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The parapharyngeal space

by

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Introduction

The parapharyngeal space lies adjacent to the naso- and oro-pharynx between the base of the skull and the hyoid. Through this space runs the carotid artery and internal jugular vein; the vagus, glossopharyngeal and hypoglossal nerves; and the sympathetic chain. It also contains the upper deep cervical chain of nodes and retromandibular portion of the parotid gland. Lesions in this site are uncommon and not often reported (Bass, 1982; Lawson *et al.*, 1979). The results of 15 years' experience of lesions within this space are presented in this series of 73 cases.

Anatomy

The exact anatomy of the deep fascial planes of the neck varies from author to author and the description below is based more on clinical observation than on the results of scientific investigation. The parapharyngeal space is an inverted pyramid whose base is the inferior surface of the petrous bone with its apex at the lesser horn of the hyoid bone (Heeneman *et al.*, 1980). Its anterior limits are the junction of pterygoid fascia to the buccinator muscle fascia and the pterygoid mandibular raphe and the tail of the submandibular gland. Posteriorly lies the fascia in front of the transverse process of the atlas, rectus capitis and levator scapulae. This fascial covering, which is very thin in parts, also separates the space from the anterior retropharyngeal compartment. Thus communication between these compartments is not uncommon. The medial wall of the parapharyngeal space is formed by the fascia on the superior constrictor where it covers the nasopharynx, the oropharynx and the fascial coverings of the tensor veli palatini, the levator veli palatini and styloglossus muscles. The lateral wall is formed by the medial pterygoid muscle, the ascending ramus of the mandible, the retromandibular portion of the parotid gland and part of the posterior belly of the digastric muscle. Inferiorly the fascia separating the attachment at the lesser horn of the hyoid is weak, a fact which allows infection to spread inferiorly.

Classically the space may be divided into three compartments: anterior or pre-styloid; medial or retropharyngeal; and posterior or retrostyloid (Lederman, 1961). The parapharyngeal space has within it the internal carotid artery, internal jugular vein, the IXth, Xth and XIIth cranial nerves (Lederman, 1961), the sympathetic chain and numerous lymph nodes including the node of Rouviere (1927) (Fig. 1). The retropharyngeal nodes receive drainage from the nasopharynx, post-nasal cavity, paranasal sinuses and hypopharynx, and these drain into the deep jugular chain and the upper spinal accessory nodes (Sven and Myers, 1981) (Fig. 2). Glomus bodies are numerous within the space. Thus tumours of many and varied origin may occur within this space.

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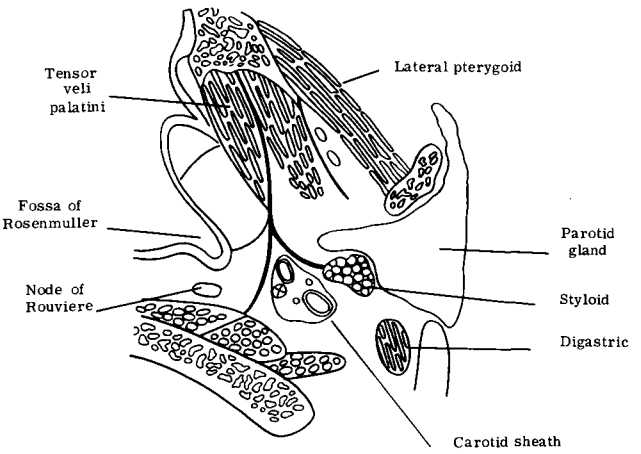


FIG. 1
Transverse section through parapharyngeal space.

