CLINICAL STUDY

Our experience with surgical treatment of the schwannomas of peripheral nerves

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Abstract

Introduction: **This work is presenting the results of the operations of 20 patients in whom 20 schwannomas of the peripheral nerves of the limbs and the brachial plexus were removed using a micro-technique within a period of 11 years, from 1990 to 2001.**
Patients and methods: **18 schwannomas of the peripheral nerves of the limbs and 2 schwannomas of the brachial plexus were removed in 20 patients. Patients with schwannomas of other than the major nerves were not included in this study. Each of the tumours of the brachial plexus originated in the lower trunk and did not spread intra-spinaly spread. We have evaluated the results according to the Donner's classification of the motoric and sensitive functions.**
Results: **The motoric functions have improved or remained unchanged in 18 (90 %) patients and 5 (83.3 %) patients with pain in the distribution area of the affected nerve experienced complete or partial relieve of the symptoms. The results were more significant in smaller and more distally localised tumours.**
Conclusion: **The patients should be surgically treated on time, before the tumours reach greater volume and before neurological deficit develops, at a department specialized on the diseases of peripheral nerves.**
(Tab. 3, Ref. 9.)
Key words: brachial plexus, schwannomas, peripheral nerve.

Schwannomas are the most frequent tumours of the neural sheaths of the peripheral nerves and the brachial plexus. Even though they are not very common, they are detected in such a frequency to cause diagnostic difficulties that often lead to mistakes such as inappropriate biopsy or inadequate resection. There are only few studies concerning the surgical treatment of these tumours (1, 2, 3, 4, 5).

They are more frequently associated with peripheral nerves and therefore the treatment of those that affect the brachial plexus requires an exact and a perfect understanding of the pathological variations. Each element of the plexus, which is in a close relation with the tumour, has to be identified. The incidence of the plexus schwannomas is low. Most neurosurgeons encounter only a few during a lifelong practise.

We present experiences with a surgical treatment of schwannomas of the peripheral nerves and the brachial plexus.

Patients and methods

We have surgically treated 20 patients in the Neurosurgery clinics in Bratislava from 1990 to 2001. There were 18 patients with tumours of the peripheral nerves and 2 patients with tumours of the brachial plexus.

All of the patients were completely neurologically examined; they underwent pre and post-operative examinations detecting the presence or absence of spontaneous local or evoked pain, weakness or tingling. The evaluation of the results proceeded according to a five-degree Donner's (1) classification of the motoric and sensitive functions from the year 1994 (Tab. 1).

Schwannomas (neurilemmomas, neurinomas) are benign, soft, slowly growing tumours that may grow from different nerves including cranial, spinal roots or peripheral nerves. The tumour is solid, does not adhere to the skin or muscle and it can be movable from side to side.

The epineurium is forming a capsule, which is located eccentrically. Fascicles were observed in schwannomas. They were run-

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Tab. 1. Neural sheath tumors of major nerves.

Muscle strength and sensory grading system			
	Grade	Evaluation	Description
Individual muscle grades	0	absent	No contraction
	1	poor	Trace contraction
	2	fair	Movement against gravity only
	3	moderate	Movement against gravity and some (mild) resistance
	4	good	Movement against moderate resistance
	5	excellent	Movement against maximal resistance
Sensory grades	0	absent	No response to touch, pinprick, or pressure
	1	bad	Testing gives hyperesthesia or paresthesia; deep pain recovery in autonomous zones
	2	poor	Sensory response sufficient for grip and slow protection; sensory stimuli mislocalized with overresponse
	3	moderate	Response to touch and pinprick in autonomous zone; sensation mislocalized and not normal with some overresponse
	4	good	Response to touch and pinprick in autonomous zones; response localized but not normal; no overresponse
	5	excellent	Normal response to touch and pinprick in entire field including autonomous zones

ning between the leaves of the tumour capsule but did not enter the tumour. The appearance of the epineural vessels that cross the tumour capsule is characteristic; they are widened and tortuous.

The average age of the patients was 49 years. There were 7 females and 13 males out of the total number. There was no significant difference between the right and left side. The average size of the tumours was 38 mm. The average period since the tumours appeared till the surgical treatment was performed was 5 years. The duration of the symptoms was between 3 months and 14 years. 2 patients were symptomatic more than 10 years.

The schwannom tumour was completely removed with a microsurgical technique in every patient. Anaesthetics causing relaxation of muscles were not used and it was therefore possible to identify the motoric fascicles using a simple stimulation.

The per-operative stimulation and a record of NAP during an EMG provide data that let us sacrifice the fascicles entering and leaving the tumours when they are not functional. This enables to remove entirely the whole mass of the tumour.

Schwannomas of the plexus (2) were growing from the lower trunk. They were treated from a frontal approach – 1 case, or from a sub-capsular approach – 1 case. The tumour was removed in co-operation with a thoracic surgeon in both cases. The first step of the operation was an isolation and identification of the adjacent element to prevent possible damage.

We have performed a tumour reduction in 4 cases to simplify the dissection, 3 patients underwent a biopsy at other departments.

The patients were monitored for at least 12 months after the operation. Pre and post-operation EMG examination was performed in all patients.

