Novel Insights from Clinical Practice

Contemporary Management of Benign Parapharyngeal Lesions Using Minimally Invasive Techniques: Case Discussion and Review of the Literature

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What Is It about?

In this article, we evaluate the historical and contemporary management of benign masses in the parapharyngeal space. Given the difficulty in accessing this region of the body, surgical techniques prior to the advent of minimally invasive techniques involved significant potential morbidity for the patient. In those patients with benign diagnoses and bothersome symptoms, modern techniques in transoral laser surgery provide meaningful alternatives to surgical treatment with significantly decreased morbidity. We provide a review of contemporary management options for benign parapharyngeal masses and highlight an example of one such case managed with transoral KTP laser surgery.

Keywords

Branchial cyst · Minimally invasive · KTP laser · Parapharyngeal mass

Abstract

Branchial anomalies can present in the parapharyngeal space, creating unique challenges in management. Historically, this approach warranted an open approach, including transcervical, transparotid with total parotidectomy and retromandibular dissection, or transmandibular dissection with mandibulotomy. However, the advent of minimally invasive transoral techniques and laser resection have allowed for successful resection of masses in this anatomical region without an external approach. We illustrate these advancements with the case of a 30-year-old man with globus sensation and throat discomfort, found to have a mass of the right posterolateral oropharynx causing severe airway obstruction. Imaging showed a parapharyngeal mass with extension to the carotid sheath and retropharyngeal space, which was successfully resected with potassium-titanyl-phosphate (KTP) laser using a minimally invasive transoral approach with no major complications. Transoral excision offers decreased morbidity and a cosmetically favorable outcome compared to transcervical excision. KTP laser may be safely used for transoral excision of a benign parapharyngeal mass.

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Established Facts

- The mainstay of treatment for branchial cleft cysts is excision, but management options vary with the extent and location of the mass.
- An external approach, to date, represents the overwhelming majority of reported approaches to masses of the parapharyngeal space, but has greater morbidity, increased risk of neurovascular complications, increased post-operative pain, and longer post-operative recovery time.
- Transoral excision offers decreased morbidity and a cosmetically favorable outcome compared to transcervical excision, but incomplete excision of the cyst carries a high risk of recurrence.

Novel Insights

- Transoral laser surgery techniques and KTP laser may be safely used for transoral excision of a benign parapharyngeal mass.

Introduction

Parapharyngeal space masses require special considerations due to their close proximity to vital neurovascular structures [1, 2]. Historically, approach to this region required open external cervical approaches with potential for significant morbidity and consideration for mandibulotomy. Advances in minimally invasive techniques and transoral laser surgery have significantly decreased the morbidity of resection in the parapharyngeal space, particularly with regard to benign lesions where margin status and the potential for post-operative radiation are not under consideration.

We present a discussion of contemporary operative management of benign oropharyngeal masses, starting with an illustrative case in which we used potassium-titanyl-phosphate (KTP) laser to perform transoral excision of a large parapharyngeal branchial cyst extending into the retropharyngeal space.

Case Discussion

Initial Presentation

A 30-year-old man presented with 3 years of throat fullness. He first noted a mass during an episode of sore throat and reported persistent symptoms of throat discomfort and globus sensation. He otherwise denied dysphonia, dyspnea, or dysphagia. The patient denied any history of fever and was otherwise in good general health. Physical examination revealed a 4- to 5-cm cystic, pedunculated mass in the right posterolateral oropharynx, notable for a blueish hue of the overlying mucosa. The remainder of his head and neck examination was unremarkable. Flexible nasolaryngoscopy demonstrated 50–60% obstruction of the pharyngeal airway by the mass without extension into the nasopharynx or hypopharynx. Contrast-enhanced computed tomography confirmed a cystic right lateral oropharyngeal mass, originating from the parapharyngeal and retropharyngeal spaces with differential consideration including branchial cleft anomaly, lymphangioma, or obstructive salivary gland pathology (Fig. 1). The lesion appeared to arise from the posterior right tonsillar pillar and abutted the internal carotid artery laterally without suspicion of adhesion or invasion.