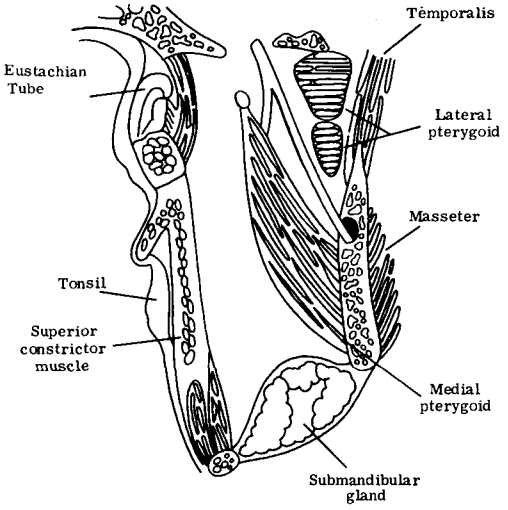


FIG. 2
Coronal section through parapharyngeal space.

Diagnosis

The most common presentation of a lesion of the parapharyngeal space is probably a painless mass but symptoms have often been present and have been treated for some time before a correct diagnosis is made. Symptoms of a hearing-loss from middle-ear effusion subsequent to eustachian tube blockage (Heeneman *et al.*, 1980) may occur but in our experience this symptom was rare. The mouth of the eustachian tube lies within the nasopharynx and for a parapharyngeal space tumour to compress this it must indent the nasopharynx for a distance of several centimetres before the tubal mouth is occluded sufficiently to produce middle-ear effusion.

The lesions are usually painless because of the expansile nature of the space but pain must raise a strong suspicion of malignancy. Cranial nerve involvement may give rise to the syndrome of Vernet (paralysis of the IXth, Xth and XIth cranial nerves). Speech or swallowing problems may result from these nerves being damaged but the usual cause of these problems is merely one of displacement of the palate by the size of the lesion. Involvement of the sympathetic chain causes a Horner's syndrome and occasionally the mandibular division of the trigeminal nerve may be affected. Benign tumours only rarely cause nerve paralysis and if a paralysis is observed the suspicion of malignancy is raised. Trismus is a common symptom, the result of impairment of function of the medial and lateral pterygoid muscles. Very large tumours may directly impinge on the upper airway down to the level of the supraglottic larynx.

Displacement of the medial wall is pathognomonic of a parapharyngeal space lesion and the pattern of displacement is important (Fluur, 1964). Parotid tumours

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displace the whole tonsil and fauces, whereas neurogenous lesions displace the posterior part of the pharynx and posterior pillar of the tonsil. Very large tumours may infiltrate the space between the heads of the tensor palati causing soft palate enlargement.

If infection or metastatic spread is suspected a full examination of the ears, nose, throat and teeth must be carried out. Indirect laryngoscopy is essential to assess the state of the recurrent laryngeal nerves.

Radiology is invaluable in the establishment of a diagnosis. While plain X-ray films may show bony erosion, radio-isotope scanning techniques and sialography have not been as helpful as would have been expected because it is difficult to tell whether the lesion is in the superficial or deep lobe of the parotid gland. The presence of abnormal pulsation or a noticed emptying and refilling defect makes angiography essential. This may show displacement of the carotid artery, typical tumour circulation of a chemodectoma of nerve or artery or a carotid artery aneurysm. Recently the use of computerized axial tomography in conjunction with sialography has been found useful in the diagnosis of parapharyngeal lesions (Sam and Biller, 1979; Rice *et al.*, 1979; Vaughan, 1982). With a CAT scan the muscle planes are easily recognisable anteriorly. The nasopharyngeal airway, fossa of Rosenmuller and lateral wall of the pharynx are easily identified as an air-soft tissue interface. The styloid apparatus with its muscle attachments and laterally the bone of the ascending ramus are easily seen. These landmarks demonstrate the space well and with the opacification of the duct systems of the parotid with contrast, involvement or displacement of the deep lobe is well demonstrated by this transverse axial display.

The biopsy of lesions of the parapharyngeal space through the mouth is contra-indicated because there is the possibility of both implantation and uncontrollable bleeding. Biopsies of suspicious areas in the oropharynx and tonsillectomy, however, should be carried out if a metastatic gland is suspected.

Results

The series may be divided into five categories: parotid tumours, neurogenous tumours, infective lesions, lesions of lymph nodes, and miscellaneous (Table I).

