One transoral patient developed seroma in operated site on post-operative day 1 which was drained. None had any recurrence.

DISCUSSION

Parapharyngeal space (PPS) tumors are mostly benign tumors like pleomorphic adenoma, paraganglioma, schwannoma, etc. Majority of PPS tumors are detected during routine oral examination as asymptomatic masses pushing soft palate and unilateral tonsillar enlargement. They may also present with ear fullness, dysphagia, odynophagia, difficulty in mouth opening, hoarseness of voice, or change in voice. Proper preoperative evaluation

is necessary to choose the best route of approach to these tumors.

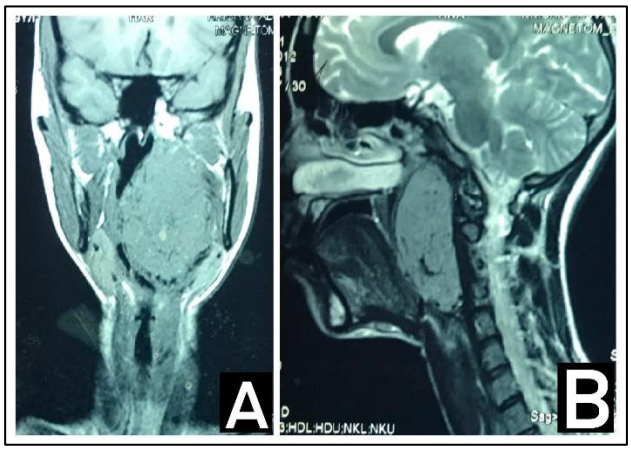

Figure 3: MRI scan showing a well-defined hyper intense mass in the left parapharyngeal space extending from skull base to mandible presenting as oropharyngeal bulge. (A) Coronal view; (B) Sagittal view.

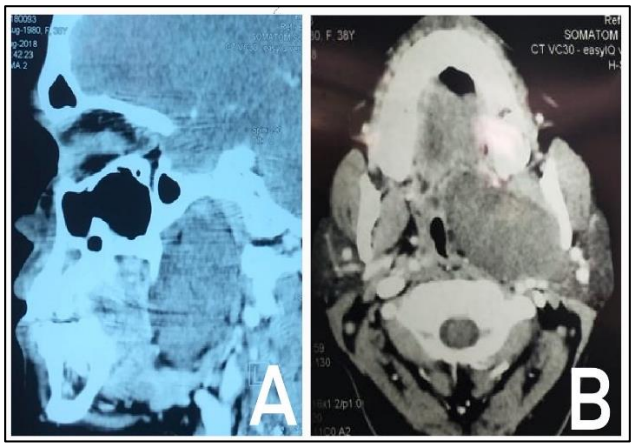

Figure 4: (A) Computerized tomography of left parapharyngeal space showing tumor extending from the base skull and into upper part of PPS. (B) A well-defined mass in left parapharyngeal space in prestyloid compartment.

MRI is the most important investigation in diagnosing tumors of PPS space. In carotid body tumors or paragangliomas MR angiography helps to delineate carotid artery and show the relation between carotid artery and tumor. MRI helps localise the position of tumor either intraparotid or extraparotid by the fat plane between gland and tumor and either pre-styloid or post-styloid compartment (Figure 3). MRI signal characteristics can differentiate between paragangliomas, vascular tumors, schwannomas etc. CT neck is done to know skull base involvement, erosion of pterygoid plates or cervical vertebra, involvement of carotid sheath and intracranial extension through jugular foramen (Figure 4). CT neck can help to know whether the tumor is pre-styloid or post-styloid. Post-styloid tumors like schwannoma can displace the carotid artery. In smaller tumors, presence of a fat plane between deep lobe of parotid and the mass implies extraparotid location of the tumor. Pleomorphic adenomas have irregular areas of minimal enhancement. Paraganglioma, hemangioma and aneurysms show contrast enhancement. Irregular tumor margins, invasion to surrounding structures and fat planes and presence of necroric nodes suggest malignancy. A 3D reconstruction of both MRI and CT helps to plan the surgical approaches priorly. Carotid angiography can be done in vascular tumors or those extending to skull base.

In post-styloid tumors suspected to be paraganglioma, glomus jugulare or carotid body tumor, serum catecholamine and urine vanillylmandelic acid are analysed. Propanolol or phenoxybenzamine is given preoperatively in these cases.[9]

FNAC can be done to know the histopathology of these tumors. However, transcervical FNAC is better than transoral biopsy as the risk of bleeding, tumor spillage and recurrences are high with biopsy. The surgical dissection also becomes difficult after transoral biopsy as there is fibrosis of that area. However, in pulsating tumors FNAC is avoided as it gives no added advantage over MRA in diagnosing.