Fig. 1. Pre-operative CT scan (axial cut) demonstrating the parapharyngeal branchial cleft cyst.

The patient was counseled on management options, including observation, aspiration, or surgical excision, and opted to proceed with the latter. Given the extent of pharyngeal protrusion of the lesion, consideration was given to an attempt at transoral excision, with tentative consent also provided for an external transcervical approach.

Operative Course: Transoral Excision with KTP Laser

The patient was intubated uneventfully with a small orotracheal tube, which was secured to the midline lower lip. A Crowe-Davis mouth gag was placed in the oral cavity and two red rubber catheters were placed transnasally to retract the soft palate and expose the lesion (Fig. 2a). A 0.6-mm KTP laser fiber was passed through a handheld rigid probe used for laser energy delivery.

The lesion was retracted medially and, using the KTP laser beam in contact mode as a cutting tool, an incision was made in the posterior tonsillar pillar. The incision was extended through the pharyngeal constrictor, and close dissection was performed to separate the mass from its adjacent boundary structures, namely the pharyngeal constrictors, longus colli, and prevertebral muscles. Next, the posterior tonsillar pillar was retracted, and dissection was carried into the parapharyngeal space. The internal carotid sheath was visualized and the lesion was separated from it without difficulty. An ascending pharyngeal artery branch was encountered and selectively cauterized with bipolar electrocautery. The dissection was then carried superiorly and around the palatopharyngeal muscle to release the mass from its final superior retropharyngeal attachments. Hemostasis was achieved, and the wound was copiously irrigated. Fibrin sealant was applied along the carotid sheath dissection plane, and an approximately 5-cm-wide mucosal defect was left to heal by secondary intention (Fig. 2b). The patient was extubated uneventfully and discharged home on the day of the procedure.

Post-Operative Course

Final pathology demonstrated a benign cyst lined by respiratory mucosa, consistent with a branchial cleft cyst. Post-operatively, the patient was placed on a soft diet and a 1-week course of oral antibiotics. His course was notable for a brief episode of self-limited oral

Fig. 2. Intra-operative photos demonstrating the cyst in situ (**a**), resection cavity (**b**), and post-operative pharynx (**c**).

bleeding on post-operative day 1, and admission for odynophagia at 36 h, at which time a CT scan was unremarkable for acute complications, and incidentally allowed confirmation of the completeness of excision by early visualization of the surgical defect extending to the carotid sheath (Fig. 3). He improved with medical management, and his course was otherwise uneventful. At his post-operative day 6 office visit, physical examination and flexible laryngoscopy revealed a clean mucosal defect of the right oropharynx, with fibrinous eschar overlying the defect and no bleeding. He was advanced to a regular diet 3 weeks post-operatively without difficulty. He was last seen 9 months post-operatively, with transoral examination demonstrating complete pharyngeal remucosalization (Fig. 2c), while the patient remained durably asymptomatic.

Discussion

Benign Masses of the Parapharyngeal Space and Second Branchial Cleft Cysts

Parapharyngeal space masses are rare and require special considerations due to their close proximity to vital neurovascular structures [1, 2]. The parapharyngeal space is divided anatomically into prestyloid and poststyloid spaces, with the differential diagnosis driven by

Fig. 3. Post-operative CT scan (axial cut) demonstrating interval resection of the parapharyngeal mass with no residual tumor.

local structures [1–3]. Consideration must always be given to potential malignancies in the oropharynx and parapharyngeal space, and the management of malignant tumors of the oropharynx is also an evolving paradigm in the era of minimally invasive techniques such as robotic surgery.

Benign entities play a rare but nonetheless significant role in the parapharyngeal space. A prior single-institution review of parapharyngeal space masses reported that approximately 80% are benign entities, among which greater than 50% were neurogenic and approximately 30% were salivary in origin [4]. Schwannomas with cystic degeneration, minor salivary gland tumors, and paragangliomas are all considerations in the initial evaluation of a benign parapharyngeal space mass.