The parotid group (73 per cent) was made up of 53 tumours, 36 malignant and 17 benign. In the malignant group there were 20 women and 16 men, the average age being 59; this included three acinic cell carcinomas, seven adenoid cystic carcinomas, 10 squamous cell carcinomas, two mucoepidermoid carcinomas, four adenocarcinomas, six malignant mixed cell tumours and one each of spheroidal cell carcinoma, lymphosarcoma, multiple myeloma and malignant Warthin's tumour. In the benign tumour group there were seven men and 10 women, the average age being 50; this included 13 pleomorphic adenomas, two Warthin's tumours and two oncocytomas.

In the neurogenous tumour group (7 per cent), there were four women and one man; this included three chemodectomas, one glomus vagale and one neurilemmoma.

There were five patients (7 per cent) in the lymph node group, two malignant and three benign. The malignant nodes were shown histologically to be squamous carcinoma and the benign lesions were all tuberculosis.

The infective group was made up of seven patients (9 per cent) with parapharyngeal space abscesses; four had the origin of their infection from the teeth, two from the tonsil and one resulted from an oesophageal tear.

The miscellaneous group was made up of three patients, one with a lipoma and two with branchial cysts arising from lymph nodes within the space.

Discussion

Parotid tumours

Deep lobe tumours of the parotid gland, and therefore of the parapharyngeal space, account for about 12–25 per cent of all parotid tumours. They may be localized in the deep lobe, be of dumbell shape, or be a part of a malignant infiltration of the whole

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TABLE I

No.	Age	Sex	Site of origin	Diagnosis	Treatment
1	45	F	Parotid	Acinic cell carcinoma	TP/Nerve grafting
2	60	M	Parotid	Acinic cell carcinoma	TP/DXT
3	35	F	Parotid	Acinic cell carcinoma	TP/Nerve grafting
4	48	F	Parotid	Adenoid cystic carcinoma	TP/DXT
5	60	M	Parotid	Adenoid cystic carcinoma	TP/DXT/Nerve grafting
6	78	M	Parotid	Adenoid cystic carcinoma	TP/Nerve grafting
7	52	F	Parotid	Adenoid cystic carcinoma	TP/Nerve grafting
8	36	F	Parotid	Adenoid cystic carcinoma	TP/DXT
9	64	F	Parotid	Adenoid cystic carcinoma	TP/DXT/Nerve grafting
10	36	F	Parotid	Adenoid cystic carcinoma	TP/DXT
11	71	M	Parotid	Squamous cell carcinoma	TP/DXT/Partial mandibulectomy
12	56	M	Parotid	Squamous cell carcinoma	TP/Skin flap
13	72	F	Parotid	Squamous cell carcinoma	TP
14	79	F	Parotid	Squamous cell carcinoma	TP
15	56	F	Parotid	Squamous cell carcinoma	TP/DXT/Nerve grafting
16	64	M	Parotid	Squamous cell carcinoma	TP/Skin flap
17	77	M	Parotid	Squamous cell carcinoma	TP/DXT/Nerve grafting
18	85	F	Parotid	Squamous cell carcinoma	TP
19	49	F	Parotid	Squamous cell carcinoma	TP/DXT
20	26	F	Parotid	Mucoepidermoid carcinoma	TP/DXT
21	66	M	Parotid	Mucoepidermoid carcinoma	TP/DXT/Nerve grafting
22	12	F	Parotid	Adenocarcinoma	TP/Nerve grafting
23	71	M	Parotid	Adenocarcinoma	TP
24	67	F	Parotid	Adenocarcinoma	TP/DXT
25	63	F	Parotid	Adenocarcinoma	TP/DXT/Nerve grafting
26	9	M	Parotid	Adenocarcinoma	TP
27	66	M	Parotid	Spheroidal cell carcinoma	TP
28	72	F	Parotid	Malignant mixed cell tumour	TP/DXT
29	75	M	Parotid	Malignant mixed cell tumour	TP/DXT
30	69	M	Parotid	Malignant mixed cell tumour	TP/Skin flap
31	64	F	Parotid	Malignant mixed cell tumour	TP/DXT
32	55	F	Parotid	Malignant mixed cell tumour	TP/DXT
33	81	F	Parotid	Malignant mixed cell tumour	TP/DXT/Nerve grafting
34	69	M	Parotid	Malignant Warthin's tumour	TP/DXT/Nerve grafting
35	77	M	Parotid	Multiple myeloma	TP
36	85	M	Parotid	Lymphosarcoma	DXT
37	43	M	Parotid	Pleomorphic adenoma	TP/Nerve grafting
38	62	M	Parotid	Pleomorphic adenoma	TP/DXT
39	32	M	Parotid	Pleomorphic adenoma	TP
40	45	F	Parotid	Pleomorphic adenoma	TP
41	41	M	Parotid	Pleomorphic adenoma	TP/DXT
42	55	M	Parotid	Pleomorphic adenoma	TP
43	22	F	Parotid	Pleomorphic adenoma	TP/DXT
44	45	F	Parotid	Pleomorphic adenoma	TP
45	55	F	Parotid	Pleomorphic adenoma	TP
46	38	F	Parotid	Pleomorphic adenoma	TP
47	38	M	Parotid	Pleomorphic adenoma	TP
48	64	F	Parotid	Pleomorphic adenoma	TP/DXT
49	29	M	Parotid	Pleomorphic adenoma	TP
50	71	F	Parotid	Warthin's tumour	TP
51	72	F	Parotid	Warthin's tumour	TP
52	72	F	Parotid	Oncocytoma	TP
53	74	F	Parotid	Oncocytoma	TP
54	55	M	Parotid	Lipoma	SP/Lipoma removal
55	72	F	Parotid	Branchial cyst	SP/Cyst removal
56	54	M	Parotid	Branchial cyst	SP/Cyst removal
57	69	M	Parotid node	Squamous cell carcinoma	TP/DXT
58	54	M	Parotid node	Squamous cell carcinoma	TP/DXT

