

Extracranial Non-vestibular Head and Neck Schwannomas: A Ten-year Experience

Gavin CW Kang,¹MBBS, Khee-Chee Soo,^{1,2}FRACS (Gen Surg), FAMS (Gen Surg), Dennis TH Lim,^{1,2}FRCS (Edin), FAMS (Gen Surg)

Abstract:

Introduction: We present a series of head and neck extracranial non-vestibular schwannomas treated during a ten-year period, assessing epidemiology, presenting signs and symptoms, location, nerve of origin, diagnostic modalities, treatment and clinical outcome. **Materials and Methods:** Clinical records of all patients with head and neck schwannomas treated at our department from April 1995 to July 2005 were retrospectively reviewed. **Results:** There was female predominance (67%). The mean age at diagnosis was 48 years. Sixteen (76%) presented with a unilateral neck mass. Eleven schwannomas (52%) were in the parapharyngeal space. The most common nerves of origin were the vagus and the cervical sympathetic chain. The tumour may masquerade as a cervical lymph node and other myriad conditions. Treatment for all but 2 cases was complete excision with nerve preservation. Two cases of facial schwannoma required sacrifice of the affected nerve portion with nerve reconstruction. All facial schwannoma patients suffered postoperative facial palsy with only partial resolution (mean final House-Brackman grade, 3.25/6). Among non-facial schwannoma patients, postoperative neural deficit occurred in 12 with partial to complete resolution in 7. The median follow-up period was 24 months. No schwannoma was malignant and none recurred. **Conclusion:** Non-vestibular extracranial head and neck schwannomas most frequently present as an innocuous longstanding unilateral parapharyngeal neck mass. Preoperative diagnosis may be aided by fine-needle cytology and magnetic resonance imaging or computed tomographic imaging. The mainstay of treatment is complete intracapsular excision preserving the nerve of origin, but for extensive tumour or facial schwannomas, subtotal resection or nerve sacrifice with reconstruction and rehabilitation are considerations. Surgery on intraparotid facial schwannomas carries considerable morbidity and conservative management has a place in treatment. Early recognition of facial schwannomas is key to optimal treatment.

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Key words: Asian, Extracranial non-vestibular, Head and neck schwannomas, Single institution

Introduction

Schwannomas, also known as neurilemmomas, neuromas, or neurinomas, are uncommon nerve sheath neoplasms that may originate from any peripheral, cranial or autonomic nerve of the body with the exception of the olfactory and optic nerve. Malignant change is unusual. Some 25% to 45%¹ of schwannomas are located in the head, and these often present as diagnostic and management challenges.

Despite the fact that a large proportion of head and neck schwannoma studies is devoted to intracranial acoustic neuromas, the majority of head and neck schwannomas are non-vestibular and extracranial. There are few Asian series on head and neck extracranial non-vestibular schwannomas.

Materials and Methods

All patients with head and neck schwannomas treated at our department between April 1995 and July 2005 were retrospectively reviewed from the medical records of the Singapore General Hospital, the largest tertiary hospital in Singapore. Data collected included patient age, sex, race, presenting signs and symptoms, anatomical location of the tumour, tumour size, nerve of origin, diagnostic modality, surgical approach, intraoperative finding, histopathological finding, and outcome after treatment.

The presence of characteristic Antoni A or B histologic patterns with or without S-100 stain was used to identify schwannomas. S-100 immunohistochemical staining is

¹ Department of General Surgery, Singapore General Hospital, Singapore

² National Cancer Centre Singapore, Singapore

Address for Correspondence: Dr Dennis TH Lim, Department of General Surgery, Singapore General Hospital, Outram Road, Singapore 169608.

positive in most Schwann cell-derived tumours. The absence of mitoses, necrosis, invasiveness, and specific features such as nuclear hyperchromia and pleomorphism or large atypical cells confirms the benign nature of the schwannoma.² Grossly identified, schwannomas are well-circumscribed encapsulated firm, grey myxoid masses attached to nerve but may have areas of cystic and xanthomatous change.

Results

Twenty-two patients with head and neck schwannomas were identified. One patient with no information other than age and diagnosis of a recurrent head and neck schwannoma was excluded from the study. Our study set of schwannomas was necessarily extracranial non-vestibular and mainly non-trigeminal because the vestibular and trigeminal schwannoma patients usually receive tertiary treatment through either otolaryngology or neurosurgery.

