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Original Article

Does Biopsy before Excision Have Contribution to Clinical Results in Patients with Schwannoma? A Single-Center Prospective Observational Study

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Abstract

Introduction: This study aimed to investigate whether tru-cut biopsy before excision contributes to clinical outcomes in patients diagnosed with limb schwannoma.

Materials and methods: Tru-cut biopsy was performed before excision in patients diagnosed with schwannoma of the extremity in clinical and radiological evaluations. All patients underwent total excision with microsurgical methods. Demographic data, complications of tru-cut biopsy, treatments, and clinical results were analyzed.

Results: Data for 17 patients (9 males and 8 females) were analyzed. The mean age was 49.8 years. No complications related to tru-cut biopsy were observed. The mean preoperative and postoperative VAS scores were 4.3 and 0.4, respectively. One patient developed postoperative neurological complications. No recurrence was observed in any patient.

Conclusions: In schwannomas of the extremities, tru-cut biopsy before excision is an applicable and reliable option. The preoperative diagnosis is ascertained as schwannoma, and the outcomes of making the excision with microsurgical techniques are quite good.

Keywords

excision, complication, schwannoma, outcomes, tru-cut

INTRODUCTION

Peripheral nerve sheath tumours (PNST) are sporadic. The most common type of PNST is schwannoma, also known as neurilemma or perineural fibroblastoma. Schwannomas most commonly involve the brachial plexus and spinal nerves; limb locations are rare.[1]

In schwannomas located in the extremities, the presence of a mass accompanying sensory impairment in the nerve distribution area or positive Tinel's sign in the nerve line is helpful in the clinical diagnosis. In all patients, contrast magnetic resonance imaging (MRI) is recommended to identify the size, borders, anatomical location, and nature of the lesion.[2]

A clinical diagnosis is difficult in patients with a pre-diagnosed schwannoma in the extremity. However, a biopsy is applied in suspicion of malignancy or if clinical and radiological diagnoses are inconclusive. When a soft tissue sarcoma goes unseen or is not treated with the right algorithm, clinical results may lead to amputation, the only option to prevent mortality.[3]

The treatment of symptomatic schwannomas in the extremities is surgical excision. There is a risk of neurological deficits during surgical excision, for which the surgeon should be prepared. There are studies retrospectively analyzing the clinical results of schwannomas after surgical excision. In some of these studies, the diagnosis was made clinically or radiologically, while a biopsy was performed in some others.[2-4]

However, the effect of diagnostic procedures on prognosis has not been investigated in previous studies. There is not enough evidence regarding the possible benefits or harms of tru-cut biopsy, a method applied to make a diagnosis before surgery.

AIM

This study aimed to investigate whether tru-cut biopsy contributes to clinical outcomes in patients diagnosed with schwannoma of the extremity. Another objective was to observe the possible complications of biopsy.

MATERIALS AND METHODS

This prospective study was carried out in the Dr Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Orthopedics and Traumatology Clinic. Ethical approval was obtained from the ethics committee of the same hospital. Patients referred to our hospital (a tertiary oncology center) with a differential diagnosis of schwannoma between January 2018 and December 2019, and patients with confirmed schwannoma in our hospital were included in the study.

The patients' histories included swelling, pain, and neurological symptoms. In the presence of pain, its character, spread, and degree were queried. Pain severity was assessed with a visual analog scale (VAS). A diagnosis of neurofibromatosis or a previous history of schwannoma operation from localization was surveyed. In the physical examination, the presence of swellings, sensory functions, and muscle strength was evaluated, and a Tinel's test was performed if necessary.

Contrast-enhanced MRI and/or superficial tissue ultrasound for existing mass lesions were evaluated. Additionally, an EMG test was performed if deemed necessary.

Inclusion criteria were the presence of a limb-located benign peripheral nerve sheath tumour (BPNST) or schwannoma in the clinical and radiological differential diagnosis and the patient's acceptance to participate in the study. Exclusion criteria were tru-cut biopsy returning as non-schwannoma, a relapsing schwannoma, a surgical history in another hospital for the mass, the presence of neurofibromatosis, a follow-up plan without total excision after biopsy, and the absence of patient consent.