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TABLE I (CONTINUED)

No.	Age	Sex	Site of origin	Diagnosis	Treatment
59	27	M	Parotid node	Tuberculosis	TP
60	58	F	Parotid node	Tuberculosis	TP
61	45	F	Parotid node	Tuberculosis	Excision
62	38	M	Nerve	Neurilemmoma	TP
63	37	F	Nerve	Glomus vagale	Excision
64	38	F	Carotid artery	Chemodectoma	Excision
65	54	F	Carotid artery	Chemodectoma	Excision
66	37	F	Carotid artery	Chemodectoma	Nil treatment
67	50	M	Tonsil	Abscess	Incision/Drainage
68	55	M	Tonsil	Abscess	Incision/Drainage
69	6	F	Tooth	Abscess	Incision/Drainage
70	59	F	Oesophageal tear	Abscess	Incision/Drainage
71	43	M	Tooth	Abscess	Incision/Drainage
72	42	M	Tooth	Abscess	Incision/Drainage
73	56	M	Tooth	Abscess	Extraction of tooth

DXT—Radiotherapy. SP—Superficial Parotidectomy. TP—Total Parotidectomy.

gland. The dumbell shape is a result of constriction of the tumour in the region of the stylomandibular ligament and surrounding structures. Tumours arising in the deep lobe of the parotid may be benign or malignant. Histological differentiation of malignant salivary gland tumours may be difficult but the histology of each equivocal case has been discussed with several pathologists before the diagnosis has been finalised. Work (1977) describes in his series of parapharyngeal lesions an incidence of 50 per cent of parotid tumours, while in our series it is 75 per cent. The incidence of squamous cell carcinoma at 17 per cent of the parotid tumours is also higher than other reported series (Hanna *et al.*, 1968). One case of extremely rare malignant Warthin's tumour is included in our series. The sex ratio in the parotid group is practically equal, unlike the female predominance described by Hanna *et al.* (1968) and by Work (1977). The malignant group overall have a higher average age of 60 while the non-malignant tumours have an average age of 50.