The study population consisted of 7 males and 14 females, with a mean age of 47.7 years (range, 26 to 67) and a median age of 48 years. Each had a solitary head and neck schwannoma and none suffered from neurofibromatosis. Fifteen (71%) of the 21 patients underwent preoperative computed tomography (CT) or magnetic resonance imaging (MRI) to facilitate diagnosis and delineate extent and related anatomy. One had only ultrasound imaging of the tumour done preoperatively. All patients underwent surgical excision of the tumour. Table 1 shows the epidemiological data of the population, along with the presenting signs and symptoms, initial diagnosis, and diagnostic modality utilised.

Every patient had at least one presenting symptom or sign, with only 4 patients reporting multiple symptoms or signs. A unilateral neck mass was reported in 16 (76%) patients making it the most common presentation of a schwannoma. Of these 16, 10 had a neck mass that was left-sided. Out of all the cases, 12 (57%) were left-sided schwannomas. There was a singular case of a recurrent right-sided neck schwannoma.

Schwannomas in our case series were distributed over 4 anatomical sites – the parapharyngeal space (11), neck (5), parotid (4) and skullbase (1). The nerve of origin (Table 1) was identified in 20 (95%) of 21 patients. Of those identified, 6 were derived from the vagus nerve; 5, the cervical sympathetic chain; 4, the facial nerve; 2, the brachial plexus; 1, the trigeminal nerve; 1, the accessory nerve; and 1, the hypoglossal nerve.

In all cases, the tumour was completely resected surgically. The surgical approach varied depending on the preoperative presumptive diagnosis, location and size of the tumour, and surgeon preference. Schwannomas of the parapharyngeal space and those limited to the neck were resected via

transcervical approaches. All 4 parotid schwannomas were intra-parotid and derived from the facial nerve such that complete resection mandated at least a superficial parotidectomy.

Postoperative neural deficit separate from or worse than that reported preoperatively was documented in 16 (76%) patients. Two patients had more than one operation-related neural deficit. Facial nerve injury was evident in 5 patients. Table 2 displays the postoperative nerve injuries and resolution of neural deficits. None of the patients suffered wound infection, haematoma, or cerebrospinal fluid leak, which are possible characteristic sequelae reported in other series.

The patient follow-up period ranged from 1 month to 108 months (median, 24 months). All remained free of disease at last follow-up consultation. None of the schwannomas was malignant.

Discussion

Non-vestibular extracranial head and neck schwannomas are more common but less researched than their relatively more morbid intracranial acoustic counterpart. Few studies on this specialty subject are derived from Asia and this is the largest Southeast Asian series to the best of the authors' knowledge.

Two-thirds of the study population were female in line with a study by Torossian et al³ observing female predominance in extracranial cephalic schwannomas, but at variance with Leu and Chang's series⁴ noting male predilection. More striking in the population was the preferential distribution of the tumour on the left side. This especially held true for schwannomas presenting as non-supraclavicular neck masses – 9 of 14 (64%) were left-sided. All patients in the study were of Chinese ethnicity, apart from 3 (14.3%) ethnic Indians.

Three-quarters of the cases presented with an asymptomatic stable neck mass that caused little concern other than the possibility of malignancy and cosmesis. Many of these neck masses were longstanding and have been manifested in the patient for as long as 3 to 9 years. More than half (52%) of the schwannomas in the study, comprising 6 vagal and 5 cervical sympathetic chain schwannomas, was anatomically located in the parapharyngeal space. This concurs with other series^{4,6} identifying the parapharyngeal space as the most common non-vestibular head and neck schwannoma location. Of note, 29% of schwannomas in the series originated from the vagus.