After the tru-cut biopsy, patients were followed up for related complications during the examination of the pathology material and the planning of the excision. Total excision was performed in all patients where the tru-cut biopsy indicated schwannoma. The dimensions of the excised material after complete excision were measured and recorded. After the excision surgery, the improvement rates of patients' symptoms were examined. During the follow-up, the pain was assessed with the VAS score. Concerning recurrence and complications, follow-up visits were planned at 1, 3, and 6 months, and then annually. All patients were followed up for at least 6 months.

Statistical analysis

All statistical analyses were made with the IBM SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as mean ± standard deviation, frequency, and percentage.

RESULTS

Of the patients with suspected schwannoma in the clinical and radiological examinations, 17 patients with schwannoma were confirmed by pathological examination.

Of the patients, 9 (52.9%) were males, their mean age was 49.8 years (range 9-76). The anamnesis and clinical examinations of the admitted patients are summarized in **Table 1**. There were also patients presenting with only palpable mass or pain. The mean VAS score was 4.3 (range 0-9). In addition to these symptoms, two patients had numbness **(Table 1)**.

Imaging findings are presented in **Table 1**, which were in the form of smooth contoured, contrast-enhancing mass lesions in the MRI, with hypointensity in the T1 sequence and hyperintensity in the T2 sequence. In some patients, the nerve of origin was detected in the images. Additionally, one patient had a target finding **(Table 1)**.

Total excision was performed in all patients per the microsurgery principles after verifying the tru-cut biopsy diagnosis as schwannoma. No complication related to the tru-cut biopsy procedure was seen in any patient in the clinical evaluation before the total excision.

The size of the excised tumour, the relationship of the lesion with the nerve, the interventions, and follow-up results are reported in **Table 2**. During excision, five patients had one or more fascicles entering or exiting the tumour, requiring more careful dissection, and in one of these patients, complete excision of the nerve (anterior interosseous nerve) was required **(Table 2)**. Nerve reconstruction surgery was planned for this patient. However, the patient did not accept the intervention stating that he was contented with this state and did not want any additional operations.

In the follow-up after total excision, one patient (case 15) left the follow-up before six months. This patient was excluded at this stage **(Table 2)**.