The removal of deep lobe parotid tumours requires a superficial parotidectomy with full exposure of the facial nerve and all its branches. With the superficial lobe pedicled to the deep lobe there are then two approaches to the parapharyngeal space with respect to the nerve. The first approach is useful in most cases and involves full mobilization of the main lower trunk of the nerve and its branches which allows adequate access to the space. Although mandibulectomy has been described for greater access (Work, 1977), we have never had to perform it in removing tumours up to a size of 10 cm. by 8 cm. It is indeed seldom that we even had to dislocate the mandible forward, a technique which doubles the size of access to the space.

Blunt dissection of the parapharyngeal space is usually easy because of the large amount of loose areolar tissue. While blunt dissection (which is virtually enucleation) of a deep lobe tumour has a very low recurrence rate, a similar exercise carried out in the superficial lobe is well-known to cause a 5–20 per cent chance of recurrence. The reason for this difference is the abundance of areolar tissue in the parapharyngeal space which allows easy enucleation without disturbance of the tumour capsule.

The second approach is often required for the so-called dumbell tumour. Here the retromandibular tumour often lies between the upper and lower divisions of the nerve, and the superficial lobe should be pedicled

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at this point. A much wider nerve dissection is then required, freeing the whole facial nerve from the main trunk to the peripheral branches anterior to the parotid gland, and this avoids stretching the nerve. In these cases forward dislocation of the mandible eases access to the parapharyngeal space and subsequent blunt dissection.

If a malignant tumour infiltrates from the superficial to deep lobe it is almost inevitable that the facial nerve will be sacrificed but, with section of the nerve, access to the space is easy. Of 34 patients with malignant disease, 12 patients required some form of nerve grafting at the time of primary surgery.

Infection

The parapharyngeal space is one of the three spaces where infections localize in the head and neck (Levitt, 1977). In this series four (57 per cent) were as a result of tooth infection, and two (28 per cent) a result of tonsil infection. Other series have incidences of 60 per cent for tonsil infection and 30 per cent for teeth as the cause of infection (Maran and Stell, 1979). Spread from the mastoid process down the digastric muscle (Bezold's abscess) has been reported (Maran and Stell, 1979).

In the four patients with a dental cause for their infection, the wisdom teeth were involved. Lower wisdom teeth are renowned for the unusual positions in which they may be found and it is not unusual for the roots to be placed lingually. If there is infection of the apex of the roots it is very easy for the infection to gain access into the parapharyngeal space. This thin lingual bone, which is easily damaged, is also the reason that a tooth may slip from the forceps during extraction and be forced into the parapharyngeal space with a resulting infection.

The patients with a tonsillar cause usually present complaining of a fever and swelling in the neck. The tonsils themselves cause little discomfort. It may be hypothesized that spread into the parapharyngeal space from an infected tonsil is through a weakness in the tonsillar capsule. The infection, once out of these confines, spreads to the space through pre-formed holes in the superior constrictor muscle or by rupture of efferent lymphatic channels.

Parapharyngeal abscesses are approached by a vertical incision at the anterior border of the sterno-mastoid muscle. The space and the whole length of the carotid sheath are explored from the base of the skull to the clavicle and the area is drained inferiorly. It is important also to open into the pterygo-maxillary space medial to the mandible as pus may be found there.

Neurogenous Tumours

Carotid body tumour

This is the best-known chemodectoma, with an increased incidence in places of high altitude and an equal sex distribution, with age presentation between the ages 30 and 50, although cases of younger patients have been reported (Batsakis, 1974). Histologically they show a marked similarity to the architecture of the normal carotid body and proven metastasis are very rare (Batsakis, 1974).

This series includes three cases of carotid body tumour, two of which were removed surgically. Conley (1970) has described four situations where these tumours should be removed.

