Neurologic Outcomes of Benign Peripheral Nerve Sheath Tumors in the Upper Extremity

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INTRODUCTION: While relatively rare overall, benign peripheral nerve sheath tumors (BPNST) are a common type of upper extremity tumor. These tumors may be subcategorized into schwannomas or neurofibromas. Affected patients may present with physical examination findings such as sensory deficits or positive Tinel's, bothersome local mass effect, or aesthetic complaints. The standard of care in the treatment of BPNSTs involves marginal excision of the lesion however, neurologic outcomes of patients are poorly defined. Our study sought to characterize the nerve distribution, symptomatology, and outcomes of patients with BPNSTs that underwent resection.

METHODS:

Authors performed retrospective review of an institutional pathology database with biopsy-confirmed BPNST (January 1, 2017 to January 1, 2022). Data collected included patient demographics, presenting symptomatology, tumor location, pre- and post-operative physical exam findings, treating specialty, and dimensions of the excised lesion. Operative reports were reviewed to identify the nerve involved. Patients were excluded for incomplete documentation, loss to follow-up, and diagnosis other than schwannoma or neurofibroma. Descriptive statistics were used to analyze the data.

RESULTS:

In total, 33 patients with 38 distinct BPNST lesions met inclusion criteria. Of these lesions, 28 were schwannomas and eight were neurofibromas. Two BPNST could not be further classified and carried the diagnosis of nerve sheath tumor. Nerve involvement in the hand and upper extremity included the median, ulnar, radial, posterior interosseous, superficial radial, and minor cutaneous nerves. Schwannomas were dominant in all nerves, however the highest proportion of neurofibromas within a nerve was most observed in the ulnar nerve (33%).

Pre-operatively, pain was the most prevalent symptom, reported by 67% of patients among both the neurofibroma and schwannoma groups. A minority of patients with schwannomas reported motor deficits (n=27, 18.5%) and sensory deficits (n=26, 23%). These deficits were not observed among patients with neurofibroma (n=6, 0% & n=3, 0%). While pain symptoms were improved post-operatively, both neurofibroma and schwannoma patients experienced increases in subjective numbness and tingling. Of note, 67.9% of schwannoma patients reported pain pre-operatively while only 4.2% of the same patients reported pain post-operatively.

DISCUSSION AND CONCLUSION:

BPNSTs are relatively rare and thus detail characterization of these tumors are poorly understood in the current literature. The primary aim of this paper was to elucidate the pre-operative symptoms and physical exam findings of schwannomas and neurofibromas. Secondarily we sought to describe operative outcomes based on nerve involvement. Both aims were developed to better guide diagnosis, treatment, and patient education of these benign masses.

The average age of our patients was 53 years; female patients represented 58.8% of our sample. Schwannomas were the predominant diagnosis accounting for 73.7% of all biopsies which is contrary to what is reported in the current literature.2, 3 When evaluating for pre-operative symptoms of numbness, tingling, and pain, schwannomas were consistently more symptomatic than neurofibromas. On physical examination, schwannomas again demonstrated higher incidences of motor and sensory deficits. Those with schwannomas presenting with pain saw the greatest proportional reduction post-operatively from 67.9% to 4.2% reporting these symptoms. Our data suggests that surgical treatment of schwannomas may improve pain.

We found that of the major named nerves, the ulnar nerve was most commonly involved (39.1%). Other studies have corroborated the high incidence of ulnar nerve involvement.4 This may be secondary to the anatomy of the ulnar nerve which is subject to compressive neuropathies at many points along its' course. Given that proportion of motor deficits for ulnar nerve were sustained pre- and post-operatively patients should be commensurately counseled when considering operative intervention.

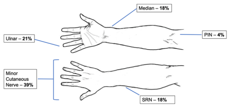

Figure 1. Distribution of **schwannomas** by upper extremity nerves

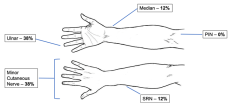

Figure 2. Distribution of **neurofibromas** by upper extremity nerves

Demographics	**Patients**
Sex	
Female	20
Male	14
Average Age	53
Race	
Asian	4
Black	3
Hispanic	2
Unknown	6
White	19

Table 1. Patient demographics

	Numbness		**Tingling**		**Pain**	
BPNST Subtype	Pre-op	Post-op	Pre-op	Post-op	Preop	Post-op
Neurofibroma	0/5 (0%)	5/8 (62.5%)	0/2 (0%)	2/5 (40%)	4/6 (80%)	1/7 (14.2%)
Schwannoma	5/26 (19.2%)	8/25 (32%)	2/22 (9.1%)	4/24 (16.7%)	19/28 (67.9%)	1/24 (5%)

Table 3. Symptomatology pre- and post-operatively by BPNST subtype

	Motor Deficit		**Sensory Deficit**		**Positive Tinels'**	
BPNST Subtype	Pre-op	Post-op	Pre-op	Post-op	Preop	Post-op
Neurofibroma	0/6 (0%)	2/7 (28.6%)	0/3 (0%)	6/8 (40%)	2/3 (66.7%)	0/3 (0%)
Schwannoma	5/27 (18.5%)	8/25 (32%)	6/26 (23.1%)	4/24 (16.7%)	10/17 (58.8%)	1/3 (33%)

Table 4. Physical exam findings pre- and post-operatively by BPNST subtype