While neurogenic presenting symptoms and signs would be expected to feature more prominently befitting cephalic neurogenic tumours, only 4 (19%) cases had any neurogenic symptoms or signs at all. Possible neurogenic symptoms and signs related to the non-vestibular tumour include pain

Table 1. Epidemiological Data, Presenting Signs and Symptoms, Diagnostic Modality, Preoperative Diagnosis and Nerve of Origin

Patient	Age at diagnosis/Sex	Presenting signs and symptoms	Initial diagnosis	Diagnostic modality and interpretation	Nerve of schwannoma origin
SP	35/Male	Right neck mass – many years	Metastatic lymph node from a thyroid cancer	FNA – blood, degenerate cells, spindle cells CT neck – vagal schwannoma	Vagus
WGG	39/Female	Left neck mass – 2 months	Thyroid nodule	FNA – blood only CT neck - haemorrhagic thyroid cyst	Vagus
LNM	45/Male	Left neck mass – 3 years	Carotid body tumour or level II lymph node	CT neck – enlarged lymph node	Vagus
GMP	48/Female	Left neck mass	Level IV lymph node	FNA – inadequate for diagnosis CT neck – vagal schwannoma	Vagus
LSC	48/Female	Right neck mass – 1 month, known case of right neck schwannoma excised 18 years back with recurrence excised 16 years ago	Schwannoma recurrence	MRI neck – recurrent schwannoma or enlarged lymph node	Vagus
TKG	66/Female	Right neck mass – 1 year	Tail of parotid tumour or carotid body tumour	CT neck – schwannoma or metastatic lymph node from papillary thyroid cancer	Vagus
RE	42/Female	Left neck mass – many years	Carotid body tumour	CT neck – schwannoma from vagal or sympathetic nerve	Cervical sympathetic chain
KBL	43/Male	Left neck mass – 9 years	Lymph node or carotid body tumour	CT neck – enlarged lymph nodes or neurogenic tumour	Cervical chain sympathetic
HYK	55/Female	Left neck mass – 5 years	Brachial cyst	FNA – benign squames CT neck – carotid body tumour or neurofibroma MRI neck – nerve tumour or enlarged lymph node	Cervical sympathetic chain
KAG	64/Female	Right neck mass – 1 year	Carotid body tumour	CT neck – enlarged lymph node or carotid body tumour	Cervical sympathetic chain
CCK	67/Female	Right neck mass – 2 years	Level II or III lymph node	FNA – schwannoma MRI neck – schwannoma from vagal or sympathetic nerve	Cervical sympathetic chain
SGC	41/Male	Left parotid swelling – 1 year	Parotid tumour	FNA – pleomorphic adenoma or schwannoma	Facial
FKY	43/Male	Right parotid swelling – 3 months	Parotid tumour	Nil	Facial
GG	48/Female	Left parotid swelling with slight pain – 1 year	Parotid tumour	Nil	Facial
TBN	64/Female	Right parotid swelling – 7 months	Parotid cyst	Nil	Facial
LWY	34/Male	Left neck mass, tender – 5 years	Level III lymph node	FNA – schwannoma, solitary fibrous tumour, or other spindle cell lesion CT neck – neuroma	Brachial plexus

Table 1. Contd

Patient	Age at diagnosis/Sex	Presenting signs and symptoms	Initial diagnosis	Diagnostic modality and interpretation	Nerve of schwannoma origin
BK	61/Female	GERD symptoms with left tender supraclavicular lump – few months Upper limb paresthesiae elicited through pressure and FNA on lump	Virchow's node (Trosier's sign)	FNA (twice) – first inflammatory cells, second atypical epithelial cells CT chest (workup for primary malignancy) – enlarged lymph node or schwannoma	Brachial plexus
OAM	56/Female	Left neck mass – 5 years	Level II lymph node or parotid tumour	FNA – reactive lymphoid population with spindle cell population	Hypoglossal
SGE	49/Female	Right occipital headache, right V/VII/XII palsies – 6 months	Intracranial tumour	MRI head – neoplastic lesion	Trigeminal
CFM	26/Male	Right cystic supraclavicular lump – 4 months	Right supraclavicular lymph node	FNA – cyst contents US neck – cystic lesion containing debri	Accessory
PN	28/Female	Posterior left neck mass – 1 month	NA	CT neck – infection or schwannoma or metastasis	Unknown

FNA: fine-needle aspiration

and tenderness, coughing upon exerting pressure on tumour, headache, Horner's syndrome, cranial nerve palsies (particularly V, VI, VII, XII), tinnitus or hearing loss.^{5,7} It has been noted that patients with neurogenic presenting signs and symptoms often had tumours located in more confined spaces such as the middle ear, sinonasal cavity, or skull base.⁵ In our series, one (LWY) with a brachial plexus schwannoma and another (GG) with a parotid schwannoma both complained of pain and tenderness of the tumour. The case of a right skull base trigeminal schwannoma – the only “confined” schwannoma in the series – presented with a multitude of occipital headache and right V, VII and XII nerve palsies, likely resulting from a combination of neuropraxia of the affected nerve and mass compression of adjacent nerves. The fourth case, that of yet another brachial plexus schwannoma initially diagnosed as a possible Virchow's node, had tenderness and upper limb paresthesiae (Tinel's sign) upon compression, with upper limb paresthesiae and pains elicited during fine-needle aspiration (FNA).