1. Those that are proven histologically and clinically malignant and which are resectable.
2. Those showing an aggressive growth pattern regardless of the histological interpretation.
3. Patients in good health under 50 years of age who present with a small or medium-sized tumour.
4. Those tumours which have extended into the pharynx and palate and are interfering with swallowing, speaking or breathing.

The size, shape and consistency and pulsatile nature of the lump on external examination is important in assessment. Formerly it was thought that pulsation indicated the possibility of a chemodectoma but almost every lesion which overlies the

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carotid transmits pulsation and it has been suggested that the more important finding is refilling after emptying in a pulsatile fashion.

In the removal of a small tumour the whole carotid tree must be mobilized from the clavicle to the base of the skull. This allows rotation and access to the postero-lateral part of the bulb where the tumour is unlikely to have encircled since the growth occurs mainly on the lateral side of the bulbs. The vagus nerve must be identified and preserved. Fig. 3 shows chemodectoma and surrounding structures after dissection, and Fig. 4 shows the area following removal of the tumour. For larger tumours, not involving the base of the skull, it is possible to perform carotid artery replacement using vein or prosthetic grafts. If tumour extends to the base of the skull it is inoperable since there is not enough artery remaining after excision on which to sew a graft. It was originally thought that chemodectomas were radio-resistant. Westbury (1960) reported four cases of response to radiotherapy in glomus jugulare tumours. Thus radiotherapy should be used for patients in whom surgery has been refused, in poor risk cases or in metastatic disease.