Imaging examinations – MRI and CT scan – were performed in patients with tumours of the plexus.

Results

Schwannomas have occurred in adults. Their characteristic feature is a poor neurological symptomatology. The affection of the plexus is rare. The affection of the radial nerve is very infrequent. We have not encountered any during the period of our research.

Larger tumours were located in the area of the brachial plexus (2), in the proximal segments of the limb in axilla (1) and in the ischial region (2). They were forming cysts and degenerative changes, calcifications and hyalinosis were present. We have not encountered any case associated with VRD during the period of our research.

All patients with schwannomas presented palpable masses; they were usually without symptoms and complained of dysaesthesia (Tinnel's sign) on percussion on the tumour except of one patient. 1 patient had a gigantic schwannoma of the plexus (12x10x8 cm).

The symptoms were in the range from paraesthesias, pain to a minimal motoric weakness. Complaints of disorders of the sensitive function were common but there were no sensitive deficits present during physical examination.

The patients were restricted in their activity the way to avoid a contact with the tumour and the symptoms that follow.

Table 2 shows a pre and a post-operative motoric degree of 20 patients with schwannomas. 17 (85 %) of them have no changes and in 2 (10 %) worsening of his state was observed. One of the 4 patients with a pre-operative motoric weakness has improved.

From the 16 patients with an unimpaired strength before the operation, there were 15 (93.8 %) patients with an intact strength after the operation and 1 (6 %) patient with a decreased strength to degree 4.

Two patients (12.5 %) out of 16 who did not have any symp-

Tab. 2. Pre and post-operation motoric degree in 20 patients with schwannoma.

Post-operation motoric degree	Pre-operation motoric degree						
	5	4	3	2	1	0	Total
5	15	1	-	-	-	-	16
4	1	2	-	-	-	-	3
3	-	1	-	-	-	-	1
2	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-
Total	16	4	-	-	-	-	20

Tab. 3. The level of pain after an operation of a schwannoma.

	Number of pts	Number of pts with pain syndromes	Pain			
			Completely receded	Improved	Unchanged	Worsened
Schwannomas	20	6	4	1	-	1

toms before the operation suffered from mild paraesthesias after the operation.

Three, out of the 20 patients with schwannomas underwent a biopsy at another department. These three patients included one with worsened motoric functions and with an accentuation after the operation and two patients who complained of pain. One of them had pain, which was clearly of radicular origin and one had pain, which had, apart from a radicular part, also a localised component from the site of the tumour. One of these patients experienced relieve of the pain syndrome after the operation. The other patient started to suffer from new, stronger pain after the operation (Tab. 3).

Schwannomas of the brachial plexus were removed with a good result; there was no worsening of the state compared to the pre-operative state.

The best results were observed in schwannomas up to 5 cm that were localised more distally, where the success was 100 %.

Discussion

The results of the surgical treatment depended on the localisation, size and preceding attempts to remove the tumour or a biopsy. This may lead to a damage of the conduction elements and a scar formation and following difficulties to distinguish the tissue layers and thereby difficult preparation.

The only argument in favour of a biopsy is a suspicion for a malignancy (6).

According to data from literature as well as from our experiences, the post-operative results in case of the proximal localisations of the tumours of the peripheral nerves are less satisfactory (1, 5, 7) compared to the distal localisation. We can expect permanent results without an impairment of the motoric and sensitive functions if a gentle operation technique is used in case of these distal localisations.

A safe separation was in lesions smaller than 5 cm.

The incidence of pain syndromes in schwannomas is in the range from 0 % to 100 % (1, 8). We have not encountered any pain syndromes associated with tumours of the plexus.

The first symptom was not pain but a palpable mass of the tumour with a small or no neurological deficit. The pain was observed in 6 cases (31.6 %).

Good results were observed in those patients who did not undergo any biopsy or a attempt to remove the tumour surgically, but when the whole tumour was surgically removed during the first preparation. The tumours with minimal pre-operation symptoms and signs were successfully removed without a greater neurological deficit.

Our results, as well as the results in literature (1, 2, 7), show that most tumours of the peripheral nerves may be removed with a good result.

An EMG examination is able to provide an evidence of a neural lesion if it shows retardation or a conduction block in the nerve. If there are only few neural fibres impaired, the EMG examination may be normal (1, 9) as observed in 18 (90 %) patients.

CT scan and MRI are efficient in the diagnostics of tumours of the brachial plexus and in the verification of cystic changes that often accompany these tumours.

MRI is able to show reliably not only the tumour and its capsule, but also nerves from which the tumour grows.

We have not encountered malignant change or a recurrence of a schwannoma tumour.

The decision concerning a surgical treatment of schwannomas is difficult because we do not know the fate of patients with untreated schwannomas and because the risk of a malignant change is low.

Even most of these patients have no motoric deficit. The decision to operate is generally based on an expected improvement of pain, cosmetic effect and problems to dress. The results after an operation are usually great in each of these complexes of symptoms. Tumours of the neural sheaths have occurred in young and middle age patients and there is no apparent association with the gender.

The surgical treatment is recommended especially when pain or neurological deficit is present.

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