Schwannomas almost always are diagnostic problems because the history and clinical examination are non-specific and deceptive. Often, as was the situation in many cases of this series, the unilateral asymptomatic neck mass is diagnosed clinically incorrectly as an enlarged lymph node, a carotid body tumour, a brachial cyst, a thyroid cyst or nodule, even a parotid cyst or tumour in the case of parotid schwannomas. Definitive diagnosis and identification of the affected is often difficult up to the time of

surgery.⁸⁻¹¹ However, diagnostic modalities in the form of FNA cytological techniques as well as better imaging in the form of MRI or CT scans have lessened the problem of misdiagnosis to some degree.^{1,12,13} In addition to facilitating diagnosis, preoperative imaging provides information on tumour size, location, extent and surrounding anatomy, thereby aiding surgical planning.

FNA was performed on 10 patients and only in 2 (20%) was a definitive cytological diagnosis of schwannoma made based on the diagnosis of characteristic Verocay bodies, while in another three the diagnosis was suggested by the presence of spindle cells. FNA was not done in the cases presenting as parotid lumps. The diagnostic accuracy of FNA depends strongly on the specimen quality and the experience of the cytopathologist.

Based on tumour location, morphology and even signal characteristics, the radiological diagnosis of schwannoma was suggested in 11 of 15 (73%) cases in which preoperative MRI and/or CT was performed. Three had MRI alone done, 1 patient had both MRI and CT scanning; the remaining 11 received only CT (Figs. 1 and 2) scanning of the tumour. Contrast-enhanced CT and MRI are respectively useful in assessing bony and soft tissue involvement. MRI characteristics¹⁴ of schwannomas include specific signs (split fat sign, fascicular sign, target sign) and signal patterns (i.e., isointense T1 signal relative to skeletal muscle; increased and slightly heterogeneous T2 signal). MRI also finds application in evaluating schwannomas thought to be highly vascular or closely related to

Table 2. Postoperative Nerve Injury and Resolution After Resection of Schwannoma

Patient	Type of schwannoma	Postoperative neural deficit	Resolution and time to resolution
SP	Vagal	CN X – hoarseness, vocal cord paresis	Persistent at 15 months, offered cord medialisation
WGG	Vagal	CN X – hoarseness, vocal cord paresis CN IX - choking when eating	Partial recovery at 9 months, slight gap between vocal cords, offered cord medialisation
GMP	Vagal	CN X – hoarseness	Resolved at 3 months
TKG	Vagal	CN X – vocal cord paresis	Resolved at 6 months
KBL	Cervical sympathetic chain	Horner's syndrome CN VII – mild facial weakness CN XII – tongue deviation	Patient defaulted follow-up
HYK	Cervical sympathetic chain	Horner's syndrome	Resolved at 6 months
KAG	Cervical sympathetic chain	CN X – hoarseness, vocal cord paresis	Persistent at 24 months
CCK	Cervical sympathetic chain	Great auricular nerve – temporomandibular joint region pain and preauricular pain	Improved at 6 months
SGC	Facial	CN VII – palsy	Unable to close left eye fully at 108 months (House-Brackmann IV)
FKY	Facial	CN VII - unable to close right eye or blink completely, unable to raise eyebrow, drooping at angle of mouth, Frey's syndrome	Eye closure normalised at 32 months (House-Brackmann III)
GG	Facial	CN VII – palsy	Functional recovery at 24 months with galvanic stimulation therapy (House-Brackmann III)
TBN	Facial	CN VII – dense palsy with upper forehead and upper eyelid weakness, drooling	Residual right eyelid weakness at 8 months (House-Brackmann III)
BK	Brachial plexus	Brachial plexus lateral cord – neuropraxia causing left upper limb weakness maximal at shoulder and biceps atrophy	Resolved at 6 months
OAM	Hypoglossal	CN XII – tongue atrophy	Persistent at 30 months
CFM	Accessory	Paresthesiae over wound	No follow-up further to complaint
SGE	Trigeminal	CN IX or X – dysphagia Preoperative CN V/VII/XII palsy – mild facial palsy and mandibular sensory loss, ipsilateral tongue deviation	Resolved at 6 months Preoperative deficits improved slightly at 6 months