Glomus vagale tumour

The glomus vagale tumour is a much rarer

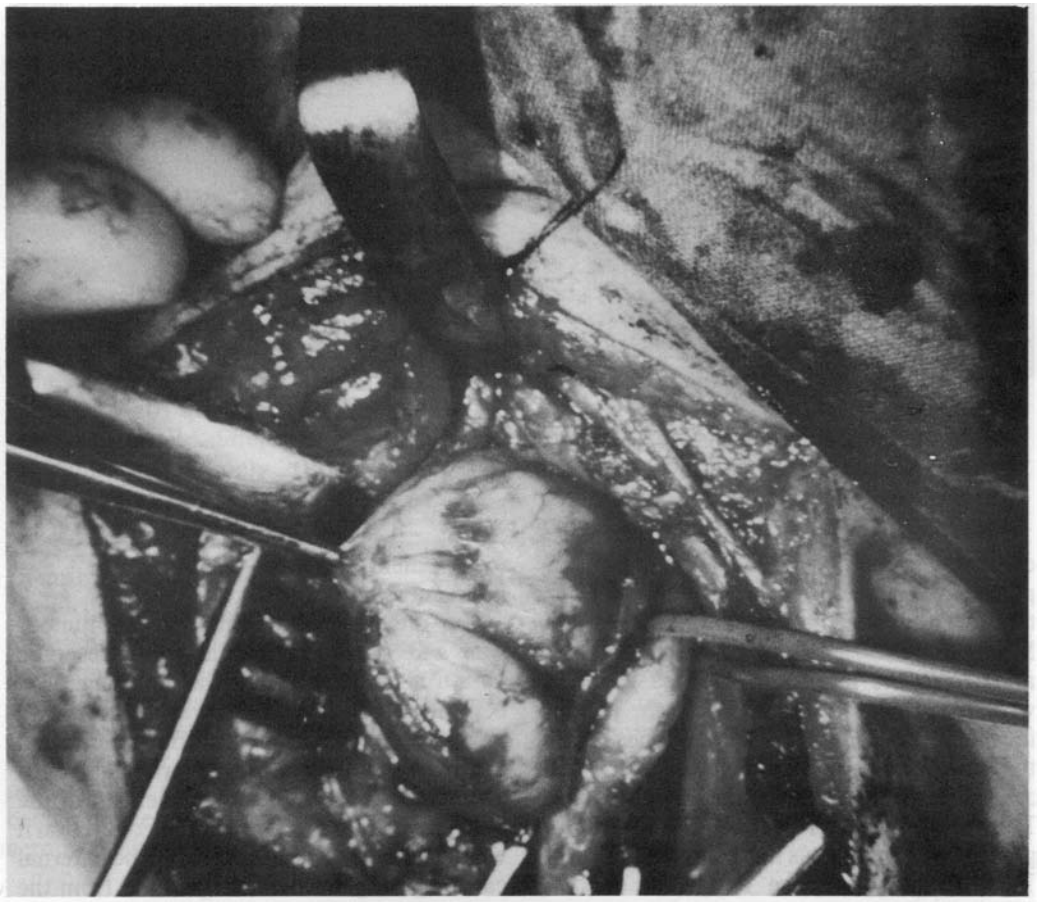


FIG. 3

Dissection of chemodectoma and carotid artery.

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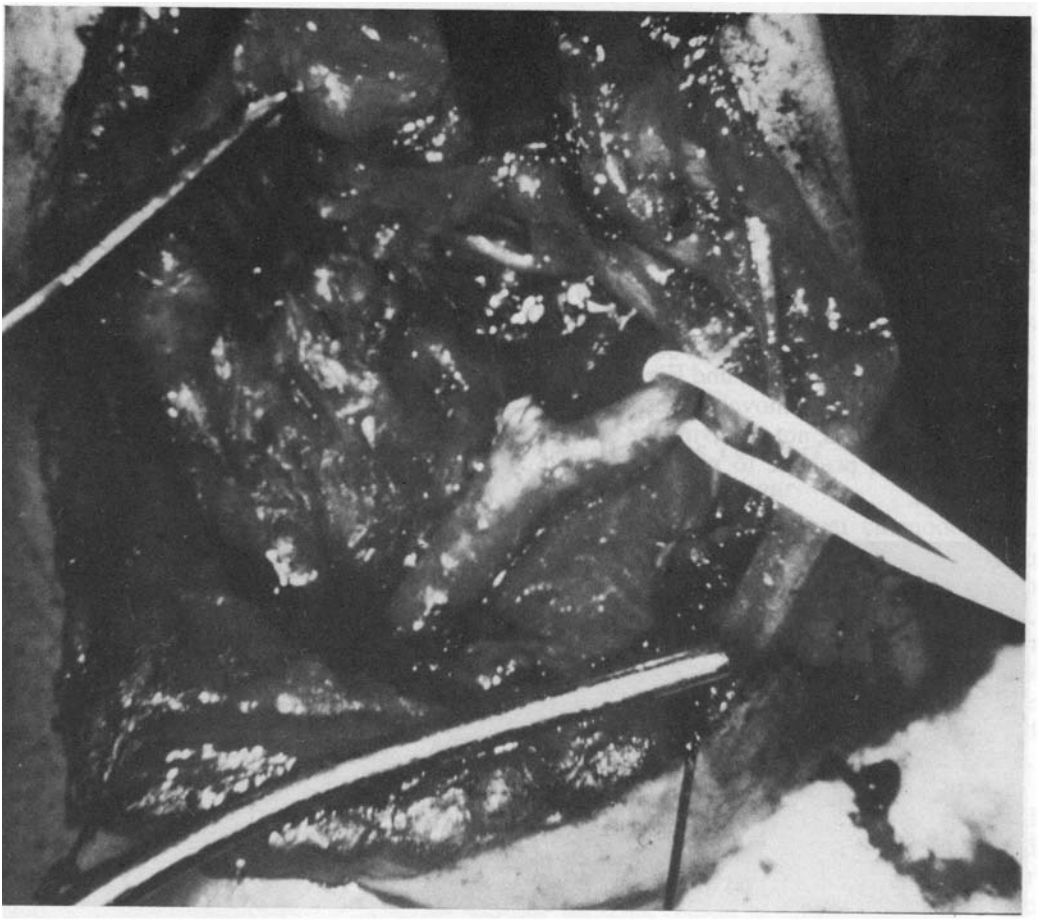