The mean follow-up time for the 16 patients was 19

Table 1. Demographic data and preoperative findings

#	Age	Sex	Side	Preoperative symptoms	VAS	Imaging findings
1	59	M	R	Pain for 6 months, numbness in the lateral foot (recently increasing)	7	In the foot distal anterolateral nerve trace, T1 hypo- T2 hyperintense, homogeneously intense contrasting mass, schwannoma?
2	68	M	L	Mass in the proximal medial thigh	0	T1 hypo- T2 hyperintense, contrast-enhancing soft tissue mass, PNST?
3	55	M	L	Intermittent pain in the knee and foot for 10 years	5	In the foot midline posterior, the intensely contrasting T1 hypo- T2 hyperintense mass within the gastrocnemius muscle, PNST? H?
4	24	M	R	Popliteal mass and pain for 1 year	5	In the popliteal area, T1 hypo- T2 hyperintense smoothly bounded soft tissue mass, schwannoma?
5	62	M	L	Popliteal mass and pain for 1 year, symptoms increased over time.	5	In the popliteal area, T1 iso- T2 hyperintense, heterogeneously contrasted smooth bounded soft tissue mass, schwannoma? Less likely Sys?
6	30	F	R	Palpable mass and pain in the proximal forearm for 6 months		Between ECRL, brachioradialis, and brachialis, T1 hypo- T2 hyperintense, smooth contour, contrast-holding mass
7	43	F	R	Painless lateral ankle mass	0	T1 hypo- T2 hyperintense in the ankle level fibula anterolateral, soft tissue mass holding contrast
8	62	F	R	Mass and pain in foot dorsum for 5 months	-	A heterogeneous nodular lesion under the skin that keeps contrast at the proximal of the 4th metatarsalon the dorsum of the foot
9	59	F	R	Pain and swelling of the foot dorsum for 1 year (recently increasing)	9	Smooth shaped contrast-enhancing soft tissue mass between 1st and 2nd metatarsi, proximally
10	72	F	L	Swelling for 10 years, pain for 2 months at anterior foot	4	At the foot midline antero-medial; T1 hypo- T2 hyperintense, properly bounded, heterogeneous intensely enhanced mass in the central, schwannoma? MMT?
11	60	M	L	Swelling at forearm volar part for 1.5 years (enlarged over time)	0	Between pronator teres and brachioradialis muscles at the elbow flexor face, T1 hypo- T2 hyperintense, smooth contour, heterogeneous contrasting mass
12	49	M	L	Swelling in postero-lateral arm for 5 years, pain for 3 months	3	Heterogeneously contrasted solid mass with a lobulated contour in the triceps muscle
13	76	F	R	Pain in the right hip for 2 months, gluteal mass	9	T1 hypo- T2 hyperintense, muscle-pushing nodular lesion in the anterior of the gluteus maximus muscle
14	37	M	R	Mass on the proximal foot for 10 years, pain for 2 months	8	T1 hypo- T2 hyperintense, heterogeneous contrasting mass in subcutaneous adipose tissue at proximal foot
15	26	F	R	Pain and numbness from the right elbow medial to the 4th and 5th fingers for 3 months	-	Intense cystic lesion extending to the joint space in the elbow medial ulnar nerve trace
16	56	M	R	Mass and pain in the anteromedial thigh for 1 year	1	Thigh anteromedial, vastus medialis distal adjacent, intense contrasting soft tissue mass, schwannoma? PNST?
17	10	F	L	Left-arm mass and pain for 3 years. The mass has grown over time	5	In the arm anterior compartment, T1 hypo- T2 hyperintense, well-limited, well contrasted mass, schwannoma?

M: male; F: female; R: right; L: left; VAS: Visual Analog Scale; PNST: peripheral nerve sheath tumour; ECRL: extensor carpi radialis longus; H: hemangioma; Sys: synovial sarcoma; MMT: malignant mesenchymal tumour

months (between 6 and 28 months). No recurrence was observed in any patient. Although pain decreased in four patients compared to the preoperative period, it was still continuing, and one patient (5.8%) had postoperative neurological complications **(Table 2)**. The mean follow-up VAS score was 0.4 (0-4).

DISCUSSION

Due to the relationship of the lesion with small or large nerve branches, there is a risk of neurological complications in interventions such as biopsy or excision. This study aimed to examine whether the application of tru-cut

Table 2. Treatments and follow-up results

	Operation	Tumour dimension (cm)	VAS	Follow-up (month)	Complication
1	TE	2×1×1	4	28	None
2	TE	5×4×3	0	28	None
3	TE, tibial nerve branch dissected	2×1×1	0	27	None
4	TE, nervus tibialis posterior dissected	4×3×2	1	25	Loss of sensation at foot first finger dorsal and plantar side
5	TE	6×4×3	0	25	None
6	TE	3×2×1		24	None
7	TE	2×2×1	0	23	None
8	TE	2×1×1		23	None
9	TE	2×2×1	0	21	None
10	TE	2×2×1	0	19	None
11	The tumour was totally excised together with the anterior interosseous nerve	3×3×3	0	17	Moderate loss in the first and second finger motor movements, loss of sensation, incomplete opposition
12	TE	3×3×2	2	15	None
13	TE	3×3×3	0	10	None
14	TE	3×2×1	0	9	None
15	TE, ulnar nerve dissected	2×1×1	*	*	*
16	TE	6×4×2	0	7	None
17	TE, musculocutaneous nerve dissected	7×3×2	1	6	None

TE: total excision; *: patient excluded from the study (see the text)

biopsy before excision would cause such a hazard. An additional aim was to determine whether the total excision after making a definitive diagnosis according to microsurgery principles instead of performing an excisional biopsy to a preliminary-diagnosed lesion has a positive effect on clinical results, especially neurological complications. No complication was observed in any patient due to the tru-cut biopsy. The results were excellent after the total excision, and complications were low.