Histopathological examination reveals 79.1% of tumors of PPS are benign. 20.9% are malignant. Commonest histopathologic diagnosis in the PPS tumors include pleomorphic adenoma which is 39.2% of all benign tumors of PPS and 31% of all tumors of PPS according to the study of Locketz et al. Benign neural tumors like paragangliomas (16.6% of benign tumors), schwannomas (15.6% of benign tumors) are also seen. Adenoid cystic carcinoma is the most common malignant type comprising 30% of malignant salivary gland tumors.[10,11] Other malignant salivary tumors include lymphoma (14.9%), sarcoma (8.2%), squamous cell carcinoma (8.6%) and metastatic disease (8.2%). Others like adenocarcinoma of salivary glands, carcinoma ex pleomorphic adenoma, mucoepidermoid carcinoma, acinic cell carcinoma, paraganglioma and malignant vascular tumors comprises lesser percentage.[10]

Many surgical approaches to PPS are described. None of them have the advantage of complete tumor removal, less morbidity, no scar and preservation of surrounding nerves and vessels. All the external approaches have an obvious scar. The transcervical approach has adequate access and exposure. But it cannot be used for tumors in upper part of PPS near the skull base. Injury to marginal mandibular nerve, vocal cord palsy or hypoglossal nerve injury can occur as complications of this approach.[12] Transparotid cervical approach as explained by Stell et al gives wide exposure to pre-styloid salivary tumors like dumbbell variety tumor from deep lobe of parotid or minor salivary gland tumors. Retrostyloid tumors, neurogenic tumors and small paragangliomas can also be removed by transparotid cervical approach. Transparotid cervical approach can be combined with midline mandibulotomy

for removal of malignant post-styloid tumors or tumors of skull base. Tumor rupture or spillage can occur with this approach. There is also risk of major vessel injury, vagus nerve, facial nerve, hypoglossal nerve, spinal accessory nerve or glossopharyngeal nerve injury in transparotid transcervical approach.[13,14] Mandibular swing approach as reported by Elaprolu et al can give wide exposure to tumors in oropharynx. But this approach may cause dental malocclusion, injury to mandibular branch of facial nerve, loss of incisor tooth, vagus nerve or hypoglossal nerve palsy and may need elective tracheostomy in some cases. It is also cosmetically not acceptable to patients. The average blood loss and postoperative stay in hospital were also more in Mandibular swing approach.[15] Video assisted minimally invasive transcervical approach as reported by Hughes III et al can be used for small size tumors less than 7 cm and can give good hemostasis and plane identification. Skull base tumors and vascular paragangliomas cannot be approached through this and the access to parapharyngeal space is limited. Hypoglossal nerve damage can be a complication in this approach.[16] Infra temporal fossa approach gives adequate intraoperative visibility. They give excellent exposure with less morbidity. The main complication in this approach is damage to facial nerve, IX, X cranial nerves, other cranial nerves and conductive hearing loss.[17]

There are many recent advances in approach to parapharyngeal space. Microdebrider assisted transcervical debulking and cavitation of the tumor can be done. This technique enhances visualization of upper end of tumor and its adjacent structures so it could be safely removed. However pleomorphic adenomas could not be removed by this as there is risk of tumor rupture and spillage. Transnasal endoscopic approach to parapharyngeal space via the infratemporal fossa or endoscopic transnasal transmaxillary transpterygoid approach are tried in recent times. Tumors of the upper parapharyngeal space can be easily resected by this approach. But there can be difficulty in bleeding control and access to the tumor and tumors requiring manipulation of internal carotid artery could not be removed by this approach.[18] Transoral approach was tried and abandoned previously as it was a blind approach. It was first described by Goodwin and Chandler. Now due to advancements in endoscopes, visualisation is better and an endoscopic assisted transoral approach is being tried. It has the advantage of less blood loss, less operating time, decreased number of hospital stay days and cosmetically more acceptable for the patient. There is also less chance of complications and neurovascular injuries and smooth postoperative period. Patient satisfaction is also very high in this approach. Small size avascular tumors like pleomorphic adenoma or schwannoma can be easily approached through transoral route.[19-21] Disadvantage of this approach is larger tumors cannot be removed en bloc and there is a risk of tumor spillage when debulking large tumors. Any damage to feeder vessels or any other vessel can become difficult to manage by this approach, so vascular tumors cannot be removed by this approach.

CONCLUSION

Most of the neoplasms of parapharyngeal space are benign. Less invasive and least complicating technique should be chosen for its removal. In our experience, smaller size tumors without vascularization present in the upper part of the parapharyngeal space can be removed safely with transoral endoscopic approach. The visualization is better with the use of endoscope. Transoral endoscopic route is a safe route of surgery with less morbidity, less complications, less chance of neurovascular injury and cosmetically more acceptable for the patient when compared to open procedures. But this study should be done with more cases and as a randomised trial to further evaluate the best method and define the criteria for selection of best route of surgery.

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Ethical approval: The study was approved by the Institutional Ethics Committee (IEC Ref. No: KIMS/F/2019/14)

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