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Parapharyngeal Space Primary Tumours

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KEYWORDS
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Abstract
Introduction and objectives: The aim of this study is to present our experience with the diagnostic and therapeutic approaches for parapharyngeal space tumours.

Patients and method: This study is a retrospective review of 90 patients diagnosed with tumours of the parapharyngeal space and treated surgically between 1984 and 2015. Patients whose tumours were not primary but invaded the parapharyngeal space expanding from another region, tumours originating in the deep lobe of the parotid gland and head and neck metastasis were excluded from this study.

Results: 74% percent of the parapharyngeal space neoplasms were benign and 26% were malignant. Pleomorphic adenoma was the most common neoplasm (27%), followed by paragangliomas (25%), miscellaneous malignant tumours (16%), neurogenic tumours (12%), miscellaneous benign tumours (10%), and malignant salivary gland tumours (10%). The transcervical approach was used in 56 cases, cervical-transparotid approach in 15 cases, type A infratemporal fossa approach in 13 cases, transmandibular approach in 4 cases and transoral approach in 2 cases. The most common complications were those deriving from nervous injuries.

Conclusions: Most parapharyngeal space tumours can be removed surgically with a low rate of complications and recurrence. The transcervical approach is the most frequently used.

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Introduction

The parapharyngeal space is a virtual anatomical area that has a morphology of an inverted triangular pyramid extending from the base of the skull to the hyoid bone. A base, an apex and 3 walls can be defined. The petrotympanic fissure in the temporal bone serves as the upper limit or base, while the greater cornu of the hyoid bone marks the lower limit. There is an external wall formed by an aponeurotic muscle group, consisting of the sternocleidomastoid muscle and its aponeurosis, the superficial cervical aponeurosis that covers the parotid gland, and ascending branch of the mandible with the pterygoid and masseteric muscles. The medial wall is formed by the lateral side of the pharynx. The posterior wall is shaped by the aponeurosis and the prevertebral muscles and the cervical transverse processes. The parapharyngeal space is divided into 2 compartments by a styloid diaphragm or osteomuscular-aponeurotic sheet originating at the styloid process, running on a slanted plane from upwards downwards, from back to front and from lateral to medial. The anterior or prestyloid compartment arises from the styloid process, likewise running on a slanted plane from upwards downwards, from back to front and from lateral to medial. The anterior or prestyloid compartment is occupied by the deep lobe of the parotid gland, fat and lymphatic nodes, the internal maxillary artery and inferior, lingual and temporal auricle alveolar nerves. In the posterior or retrostyloid compartment (the suprathyroid portion of the space) lies the neurovascular axis, consisting of the carotid artery, jugular vein, cervical sympathetic chain and the cranial nerves IX, X, XI and XII.1 After such a complicated anatomical description, it is easy to understand the great histological diversity of tumours that can originate in the parapharyngeal space.1

As a group, parapharyngeal tumours are rare within the oncological pathology of the head and neck, representing only 0.5%.2 Nevertheless, the parapharyngeal space is of particular importance, both for the diversity of structures enclosed within it, and for the varied nature of the tumours found there.

The anatomical characteristics of these tumours make it difficult to achieve an early diagnosis with a routine physical examination. Complementary imaging studies, especially computed tomography (CT) scans and magnetic resonance MR imaging, are essential both for diagnosis and for planning the surgical approach. Such planning, given the benign nature of most of these tumours and their concealed anatomical setting, plays a crucial role, in order to ensure complete removal of the lesion together with minimal patient morbidity and mortality.

Materials and Methods

We present a retrospective study on 90 patients with tumours of the parapharyngeal space, surgically treated in our hospital between 1984 and 2015. The method used was the review of clinical histories. Patient data, such as age, clinical presentation, examination, pathological anatomy, imaging tests, treatment and follow-up, were analysed.

Criteria for exclusion from the study were patients whose tumours were not primary, but rather invaded this region because of adjacency (such as carotid glomus), those originating in the deep lobe of the parotid gland, and lymph node metastases.