Levi et al.[5] compared direct excision and post-biopsy (open biopsy or needle biopsy) excision in symptomatic BPNSTs and found that the risk of complications increased 2.7 times in the patients who underwent biopsy before excision. They reported that these complications could be due to bleeding of the tumour or damage to its fascicles during the biopsy procedure.[5] In this study, all patients underwent a single biopsy (tru-cut biopsy), and no complications occurred. A control group could not be created because of the tumour's rarity. In patients with post-excision pain, it is difficult to understand whether the pain is due to the tru-cut biopsy. A decrease but no loss of pain was reported after excisional biopsy.[6]

Schwannomas are manageable tumours with rare mortality, and the only valid, current treatment is surgery. Results after excision are quite good.[6] The prognosis of the untreated patient group is unknown. Therefore, surgical treatment or follow-up decision is difficult. In this study, one patient was followed up because she did not accept the operation.

The main goal of treatment in schwannoma is the excision of the tumour by preserving neurological functions. For this reason, excision is performed by microsurgical methods. In some cases, it may even be necessary to completely sacrifice the nerve for a total tumour removal.[7] In such cases, performing subtotal excisions to protect the nerve frequently results in recurrences.[8] In cases where the nerve is protected and excision is performed with microsurgical methods, there are risks of increasing the existing pain, sensory deficits, or developing new neurological deficits.[9] In the current study, the nerve had to be sacrificed in one patient, and one case had neurological symptoms after excision. Furthermore, pain decreased but did not completely disappear in some patients.

Schwannomas are often seen in the middle-aged population, there is no sex preference, and they have a slow growth.[9] In this study, the mean age was 49 years, and no

significant sex difference was observed. Schwannomas often present with pain, mass, neurological findings, or combinations of these.[3,5] Pain and/or swelling were the most common symptoms, and some cases were accompanied by neurological findings. Generally, it was seen that patients presented with long-standing and recently increasing complaints.

Benign peripheral nerve sheath tumours are generally seen sporadically. Some cases are associated with the autosomal dominant syndrome neurofibromatosis type 1.[10] In this study, patients associated with neurofibromatosis type 1 were excluded.

This study had some limitations. Firstly, the number of cases was rather limited due to the very low incidence of this tumour. For the same reason, a control group could not be created, and no comparison could be made. Besides, the primary purpose of this study was to monitor complications rather than relapse. Hence, the minimum follow-up period was determined as 6 months. One-year follow-up was considered as the minimum duration for relapse monitoring, and four patients could not complete the one-year follow-up.

CONCLUSIONS

A tru-cut biopsy before excision is a feasible and reliable option in schwannomas located in the extremities. The results of ascertaining the diagnosis as schwannoma preoperatively and excision with microsurgery methods are quite good.

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Влияет ли биопсия перед эксцизией на клинические результаты у пациентов со шванномой? Одноцентровое проспективное обсервационное исследование

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Резюме

Введение: Целью данного исследования было выяснить, влияет ли предэксцизионная трукат-биопсия на клинический исход у пациентов с диагнозом шванномы конечностей.

Материалы и методы: Трукат-биопсию выполняли перед эксцизией у пациентов, у которых при клинических и рентгенологических обследованиях были выявлены шванномы конечностей. Всем больным была выполнена тотальная эксцизия микрохирургическими методами. Были проанализированы демографические данные, осложнения после трукат-биопсии, методы лечения и клинические результаты.

Результаты: Были проанализированы данные 17 пациентов (9 мужчин и 8 женщин). Средний возраст составил 49.8 лет. Осложнений, связанных с трукат-биопсией, не наблюдалось. Средние предоперационные и послеоперационные результаты по шкале VAS составили от 4.3 до 0.4 соответственно. У одного пациента развились послеоперационные неврологические осложнения. Ни у одного из пациентов не наблюдалось рецидива.

Заключение: При шванномах конечностей трукат-биопсия является применимым и надёжным вариантом. Дооперационный диагноз подтверждён как шваннома, результаты эксцизии микрохирургическими методами в большей степени удовлетворительны.

Ключевые слова

эксцизия, осложнение, шваннома, исходы, трукат-биопсия