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ORIGINAL

Neuromonitoring guided excision of posterior interosseous nerve schwannoma: review of literature and technical nuances

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Background: Schwannoma, also called neurilemoma, originates from Schwann cells. Approximately 19% of all solitary schwannomas occur in the upper limb, but schwannomas of the posterior interosseous nerve are quite rare, with only 3–4 cases having been reported to date.

Objective: To signify the use of neuromonitoring in peripheral nerve surgery, like the excision of tumor mass.

Method and material: A 40-year-old male presented with a swelling over the left forearm for 2 years, with complaints of localized pain and tingling sensation over the index and middle fingers while pressing over the swelling, and with no motor deficit. The tumor was excised under general anesthesia using magnification and microsurgical techniques under constant neuromonitoring.

Results: The use of magnification and microsurgical techniques with technical nuances, such as neuromonitoring, makes it more convenient and prevents underlying nerve damage.

Keywords: peripheral nerve tumour, posterior interosseous nerve schwannoma, excision, neuromonitoring, microsurgical technique
Key message: excision of peripheral nerve tumor under constant neuromonitoring.

Introduction

Peripheral nerve tumors are growths on nerves located outside the brain and spinal cord, which can be benign (non-cancerous) or malignant (cancerous). Benign types include schwannomas, in which peripheral nerve schwannomas are rare, with an annual incidence of about 0.6 per 100,000 people. Schwannomas are solitary and encapsulated tumors attached to or surrounded by nerves, and paralysis of the associated nerve is unusual, with the vagus nerve being the most commonly affected. They are the most common type of peripheral nerve tumor but are still infrequent, accounting for less than 5% of all soft tissue tumors. Due to its rarity, it is often misdiagnosed as a ganglion cyst, lipoma, myxoma, or vascular malformation. The following is a case report of a 40-year-old male who presented with left forearm swelling on the posterior/extensor side diagnosed to be POSTERIOR INTEROSSEOUS NERVE SCHWANNOMA, which is extremely rare, and to date only 3–4 cases (1–4) have been reported in literature.

Case report

A 40-year-old male presented with swelling over the extensor aspect of his left forearm since 2023. It had an insidious onset, was gradually progressive, and was initially painless but

now has occasional pain over the swelling. It was associated with a tingling sensation over the index and middle finger dorsal sides while pressing on the swelling, and Tinel's sign was positive. The patient did not experience any motor deficits. Examination revealed a single, non-tender, slightly mobile, firm, and smooth-surfaced swelling on the dorsal side, slightly lateral in position over the proximal part of the left forearm.

Pt is a known case of diabetes mellitus and hypertension, well maintained on medication.

Magnetic resonance imaging (MRI) suggested a well-defined soft tissue mass lesion of 4.1 × 1.8 × 2 cm most likely along the course of the posterior interosseous nerve (PIN) branch of the radial nerve, appearing hypointense on T1WI and heterogeneously hyperintense on T2W/short tau inversion recovery (STIR) images. Split-fat sign at either end