Results

Our study group had a wide age range, extending from months of life up to 88 years old. Mean age was 47 years and median, 44 years. There was no predominance by sex: 44 males (49%) and 46 females (51%).

The most common reason for consultation was the appearance of a mass, either at the cervical level, which
23 patients (26%) presented, or at the oropharyngeal level, which 15 patients (17%) presented. Other habitual symptoms were dysphagia, present in 15 patients (17%), and the appearance of pulsatile tinnitus, in 10 patients (11%). Other, less frequent, symptoms were dysphonia, earache, deafness, vertigo, cervical pain and taste blindness. It should be pointed out that in our series there was a group of 22 patients (24%) in whom the disease evolved without symptoms and diagnosis was a chance finding upon performing an imaging study for another reason.

The most frequent findings in the physical examination were bulging of the posterior wall of the oropharynx and of the tonsillar area, in 31 patients (34%), and palpation of a cervical mass, in 23 patients (26%). Of lesser frequency were vocal fold paralysis (6 patients, 7%), the presence of a hypotympanic mass, paresis and paralysis of the lower cranial nerves. The physical examination revealed no significant results in 12 patients (12%).

Once the existence of a parapharyngeal tumour was suspected, diagnosis was fundamentally based on the imaging tests. A CT scan (Fig. 1) was the most common radiological study in our series, performed on 83 patients (92%), followed by MR imaging (Figs. 2 and 3), in 51 patients (57%). For patients whose tumours presented high contrast uptake, or signs of increased vascularisation, arteriography or MR angiography was performed with occasional embolisation of the tumour vessels (10 cases, 11%).

From the anatomical and pathological point of view, a presurgery study biopsy using fine-needle aspiration (FNA) was carried out on 11 patients (12%). The result was concordant with the definitive pathological result in cases. A biopsy had previously been performed on 9 patients (10%), of whom 6 were carried out through cervical route and 3 through transoral route; all of these, except for 2, were on patients referred to our service.

In our series, benign tumours, in 67 patients (74%), clearly predominated over malignant ones, in 23 patients (26%). Among the benign tumours, the most frequent were the pleomorphic adenomas (24 patients), followed by the paragangliomas (23 patients) and the schwannomas (11 patients). We grouped the rest of the benign tumours into a subtype called "Miscellaneous". These were of highly varied origin and were not very significant individually. However, as a group (9 patients) they represented an important number of patients within our series (Table 1).

The histological distribution of the 23 malignant neoplasms diagnosed in our series is presented in Table 2.

All the patients were treated with standard surgery. Table 3 shows the types of approaches used.
The tumour was completely removed in 81 cases (90%) and was without clear margins in 9 cases (10%). The complete resection cases were 1 chordoma, 1 malignant salivary gland tumour, 1 malignant fibrous histiocytoma, 1 cervical sympathetic neurinoma, 2 pleomorphic adenomas, 2 rhabdomyosarcomas and 1 angiosarcoma. Complementary treatment with radiation therapy, chemotherapy or the combination of both treatments was given to these 9 patients. Five patients with paragangliomas needed to be treated with radiosurgery after the removal, while 1 paraganglioma had been treated with radiosurgery by another centre before being sent to our service. In 2 patients a transitory tracheotomy was required; both were cases of malignant tumours: 1 neuroblastoma of medium-level malignancy and 1 minor salivary gland carcinoma. One patient who underwent surgery for vagal neurinoma developed acute respiratory failure in the postoperative period that required reintubation. A nasogastric tube was inserted in 14 patients having a high possibility of developing post-surgical dysphagia, either in the same operation or in the immediate postoperative period. All the cases were tumours of neurogenic origin (paragangliomas or neurinomas) that involved the vagus nerve. Only 1 patient received a gastrostomy because the problem in swallowing persisted.