vasculature, with angiography used for cases requiring preoperative embolisation.⁵ On CT scans,¹⁵ schwannomas appear well-covered, well-defined and fusiform; they show relatively homogeneous contrast enhancement with internal cystic change becoming more prominent as the tumour enlarges. This cystic change is associated with mucinous degeneration, haemorrhage, necrosis, and microcyst formation. Ultrasonic images (Fig. 3) of schwannoma are characterised by a round or elliptical cross-section with a clear border with the internal echo reflective of histology. Patterns may be homogeneous to heterogeneous and cystic change may be seen, as was the case in one patient with a right supraclavicular schwannoma. Ultrasound has greater diagnostic utility when the diameter of the nerve of origin is large and it can be seen that the tumour is connected to

the often well-delineated nerve.^{14,15} Even with MRI or CT scans, it was in some instances in our series (Table 1) difficult to distinguish adenopathy from schwannoma. The definitive diagnosis remains that which is derived from tissue.

Schwannomas are management problems as well. Cure entails a complete resection but this conflicts with the surgical instinct to preserve the nerve of origin. Altogether, 16 patients had postoperative neural deficit. For clarity, the cases are divided into non-facial nerve and facial nerve schwannomas.

All 17 non-facial nerve schwannomas in the study were completely excised and while every effort was made to identify and spare the nerve of origin, tumour clearance occasionally necessitated partial nerve sacrifice or

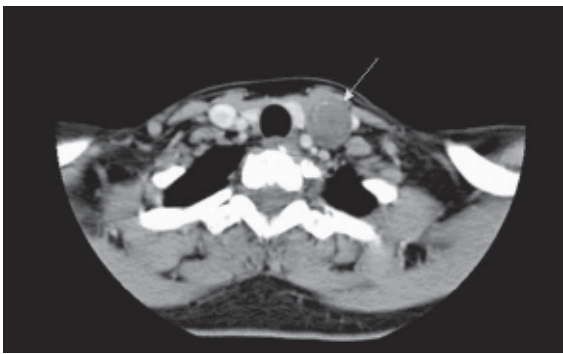


Fig.1. CT of patient GMP showing a solitary well-circumscribed vagal schwannoma (arrow) measuring approximately 2.6 x 2.3 cm in the left side of the root of the neck just lateral to the left thyroid lobe. The schwannoma shows homogenous soft tissue attenuation (30 HU) and its unique location with resulting splaying of the left common carotid artery from the internal jugular vein is noted.

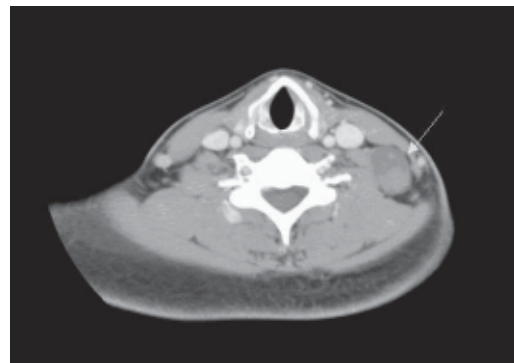


Fig.2. CT of patient LWY showing a 2.5-cm well-circumscribed schwannoma (arrow) in the left posterior cervical region arising from one of the upper branches of the brachial plexus. It has mild inhomogeneous internal enhancement and is closely related to the left scalenus anterior and medius muscles.