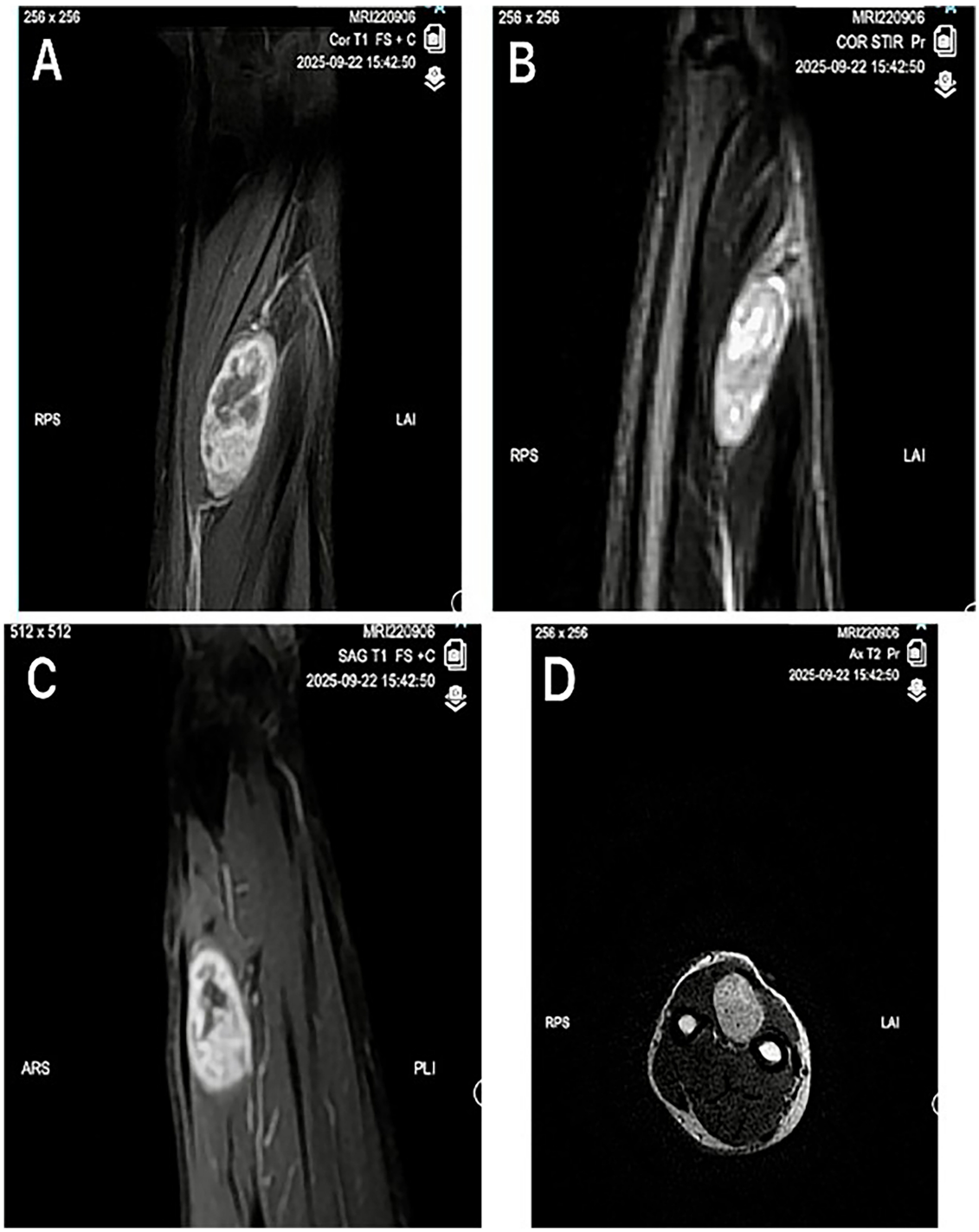

FIGURE 1 | Coronal **(A, B)**, sagittal **(C)**, and axial **(D)** section suggestive of soft tissue lesion along the PIN course, heterogeneously hyperintense with split fat sign.

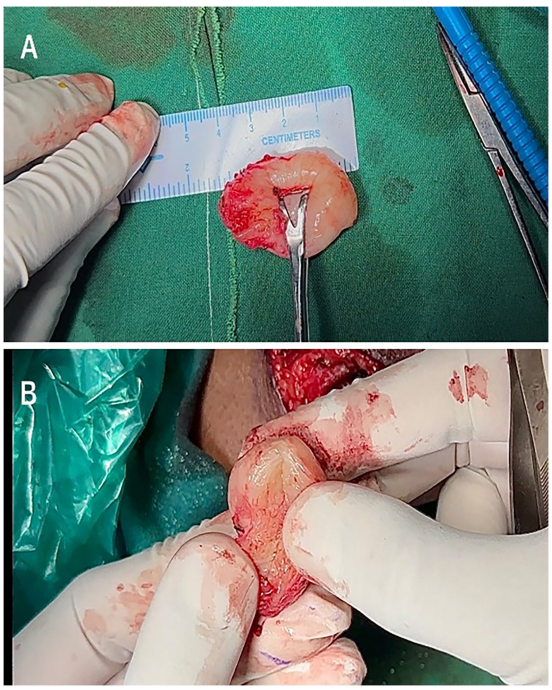

FIGURE 2 | Excised tumor mass **(A)** of size approx. 4 × 2 cm and Cut section of tumor **(B)** showing encapsulated mass.

seen in the posterior aspect of the lower forearm. The finding was suggestive of a peripheral nerve sheath tumor (**Figure 1**).

The patient was planned for surgery under general anaesthesia (GA). Surgery was performed at the Department of Neurosurgery, Jagjivan Ram Railway Hospital, Mumbai, Maharashtra, India. Informed consent was obtained for surgery, photography, and publication of photographs.

Surgery was performed under general anesthesia with neuromonitoring. A curvilinear incision was made over the swelling, and the fascia was incised over the muscle. The muscle was retracted, and the tumor and nerve were exposed; the tumor was found to arise from the PIN. The tumor was encapsulated, and gentle dissection was initiated between the tumor capsule and nerve plane under constant neuromonitoring. The tumor was completely removed without damaging the nerve fascicles (**Figures 2** and **3**). Hemostasis achieved. Procedure was uneventful. Neuromonitoring was performed for the left extensor digitorum communis, extensor indicis, abductor pollicis brevis, abductor digiti minimi, and brachioradialis. Direct triggered electromyography (EMG) was performed to identify the nerve with values triggered at 1 mA escalating to 3 mA. After identification of the nerve, dissection was performed with continuous free-run EMG, which was normal until the complete removal of the tumor. Final EMG recordings were normal (**Figure 4**).

