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Research Article

Schwannoma of the Upper Extremity: A Clinical Series

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Abstract

Background: Schwannoma, the most common primary neural tumor of the upper extremity, arises from Schwann cells of the nerve sheet. The tumor is usually painless and slow-growing. Symptomatic masses could be treated through intra- or extra-capsular excision. Herein, we aim to evaluate the long-term results of surgical treatment of 12 cases of upper extremity Schwannoma.
Methods: Twelve cases of confirmed Schwannoma who were treated in Imam Khomeini University Hospital, Tehran, Iran, from 2011 to 2022, were included in our case series. All operations were done using loupe magnification or under a microscope. Age, sex, location of the mass, size of the tumor, affected nerve, histological diagnosis, and clinical follow-up, including the neurological status of the patients, were documented.
Results: Twelve patients with a mean age of 44 years were included. Seven (58.3%) were men and five (41.66%) were women. The mean follow-up period was 45 months (range: 6-135). The hand was the most common location of involvement and the digital nerve was the most frequent origin of Schwannoma. Postoperative evaluation showed no tumor recurrence and pain resolved in all twelve patients (100%). Sensory dysfunction resolved completely in 5 out of 8 patients who reported sensory impairment preoperatively (62.5%) and no motor function improvement was seen in the patient with motor deficit.
Conclusion: Adequate operative techniques can lead to complete tumor removal without neurological loss or recurrence. Neural function improvement in most cases is achieved. New neurologic impairment after excision of Schwannoma is rare.

Keywords: Soft Tissue Neoplasms; Neurilemmoma; Schwann Cells; Upper Extremity

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Background

Upper extremity primary neural neoplasms account for less than 5% of soft tissue tumors of the upper limb (1). Schwannoma, the most common primary neural tumor of the upper extremity, arises from the Schwann cells of the nerve sheet (1-3). While there is no superiority among different gender and race groups in the occurrence of Schwannoma, it occurs more in the age group of 30-60 years (4, 5). As a painless and slow-growing tumor, Schwannoma can be asymptomatic for several years (1, 6). However, the compression effect of the tumor on the nerve causes symptoms such as pain, paresthesia, and motor deficits (4, 7).

Treatment is indicated in symptomatic patients and patients who suffer from cosmetic issues. The tumor is treated through intra- or extra-capsular excision (5, 8). In some circumstances, the excision could cause nerve damage (5, 9).

The purpose of the present study is to evaluate the long-term results of surgical treatment of upper limb Schwannoma.

Methods

Twelve cases of upper limb Schwannoma with histopathologic confirmation were included. These patients were treated at Imam Khomeini University Hospital, Tehran, Iran, from 2011 to 2022, and were available for clinical follow-up. Data included age, sex, location of the mass, size of the tumor, affected nerve, histological diagnosis, and clinical follow-up.

All operations were done using the loupe magnification or under the guidance of a microscope. The epineurium covering the tumor was opened through a longitudinal incision. After incising the tumor capsule, we isolated nerve fibers and then resected the mass. The neurological status of patients, including pain, paresthesia, and weakness, was examined at the latest clinical follow-up.

All participants provided written informed consent prior to participating. Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

Results

Twelve patients with a mean age of 44 years (range: 24-66) were included. Seven (58.3%) were men and five (41.66%) were women. The mean follow-up period was 45 months (range: 6-135). The size of resected tumors was between $1 \times 0.5 \times 0.5$ cm^3 and $4 \times 3 \times 3$ cm^3. The hand was the most common location of involvement. In five out of twelve patients, the tumor was located in the palm, and in four patients in the phalanx. The wrist and forearm also were affected in two patients and one patient, respectively (Figure 1).

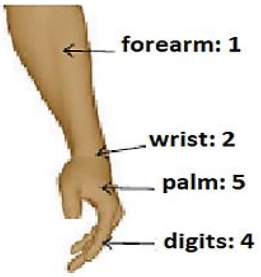

Figure 1. Number of patients based on region of involvement

Digital nerve was the most frequent origin of Schwannoma, which was observed in eight patients. In addition, the tumor arose from the median nerve in four participants (Table 1).