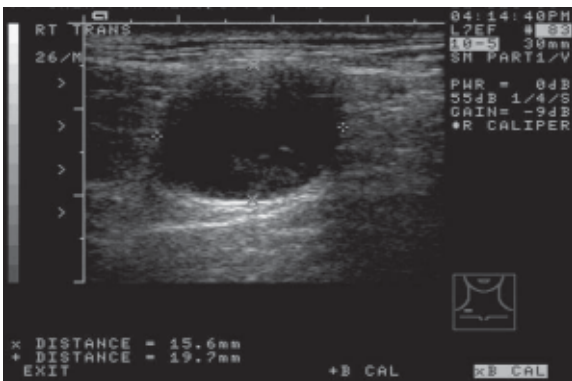


Fig. 3. Ultrasound of patient CFM showing a 19.7 x 15.6 mm right supraclavicular non-vascular well-defined cystic lesion containing dependant debris. This was diagnosed intraoperatively as an accessory nerve schwannoma.

unwittingly caused nerve compromise. Twelve had postoperative neural deficits caused by iatrogenic injury to either the nerve of origin or adjacent nerves. Analysed by nerve affected, it is noted that vagal schwannomas were associated with vocal cord palsy and voice hoarseness, cervical sympathetic chain with Horner’s syndrome, and hypoglossal nerve with tongue atrophy. One case (BK) of a brachial plexus schwannoma developed postoperative paresis of the ipsilateral upper limb, with weakness maximally evident at the shoulder associated with atrophy of the biceps. Shoulder power decreased from grade 5 before operation to grade 2. This probable iatrogenic neuropraxia, likely of the lateral cord from which the tumour arose, fortunately resolved spontaneously at 6 months. Notably, one patient (CCK) who had a cervical sympathetic chain schwannoma excised developed postoperative ipsilateral chronic pain over the temporomandibular joint and preauricular region, ostensibly from injury to the great auricular nerve. The case of accessory nerve schwannoma manifested postoperative deficit in the form of wound paresthesiae. The patient with trigeminal

schwannoma presenting with neural deficits experienced new-onset mild dysphagia post-excision. Excision of the trigeminal schwannoma, located in the infratemporal region between the pterygoids, was via a lateral skull base approach involving the use of an optical tracking system, superior control of the internal carotid artery, zygomectomy and piecemeal tumour removal.

The singular case (LSC) of recurrent right vagal schwannoma was exceptional in that this was the second local recurrence 16 years to the last resection. The patient had had 2 previous surgeries (one 16 years ago and another 18 years ago) to remove schwannoma in the exact same locality. We postulate that the recurrences stemmed from earlier subtotal resections. After the third surgery, she was well with no recurrence at 14 months.

The absence of wound infection, haematoma, or cerebrospinal fluid leak in our series is attributed to careful surgical technique, the generally healthy subset of patients with no major comorbidity, and the accessible cervicoparotid location of most of the tumours.

There were 4 cases of facial nerve schwannoma – all were intraparotid. Intraparotid schwannomas usually present as an asymptomatic slow-growing parotid lump but can cause pain: this was experienced by one of the patients. Complete resection is clearly indicated when they present with moderate to total facial nerve palsy. With mild or no facial palsy, as was the circumstance with these 4 patients (all House-Brackman grade¹⁶ 1/6 preoperatively), the best course of treatment is controversial. All had a presumptive diagnosis of parotid tumour without preoperative imaging and eventually had tumour excision involving parotidectomy. In all but 1 (TBN) patient, there was intraoperative recognition of a facial schwannoma. All 4 suffered facial nerve dysfunction (mean final House-Brackman grade post-resection, 3.25/6) despite efforts made to preserve or reconstruct neural structures. One patient (GG) had a

large facial schwannoma extending into the mastoid: a total parotidectomy was performed such that the tumour was resected together with the involved facial trunk segment; this was followed by a mastoidectomy and great auricular nerve interposition grafting to reconstruct the facial trunk. She then underwent therapist-guided galvanic stimulation of the reconstructed facial nerve achieving good functional recovery and resting tone (House-Brackman 3/6) at 24 months. Another (FKY) had tumour involving the upper division (temporozygomatic) trunk of the right facial nerve. Likewise the tumour was excised with the involved nerve segment, parotidectomy was done, and the great auricular nerve grafted. He had a postoperative facial palsy as well as sweating over his temporal region when masticating (Frey's syndrome); partial symptom resolution was attained at 32 months. The other 2 patients (SGC, TBN) underwent superficial parotidectomy with vigilant preservation of facial nerves, in spite of which both went on to develop longstanding eye closure problems.