The lack of perioperative and intraoperative mortality was notable. With respect to complications, the most frequent were cases of newly-appearing partial motor paralysis or lower cranial nerve paralysis, in 24 cases (27%). In 14 patients (16%) there was paralysis of nerve X, 4 patients (4%) presented a clear Horner syndrome due to involvement of the cervical sympathetic nerve, there were 5 cases (6%) of paralysis/paresis of the marginal branch of the facial nerve and 5 cases (4%) of facial paralysis. Six patients (7%) presented first bite syndrome (FBS) and 2, surgical wound infections; there was 1 case of bleeding of the vertebral artery, 1 neck oedema and 1 oral fistula.

Mean hospital stay was 12 days, with a median of 9 days and a range of 3–17 days. Following hospital discharge, the patients were periodically followed up on an out-patient basis in our department consultations.

At the end of the study follow-up, 81 patients were tumour free. There was recurrence of the tumour in 9 patients: 1 chordoma, 1 malignant salivary gland tumour, 1 malignant fibrous histiocytoma, 1 cervical sympathetic neurinoma, 2 pleomorphic adenomas, 2 rhabdomyosarcoma and 1 angiosarcoma. Of these, 6 died and 3 are currently alive with tumours (2 pleomorphic adenomas and 1 rhabdomyosarcoma).

**Discussion**

The parapharyngeal space is a complex virtual anatomical area, in which it is sometimes difficult to navigate and to specify the boundaries.
A high percentage of the tumours that settle in this space evolve silently and asymptptomatically; consequently, they are frequently diagnosed by chance in a routine examination or a radiological study that includes this area (24% in our series).\(^6\)\(^,\)\(^7\) For that reason, what we most normally detected in the clinical examination was the presence of a cervical through bimanual palpation or bulging in the pharyngeal walls in the oral inspection. Cervical growth generally leads to a prolonged evolution and large tumour size. It is important to carry out systematic neurological examinations to detect nerve deficits that help to do a differential diagnosis of the mass.\(^8\) The presence of pain, trismus (caused by the involvement of the internal pterygoid muscles) and cranial nerve paralysis should guide us towards the presence of a malignant tumour (neurinomas or paragangliomas).\(^9\) Consequently, the symptoms and physical examination of these tumours are not very specific.

It is essential to carry out complementary radiological studies, fundamentally CT scan and/or MR imaging, to confirm the diagnosis of parapharyngeal tumour and the topographical diagnosis that will later help to choose the surgical approach.\(^9\) The radiological study gives us information as to the pre- or retrostyloid location, the relationship that the mass establishes with the parotid gland, large blood vessels and the radiological characteristics of the tumour.

Both CT scans and MR imaging can be used as the first choice technique and both are currently recommended because of their complementary nature. Angiography study was indicated in tumours for which the CT scan suggested a neurogenic or vascular origin.\(^10\) In the oldest cases, conventional arteriography was performed, while MR angiography is presently used. Arteriography is used in very vascularised tumours and those requiring embolisation before surgery, or an occlusion test if the resection of the internal carotid artery might be needed. In these cases, arteriography should be performed 1–3 days before the operation, given that waiting more days can lead to an increase in the inflammatory phenomena or even abnormal recanalization of the tumour.

The X-ray characteristics of the tumour, the displacement its growth produces on the fat, and the carotid artery\(^11\) are highly useful for the differential diagnosis of parapharyngeal neoplasms. Pleomorphic adenomas and neurinomas look very similar in MR images; however, the former displace the vessels in a posterior direction, while the latter displace them anteriorly. Paragangliomas, in contrast to neurinomas, present flow voids in MR images; vagal paragangliomas produce an anterior and medial displacement of the carotid arterial system. The majority of the neurinomas that originate from the vagus nerve or the cervical sympathetic chain show significant enhancement in gadolinium-enhanced MR imaging and tend to displace the internal carotid artery anteriorly and laterally.