FIG. 4
After removal of chemodectoma.

chemodectoma which occurs in the parapharyngeal space. By 1981, 73 cases of this tumour had been reported (Endicott and Maniglia, 1980). Most of these tumours arise from the inferior or nodose ganglion which is situated 1 cm. distal to the jugular foramen on the vagus nerve. These rare tumours represent about 2.5 per cent of all chemodectomas (Olson and Abell, 1969). They are commoner in females and usually present with a painless mass high in the neck. They frequently cause a definite medial bulging of the lateral pharyngeal wall. Occasionally there are symptoms due to involvement of the vagus nerve, e.g. hoarseness.

Our one case of a glomus vagale tumour was a 37-year-old female who presented with a neck mass which was not diagnosed before surgery. The mass was too low for a typical superficial lobe parotid tumour and too high for a diagnosis of branchial cyst. There was some minor displacement of the pharynx behind the tonsil. At the operation it was intimately associated with the internal carotid artery but when separated from the artery its origin from the vagus nerve became apparent.

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Other nerve tumours

These include schwannomas, neurofibromas and gangliomas. In this series we report one neurilemmoma. With the benign varieties there is no interference with nerve function other than occasionally pressure on the sympathetic chain which can result in Horner's syndrome. Even if the tumours become malignant nerve function may remain intact (Das Gupta *et al.*, 1969). At operation the nerve with which the tumour is associated may become evident but in a series of 77 cases it was only found on 22 occasions (Kragh *et al.*, 1960).

Vocal cord paralysis is inevitable after removal of tumours arising from the vagus nerve but rehabilitation is possible with teflon injection of the paralysed vocal cord.

Surgeons embarking upon treatment of these tumours are advised to seek the assistance of a vascular surgeon. This also applies to removal of glomus vagale tumours which may be extremely vascular and have intimate cross-circulation with enlarged vasa vasorum in the wall of the internal carotid artery. Diagnosis of a solitary nerve tumour must remain in doubt until it is excised, so that the treatment is usually effectively carried out while establishing a diagnosis. The best treatment for malignant nerve tumours is *en block* excision of the area. Conley (1970) quotes a cure rate of 80 per cent for well differentiated malignant schwannomas and only 20 per cent for the undifferentiated type.

Lymph Nodes

Of the five patients in this group three patients presented with enlarged lymph nodes. These nodes were biopsied and histology established a diagnosis of tuberculosis; these patients were referred for anti-tubercular therapy. The other two patients had metastatic disease, the node being involved by squamous carcinoma and a primary site having to be found. In neither of the cases was the primary condition found on head and neck examination. Further searches showed one patient had a small tonsillar lesion and the other had a small lesion of the posterior pharyngeal wall.

Miscellaneous

In this group of three patients a preliminary diagnosis of a deep lobe tumour had been made but after exposure of the deep lobe of the parotid by superficial parotidectomy, in two patients branchial cysts were found in close proximity to the parotid deep lobe and in one patient a lipoma was found in a similar position. It is now believed that branchial cysts are epithelial cysts formed from lymph nodes. These branchial cysts (Bhaskar and Bernier, 1959) arose in the intra parotid lymph nodes situated within the deep lobe.

Summary

A series of 73 lesions presenting in the parapharyngeal space is presented. There were 53 (73 per cent) patients with deep lobe parotid benign or malignant tumours, five (7 per cent) patients with tumours of neurogenous origin, seven (9 per cent) patients with abscesses, five (7 per cent) patients with enlarged lymph nodes, two with branchial cysts, and one with a lipoma.

The anatomy emphasizes the expansile nature of the space and also the close proximity of vital structures. The importance of the use of combined CAT scan and sialography is discussed in the diagnosis of these patients. The various prognostic factors are mentioned and a description is given of the best way to approach the parapharyngeal space without damaging the facial nerve. With careful planning and preparation of the planned operation, the morbidity of the facial nerve may be considerably reduced.

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