Reflecting on our morbidity with facial schwannomas, the importance of early recognition of the neurogenic tumour – intraoperatively or otherwise – cannot be overemphasised. It is advisable when operating on parotid tumours to be wary and on the lookout for the possibility of a parotid schwannoma. Caughey et al¹⁷ recommended a degree of suspicion for facial nerve schwannoma if the tumour is intimately associated with the facial nerve, and advocated biopsy when a schwannoma is suspected, postponing complete resection until further imaging and options are evaluated in view of the potential disabling palsy. Liu et al¹⁸ advised delaying resection of facial nerve schwannomas to allow retention of normal facial function indefinitely, urging nerve decompression or subtotal resection for patients with mild or no facial palsy should surgery be desired.

The mainstay of treatment ideally remains complete surgical excision with preservation of the affected nerve.^{1,3,8,12} There was no recurrence for all the cases after complete surgical removal. The greatest dimension of the schwannomas excised ranged from 2 cm to 7.3 cm (mean size, 4.4 cm). Most authors^{3,7} have recommended careful intracapsular excision of the tumour to minimise postoperative neural deficit. Microneurosurgery to facilitate intraoperative microscopic diagnosis of the schwannoma and achieve more superior nerve preservation has been described. This involves microscopic enucleation of the tumour after opening epineurium without disrupting nerve continuity. Schwannomas involving the brachial plexus are best approached with microsurgical assistance to prevent potentially catastrophic iatrogenic injury. Even as all attempts are made to preserve the nerve of origin, structural preservation may not necessarily lead to preservation of its

functional integrity – this was apparent among our patients with postoperative neural deficit.

The literature^{5,18} hitherto appears to be in favour of the concept of subtotal or near-total tumour resection for non-vestibular head and neck schwannomas in situations where tumour is extensive and complete tumour resection cannot be achieved without compromising neural integrity and causing significant morbidity from paralysis and sensory loss. This approach is particularly suited to elderly patients or unfit patients who cannot tolerate prolonged surgery. Malignant transformation is exceptional in solitary schwannomas and evidence suggests that subtotal resection may provide adequate disease control of non-vestibular head and neck schwannoma, although continued follow-up is mandated. Judging from the lag time in our case of recurrent vagal schwannoma, recurrence after subtotal resection may take 2 years to 2 decades. Generally, as illustrated par excellence in the aforementioned cases of large facial trunk schwannomas, if the nerve of origin is sacrificed, immediate reconstruction and postoperative rehabilitation should be undertaken in the context of a multidisciplinary management team.¹²

The role of radiosurgery as an alternative to surgical resection is a matter of ongoing debate. Recent small-scale studies^{19,20} reviewed outcome following stereotactic radiosurgery of non-vestibular cranial nerve schwannomas and reported good tumour control rates and less morbidity in terms of post-treatment neural deficit compared with surgical resection. The patients treated had, among other types of schwannomas not in our population, jugular foramen region, facial, hypoglossal, and trigeminal schwannomas. Some had undergone previous subtotal resection but most had no prior treatment. While intuition may favour radiosurgery over resection for high-risk patients and residual or recurrent tumour, larger case-control studies are required before final conclusions can be drawn. Certainly, a conservative non-operative approach is a valid option for head and neck schwannomas if the diagnosis has been established and the patient is tolerating the tumour well without neurogenic deficit, mass effect or rapid progression. Surgery, however, remains definitive treatment.

The most important differential diagnosis of a firm defined unilateral upper neck mass so characteristic of neck schwannomas must be an enlarged lymph node. In view of this, the approach entails a detailed history, meticulous examination of the head and neck, chest, abdomen, and select investigations targeted at identifying a source of lymphadenopathy. Flexible nasoendoscopic examination of the nasopharynx, oral cavity and larynx should be done. FNA is most helpful in determining the nature of the mass. If the diagnosis remains unknown, an MRI or CT neck is the further diagnostic investigation of

choice, failing which excision biopsy is indicated, adhering to the surgical concepts highlighted should an intraoperative diagnosis of schwannoma be made.

This single-institution study explored a dedicated series of extracranial non-vestibular schwannomas in terms of clinical characteristics, diagnosis, treatment and its outcome. The most likely presentation of an extracranial non-vestibular head and neck schwannoma is an asymptomatic longstanding left-sided parapharyngeal space neck mass in a middle-aged woman. Neural deficits are uncommon presenting findings. The vagus is the most common nerve of tumour origination. Definitive preoperative diagnosis is difficult to achieve but may be aided by FNA and generous MRI, CT or ultrasound imaging. The treatment of choice for schwannoma in principle is complete excision preserving the nerve of origin, and this can be achieved in most cases with minimal postoperative morbidity, but circumstances such as extensive tumour or facial schwannomas may point to subtotal tumour resection or nerve sacrifice with immediate reconstruction and rehabilitation. Surgery on intraparotid facial schwannomas carry considerable morbidity and conservative management may have a place; timely recognition of facial schwannomas is critical for optimal treatment. None of the tumours in the study were malignant and there was no recurrence during the follow-up period post-surgery.