Our experience in this series with cytological diagnosis using FNA is limited and relatively useless. Out of the 11 patients who underwent FNA biopsy, correlation with the definitive anatomopathological results was found in only 5. These results contrast with those obtained in other series,\(^12\) in which the preoperative histological diagnosis was highly specific. In 2 of our patients, it is notable that they are the oldest in our series; biopsies were performed through the transoral route, even knowing that this is currently contraindicated. This route is not indicated because it presents greater risk of haemorrhage, the control of parapharyngeal vascular structures is worse, there is greater risk of local relapse through disseminations in the pharyngeal mucosa and, lastly, there is fibrosis in the incision area that increases the risk of oropharyngeal fistula in later surgery.\(^1\)

Consequently, the diagnostic strategy to follow when faced with clinical suspicion of a parapharyngeal mass should be, firstly, to request 1 or 2 imaging tests (MR imaging provides greater information) and then, after ruling out a vascular origin, to perform a variant of the various cervical approaches, leaving intraoperative biopsy as an option. If a vascular tumour (generally vagal paragangliomas) is suspected, tests such as either an angio-MR or arteriography and possible embolisation can be performed. Nowadays, in cases with suspicion of malignity or metastasis, a PET-CT scan would also be indicated to rule out metastatic or systemic involvement.

In this study, as in the majority of the studies reviewed,\(^5\)\(^,\)\(^7\)\(^,\)\(^9\)\(^,\)\(^13\) benign tumours clearly predominate (74% in our series) and, among these, minor salivary gland tumours (all those originating in the deep lobe of the parotid gland were excluded); neurogenic tumours were the most frequent neoplasms, with pleomorphic adenomas and paragangliomas being the most common among them. Due to the great variety of structures that the parapharyngeal space contains, there is a wide group of infrequent tumours (the same as in our series): chordoma, mesenchymoma, hemangiopericytoma,\(^14\) malignant fibrous histiocytoma and angiosarcoma.

Various approaches have been described for complete removal of these tumours: transcervical, cervical-transparotid, infratemporal, transmandibular and transoral. The choice depends on tumour location, the relationship between the tumour and the large blood vessels and suspicion of malignancy.\(^6\)\(^,\)\(^9\)\(^,\)\(^15\) It is important to know whether the tumour is benign or malignant before the operation using radiological tests because, if it is benign, it is usually much more elastic than the malignant tumours despite being very large; this elasticity makes it easier to remove. The approach most frequently used in our series was the transcervical. It was adequate and sufficient for complete, complication-free removal in most of our parapharyngeal tumours. Some patients had prestyloid or very large retrostyloid masses, making it necessary to widen the approach using a cervical-transparotid route. The main problem with the transcervical route is that controlling the base of the skull can be difficult if the mass is very large. In addition, the traditional belief held that, to respect the principles of oncological radicalism, the tumour should be removed in a single block, especially in malignant tumours requiring a more extensive surgical field to ensure free margins. Based on these reasons, transmandibular approaches were chosen in 4 patients. To minimise mandibulotomy sequelae in these cases, a visor flap with mandibulotomy medial to the anterior maxillary foramen exit was formed, finding an appropriate area between 2 teeth and avoiding severing the mentonian nerve.

Just as in other pathologies (laryngeal laser, endoscopic skull base surgery), it is possible to surgically extract a parapharyngeal space neoplasm in a fragmented manner without changing the results in terms of how radical the
excision is. Extensive approaches (including the transmandibular approach) have consequently been minimised. This can be seen in our series, in which the 4 transmandibular approach cases are among the patients treated between 1984 and 2006; from 2007 until 2014, mandibulotomy was unnecessary in all cases. When the pathology extends towards the posterior lacerate foramen, a Type A infratemporal approach (partial or complete) should be indicated; this was performed in 13 cases (neurinomas and paragangliomas above all) in our series. The transoral approach was used in only 2 patients. With the growth in transoral robotic surgery, this decades-reviled approach has currently returned to favour. The reason for this was that in dissection (especially with malignant tumours) the large blood vessels and lower cranial nerves are distal to the tumour, with the risk involved for control. Opening a septic route with the mouth in the postoperative period could also cause fistulas and superinfection, with potentially fatal consequences. Therefore, until it is being used on a wider scale, it is standardised and there are extensive series that back it up, any of the variants of open transcervical approach should be considered the standard.16,17