Branchial cleft cysts form around the seventh week of embryonic development when a portion of a branchial cleft fails to involute completely [1]. Branchial cleft cysts in the parapharyngeal region are a rare entity, with 37 cases reported to date, and due to their cystic nature are amenable to a different approach to management than their solid tumor counterparts [1, 5]. A branchial cleft cyst arising in the parapharyngeal space is defined in the Bailey classification as a type IV second branchial cleft cyst due to its location lying against the pharyngeal wall, and is thought to form from a remnant of the pharyngeal pouch [3].

Diagnostic Approach to Parapharyngeal Masses

Although branchial cleft cysts typically present in late childhood or early adulthood, a review of the current literature demonstrated a later age of presentation for branchial cleft cysts arising in the parapharyngeal space (Table 1). Most patients had minor symptoms at presentation, such as throat pain, and the masses were noted in the outpatient setting on physical exam or imaging [1, 2]. Because parapharyngeal cysts expand along the path of least resistance, they commonly present as submucosal masses protruding intraluminally into the oropharynx [5]. A predominance of clinicians evaluated the cyst with fine-needle aspiration (FNA), demonstrating cystic material with epithelial lining (Table 1). Imaging modalities used to evaluate these masses include CT neck with contrast and/or MRI neck with contrast. On MRI, these masses were typically hyperintense on T1 and could be hyper- or hypointense on

Table 1. Characteristics of the reviewed studies

First author	Age at presentation, years	Gender	Size, cm	Laterality	Imaging	FNA	Management
Gupta [2]	35	F	5	Left	MRI with contrast	Y	Transcervical/submandibular
Saussez [1]	54	M	10	Left	CT with contrast	Y	Transoral aspiration/bipolar
Piccin [4]	48	N	8.2	Left	CT + MRI with contrast	N	Transcervical/mandibulotomy
Diaz-Manzano [10]	40	M	5	Left	MRI with contrast	Y ¹	Transoral marsupialization
Ghosh [9]	8	F	3	Left	CT with contrast	Y	Transcervical + transoral marsupialization
Ahn [6]	54	M	U	Left	MRI with contrast	N	Transzygomatic-transtemporal
Dallan [8]	40	F	4–5	Right	MRI with contrast	N	Transoral transcervical

U, unreported.

¹ FNA results were inconclusive.

T2 [2, 5–8]. In the present case, FNA was not deemed necessary, given the stereotypically benign presentation of the lesion without risk factors or clinical and radiographic elements of suspicion for a neoplastic etiology.

External Approach to Benign Parapharyngeal Masses

The mainstay of treatment for branchial cleft cysts is excision, but management options vary with the extent and location of the mass [1–9]. Broadly, there are three options for an external approach to excision, including transcervical, transparotid with total parotidectomy and retromandibular dissection, or transmandibular dissection with mandibulotomy. A transcervical approach offers the best chance of complete excision (therefore minimizing the risk of recurrence) [6]. An external approach, to date, represents the overwhelming majority of reported approaches to masses of the parapharyngeal space. In fact, a 10-year single-institution retrospective chart review concluding in 2003 reported 116 parapharyngeal space masses, all of which had been managed with an external approach, including 30 transcervical-transmastoid approaches, 20 transparotid-transcervical approaches, and 3 mandibulotomies [7]. However, external approaches have greater morbidity, increased risk of neurovascular complications, increased post-operative pain, and longer post-operative recovery time required [1–3, 5, 6, 8, 9]. The drawbacks of undergoing this type of extensive procedure for a benign entity further illustrates the benefit of conservative transoral options such as aspiration, incision, and drainage with marsupialization, and injection of sclerosing agents.

In our review of parapharyngeal branchial cleft cysts, to date, there is a slight predominance of external approach versus transoral approach, with 24 cases managed with external approach and 14 cases managed with transoral approach, including 1 case in which a combined transoral and transparotid approach was used [1, 2, 8, 10]. A thorough systematic review in

2014 inclusive of over 1,100 parapharyngeal space masses reported a 48% rate of transcervical approach to this region [11]. However, recent trends favor the use of minimally invasive approaches without external incision.