Table 1. Patients' characteristics

No.	Age (year)	Gender	Size of the tumor (cm^3)	Location	Nerve	Follow-up period (month)
1	66	Men	2.5 × 2 × 1.5	Forearm	Median	6
2	50	Women	1.5 × 0.7 × 0.7	Hand	Digital	6
3	31	Men	2.4 × 0.8 × 1	Phalanx	Digital	11
4	48	Men	3 × 2 × 2.5	Hand	Digital	11
5	39	Women	1.2 × 0.6 × 0.4	Phalanx	Digital	12
6	27	Women	5 × 3.5 × 1.5	Wrist	Median	21
7	36	Women	2.5 × 2 × 1	Hand	Median	52
8	66	Women	4 × 3 × 3	Hand	Digital	48
9	25	Men	1.8 × 1 × 0.5	Phalanx	Digital	60
10	24	Men	1 × 0.5 × 0.5	Phalanx	Digital	72
11	61	Men	2 × 2 × 1.5	Hand	Digital	96
12	55	Men	2 × 1 × 0.5	Wrist	Median	135

Preoperative examination indicated the presence of paresthesia in 11 out of 12 patients (91.6%). Pain was present in 9 patients (75%), while superficial sensory deficit was observed in 8 (66.6%) and impairment of motor function in only one (8.3%).

Postoperative examination showed no tumor recurrence in the follow-up period. Pain resolved in all twelve patients (100%). Sensory dysfunction resolved completely in 5 out of 8 patients (62.5%) and partially in the remaining patients with preoperative sensory impairment. No motor function improvement was seen in the patient with motor deficit.

Discussion

In the present study, Schwannoma was predominantly located in the hand (9 out of 12 excised tumors). Moreover, the most common site of tumor origin was the digital nerve (5 out of 12 tumors). These results are in agreement with the results of previous studies (10, 11). We found that the median nerve was the major nerve affected by the tumor (in 4 out of 12 cases). Data analysis from 72 cases with upper extremity Schwannoma by Siqueira et al. showed that the tumor was located in the ulnar nerve in 12 cases, in the median nerve in 12 cases, and in the radial nerve in 3 cases (12). However, some studies have indicated other major nerves as the most frequently involved ones. Date et al. reported that the ulnar nerve was the most affected nerve by Schwannoma, followed by the median and the radial nerves, respectively (13). The most common origin of the upper limb Schwannoma was ulnar nerve according to Adani et al. study. The ulnar nerve was affected by the tumor in 14 out of 24 patients; in four patients median nerve, in three patients musculocutaneous nerve, and in three remaining patients digital nerves were the origin of the Schwannoma (14).

The most common postoperative complication is paresthesia (15). Motor and sensory branches must be preserved during surgery and unnecessary sacrifice of functional nerves must be avoided. Different factors may cause neurologic deficits after excision of Schwannoma (16, 17). First of all, damage to fascicles during the incision of the epineurium should be considered (17). Irritation or compression of intact fascicles may also result in neurological deficits during the dissection of the tumor. Park et al. found that transection of fascicles entering the tumor might cause postoperative neurological impairment (16). The incidence of neurological dysfunction after resection of Schwannoma varies between 1.5 and 80 percent (4, 14, 16-18).

Complications are more common in short-term follow-up. Adani et al. evaluated 24 patients with upper extremity Schwannoma. Early postoperative report showed that the paresthesia worsened in 23 patients. However, all the patients experienced no paresthesia after 12 months (14). As we know, the Schwannoma is an eccentric and non-infiltrating tumor; therefore, it can be excised with no damage to the nerve structures (7, 14, 19). In our series, all excisions were done without damage to fascicular structures. Sensory impairment improved in all patients post-operatively (completely in 5 cases and partially in 3 cases). We documented two out of twelve patients developed new neurological impairment in early post-operative period which were resolved in our follow-up visits. During our last neurological evaluation, we found no new sensory or motor deficit. The postoperative sensory deficit rate was 15.2% in Siqueira et al.'s study (11 out of 72 patients) (12). Most of the neurological dysfunction was transient. Only three patients showed permanent sensory impairment and one showed permanent motor dysfunction (12).

Kim et al. evaluated 30 patients with lower extremity Schwannoma. They reported that the early post-operative complication rate was 76.7%. They also found major neurological deficits persisted in only two cases (18). Similarly, Kang et al. reported permanent sensory deficit in 1 out of 20 patients (4). Our observations also indicated that improvement in nerve function occurred in most cases, and persistent postoperative neurological deficits were rare. Consequently, surgical removal of peripheral nerve Schwannoma requires microsurgical experience and knowledge of the tumor anatomy. Iatrogenic nerve damage may occur due to the lack of adequate knowledge and experience.

Conclusion

Schwannoma, the most common primary neural tumor of the hand, can be resected with minimal damage. The use of adequate operative techniques can lead to complete tumor removal without neurological loss or recurrence. Early post-operative peripheral nerve dysfunction is temporary in the majority of cases and in most cases, neural function improvement is achieved. New persistent postoperative neurologic impairment after excision of Schwannoma is rare.

Conflict of Interest

The authors declare no conflict of interest in this study.

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participate in this study and publish these results.

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