As in the literature reviewed,18,19 most of the sequelae in our series were of neurogenic origin (paresis or paralysis of lower cranial nerves) related to paraganglioma and neurinoma resections. The most frequent finding is transient or permanent damage to a nerve stem. The facial nerve can be involved in malignant tumours that infiltrate the parotid gland. The lower cranial nerves (IX, X, XI, XII) can be involved in neurogenic tumours or in the dissection of malignant or tightly attached tumours. In spite of the fact that these nerves are easy to dissect, they can often be paralysed; the closer to the base of the skull, the more likely it is that this will happen. Isolated injury to the vagus nerve causes dysphonia, but rarely aspirations. However, when this nerve is simultaneously involved with cranial nerves IX and XII, swallowing problems arise, which can even require insertion of a nasogastric tube and, in very rare cases, performing a gastrostomy or percutaneous endoscopic gastrostomy (PEG) to achieve contralateral compensation. Techniques for medialisation of the paretic vocal fold, such as type I thyroplasty, can be used (3 patients in our series). We have noted that in older patients having prior nerve palsy (X, XII, IX) after the removal of a neurinoma or parapharyngeal paraganglioma, without additional nerve lesions after surgery, aspiration and poor swallowing arose and worsened. Compensation of swallowing and phonation are closely related to patient age and, the older the patient, the worse the compensation.

Injury to the nerve XI or the spinal nerve causes motor deficits (especially in the shoulder), while damaging the cervical sympathetic plexus leads to the well-known Horner syndrome and to FBS. Horner syndrome is generally compensated without serious difficulty in a few months; patients with FBS experience a strong periparotid pain during the first bite taken when eating, which usually decreases (or disappears) after the first bite(s). A complication important to be able to recognise and differentiate from normal postoperative pain, FBS is linked to damage to the cervical sympathetic chain or the sympathetic plexus that innervates the parotid gland.20 It usually disappears in a few months but, if it bothers the patient, Botox® injections in the parotid area may help to alleviate the pain.

In our series, there were no cases of intraoperative or immediate postoperative mortality. During evolution, the tumour caused the death of 6 (7%) patients diagnosed as having a malignant tumour who developed locoregional recurrences. This is a high percentage compared to other published series in which mortality was null.9 Our results could be explained by the presence of a greater number of malignant tumours in our series, given that ours is a reference centre. As for benign pathology, we found only 3 cases of recurrence, which corresponded to 1 pleomorphic adenoma and 2 jugular paragangliomas.

In our series, treatment with radiation therapy, chemotherapy or chemoradiotherapy21-24 was used as a complement exclusively in patients with benign or malignant tumours for which complete resection was impossible (9 cases, 10%).

Conclusions

Parapharyngeal tumours are rare in the population and are usually asymptomatic in the majority of the cases because of their special anatomical location. Clinical suspicion appears incidentally, when a routine physical examination is carried out or when a cervical mass appears on the lateral wall of the pharynx, which are the most common methods of detection. Other possibilities are the presence of pain, trismus or lower cranial nerve paralysis.

Diagnosis is normally based on radiology, CT scan or NMR imaging. In specific cases, it is necessary to perform angiographs and occasional embolisation. Biopsies are not indicated unless they are in the context of resection surgery.

The design of the surgical approach depends on the tumour location and size. The transcervical or cervical-transparotid route is valid for the majority of the pre- and retrostyloid tumours. A systematic transoral approach is not indicated because of the potential complications inherent with this technique.

Postoperative morbidity of parapharyngeal tumours is principally due to the neuropathies of the lower cranial nerves that are presented in resecting neurogenic tumours or tumours of a malignant nature.

Conflict of Interests

The authors have no conflicts of interest to declare.

References