Minimally Invasive Techniques for Benign Parapharyngeal Masses

A transoral approach to the parapharyngeal space has previously been associated with a theoretical increased risk of tumor spillage or incomplete resection [12]. Transoral excision is favored when the lesion was medial to the great vessels, and offers decreased morbidity with a cosmetically favorable outcome. When feasible, the transoral approach offers decreased post-operative pain and decreased time to resumption of regular diet [1, 2, 9]. Notably, transoral approaches to cystic lesions without complete excision of the cyst have a high risk of recurrence.

With regards to the specific management of branchial cleft cysts with this approach, the successful transoral excision of a piriform sinus branchial cyst with CO₂ laser has also been recently reported, drawing from technical expertise and application of this technology in transoral approaches to the hypopharynx, which have been in widespread practice for malignant lesions since the advent of transoral laser microsurgery [13].

When necessary, transoral techniques can also be combined with a transcervical technique where the external approach is deemed unavoidable. The combined approach may offer decreased morbidity or an opportunity for complete resection in cases where this is not thought to be possible with either approach alone. Betka et al. [12] reported their experience of 26 consecutive patients with parapharyngeal space masses who underwent resection with either a transoral or combined transoral-transcervical approach, including the resection of two malignant masses.

Lastly, advances in robotic surgery have also been applied to benign entities of the parapharyngeal space, with 13 cases reported of a robotic surgical approach to the masses of this region, with complete en block resection performed in all but one [14, 15]. Although the precise indications for this approach and long-term outcomes have yet to be determined, continued advancements and increased experience may yield expanded applications for robotic surgery for benign lesions of the parapharyngeal space.

Safety and Efficacy of KTP Laser Excision in the Oropharynx

Like most lasers, KTP laser is photoselective, but its 532-nm wavelength is absorbed preferentially by hemoglobin, offering excellent coagulation capabilities with limited penetration of nearby tissues. However, the depth of penetration of diffused energy is greater with KTP than with CO₂ laser, which can result in greater local post-operative inflammation and discomfort, as experienced by our patient. The amount of diffused energy may be mitigated by decreased power or appropriate pulsed delivery parameters. It was previously thought that KTP laser use in the oral cavity and oropharynx would result in decreased blood loss, reduced post-operative pain, and rapid wound healing [16, 17]. Subsequent studies in total tonsillectomy demonstrated increased pain, increased operative time due to laser setup and malfunction, decreased blood loss, and decreased or unchanged healing time [16]. Although of seemingly little benefit for a routine application like tonsillectomy, this method nonetheless offers the use of a precise tool to achieve complete excision in deeper-seated, more complex benign conditions, providing a minimally invasive approach and possible avoidance of an external approach.

When evaluating patients for KTP laser excision, it is critical to assess appropriate candidacy for this type of excision, paying close attention to nearby structures and anticipating sufficient exposure to the mass transorally. With appropriate patient selection, KTP laser is a safe alternative for transoral excision of benign parapharyngeal masses.

Conclusion

The operative approach to benign masses of the parapharyngeal space has previously been managed with external cervical approaches, placing patients at risk for high morbidity and post-operative pain. Modern techniques in transoral laser surgery offers a safe, effective, conservative management option for resection of these masses.

Statement of Ethics

This study complies with internationally accepted standards for research practice and reporting as laid out in the COPE guidelines. The subject described in this work gave their written informed consent to publish their case, including the publication of images. Our project was additionally approved for a HIPAA waiver by the institutional review board for Weill Cornell Medical College.

Conflict of Interest Statement

The authors of this study have no conflicts of interests to disclose.

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Author Contributions

All three authors have met the four criteria for authorship as laid out by the ICMJE. Specific contributions are noted as follows: T.P.H. – manuscript preparation, reporting of clinical data, literature analysis, development of table and figures. M.C. – manuscript preparation, literature review, data collection. B.S. – supervision of all activities and intellectual direction, manuscript revision for intellectual content, clinical care and management of the patient.

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