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REFERENCES

- Colreavy MP, Lacy PD, Hughes J, Bouchier-Hayes D, Brennan P, O'Dwyer AJ, et al. Head and neck schwannomas—a 10 year review. *J Laryngol Otol* 2000;114:119-24.
- Torre V, Bucolo S, Galletti B, Fera G, Mangione AO, Suraci G, et al. Benign extracranial cervical-facial schwannomas: anatomo-clinical and diagnostic considerations on our case reports and review of literature [Italian]. *Acta Otorhinolaryngol Ital* 1999;19:160-5.
- Torossian JM, Beziat JL, Abou Chebel N, Devouassoux-Shisheboran M, Fischer G. Extracranial cephalic schwannomas: a series of 15 patients. *J Craniofac Surg* 1999;10:389-94.
- Leu YS, Chang KC. Extracranial head and neck schwannomas: a review of 8 years experience. *Acta Otolaryngol* 2002;122:435-7.
- Malone JP, Lee WJ, Levin RJ. Clinical characteristics and treatment outcome for nonvestibular schwannomas of the head and neck. *Am J Otolaryngol* 2005;26:108-12.
- Rosner M, Fisher W, Mulligan L. Cervical sympathetic schwannoma: case report. *Neurosurgery* 2001;49:1452-4.
- Sakao T, Noguchi S, Murakami N, Uchino S. Neurilemmoma of the neck; a report of 35 cases [Japanese]. *Nippon Geka Gakkai Zasshi* 1990;91:407-10.
- Sharaki MM, Talaat M, Hamam SM. Schwannoma of the neck. *Clin Otolaryngol Allied Sci* 1982;7:245-51.
- St Pierre S, Theriault R, Leclerc JE. Schwannomas of the vagus nerve in the head and neck. *J Otolaryngol* 1985;14:167-70.
- Uzun L, Ugur MB, Ozdemir H. Cervical sympathetic chain schwannoma mimicking a carotid body tumor: a case report. *Tumori* 2005;91:84-6.
- Fornaro R, Canaletti M, Spaggiari P, Davini MD, Masuri M, Sticchi C, et al. Report on a case of schwannoma of the neck: clinical and therapeutic considerations [Italian]. *Chir Ital* 2005;57:91-8.
- Moukarbel RV, Sabri AN. Current management of head and neck schwannomas. *Curr Opin Otolaryngol Head Neck Surg* 2005;13:117-22.
- Al-Ghamdi S, Black MJ, Lafond G. Extracranial head and neck schwannomas. *J Otolaryngol* 1992;21:186-8.
- Beaman FD, Kransdorf MJ, Menke DM. Schwannoma: radiologic-pathologic correlation. *Radiographics* 2004;24:1477-81.
- Yamazaki H, Kaneko A, Ota Y, Tsukinoki K. Schwannoma of the mental nerve: usefulness of preoperative imaging: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004;97:122-6.
- House JW, Brackmann DE. Facial nerve grading system. *Otolaryngol Head Neck Surg* 1985;93:146-7.
- Caughey RJ, May M, Schaitkin BM. Intraparotid facial nerve schwannoma: diagnosis and management. *Otolaryngol Head Neck Surg* 2004;130:586-92.
- Liu R, Fagan P. Facial nerve schwannoma: surgical excision versus conservative management. *Ann Otol Rhinol Laryngol* 2001;110:1025-9.
- Pollock BE, Foote RL, Stafford SL. Stereotactic radiosurgery: the preferred management for patients with nonvestibular schwannomas? *Int J Radiat Oncol Biol Phys* 2002 15;52:1002-7.
- Zabel A, Debus J, Thilmann C, Schlegel W, Wannemacher M. Management of benign cranial nonacoustic schwannomas by fractionated stereotactic radiotherapy. *Int J Cancer* 2001;96:356-62.