After a month of operation, the patient had complete resolution of localized pain or tingling sensations over the index and middle fingers.

Histopathological examination of the excised tumor showed an encapsulated neoplasm composed of cytologically bland spindle cells arranged in short fascicles, containing more densely cellular areas with nuclear palisading (Antoni A) alternating with paucicellular areas (Antoni B). Verruca bodies noted. Focal areas of hemorrhage and myxoid degeneration were noted. (**Figure 5**).

The patient was followed up for more than 6 months, and there were no signs or symptoms of recurrence.

Discussion

Schwannomas are the most common type of peripheral nerve sheath tumor, and approximately 19% of all solitary schwannomas occur in the upper limb, making it the most common anatomical location after the head, neck, and trunk (10). However, they commonly occur on the flexor (anterior) surface due to the higher concentration of nerve fibers in these areas and are commonly seen near the elbow (5). It mainly affects the ulnar nerve. PIN schwannomas are rare, with only 3–4 cases having been reported to date.

Schwannomas are solitary encapsulated tumors attached to or surrounded by nerves, and paralysis of the associated nerve is unusual; thus, PIN palsy is unusual and quite rare (1–4). They are very slow-growing tumors and have no to minimal symptoms initially; when the size increases, symptoms become apparent (3). Therefore, the presentation of the patient to the hospital was delayed. In our case, the patient presented to us when he experienced localized pain and tingling sensation on pressing over the swelling and had ignored the swelling for more than 2 years. In the case reported by Sharma et al., the lesion came into attention when the patient developed an extension deficit of the fourth and fifth fingers and swelling for approximately 1 year (1). In the case reported by Ichiwaka et al., the lesion was noticed when the patient experienced impairment of extension of the metacarpophalangeal joint (2). In another case reported by Tardos et al., the lesion was noticed earlier when the patient was under treatment for an unrelated condition (3).

PIN is a purely motor nerve, and symptoms vary from mild to severe weakness in thumb and finger extension. Wrist extension is spared as the extensor carpi radialis longus is supplied by the radial nerve (6). The Tinel sign can be positive and is indicative of varying degrees of axonal discontinuity or disruption. In our case, the patient did not have any motor deficit but had a positive Tinel sign (+ve). The symptoms experienced by the patient completely resolved after 1 month. Sharma's patient fully recovered from all neurological deficits in 6 weeks (1), Ichikawa's patient recovered full range of motion in 6 months (2), and Tardo's patient was closely monitored as there were no significant signs or symptoms (3).

Schwannomas are often misdiagnosed as ganglion cysts, lipomas, neurofibromas, or xanthomatous giant cell tumors (1, 2). MRI is useful for determining the origin site, size,

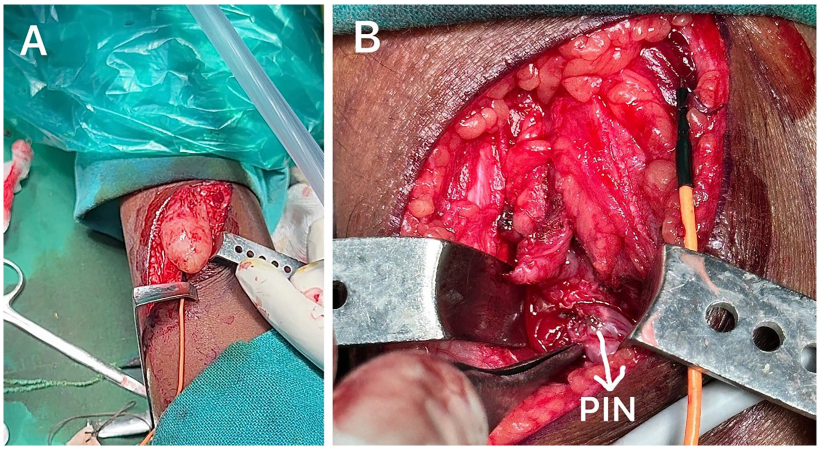

FIGURE 3 | Intraoperative picture **(A)** Tumor mass after retracting the muscle and **(B)** showing preserved PIN nerve and neuromonitoring electrode (orange wire) placed in the extensor muscle.

FIGURE 4 | Image of Neuromonitoring electrode placement before surgery and final EMG recording.

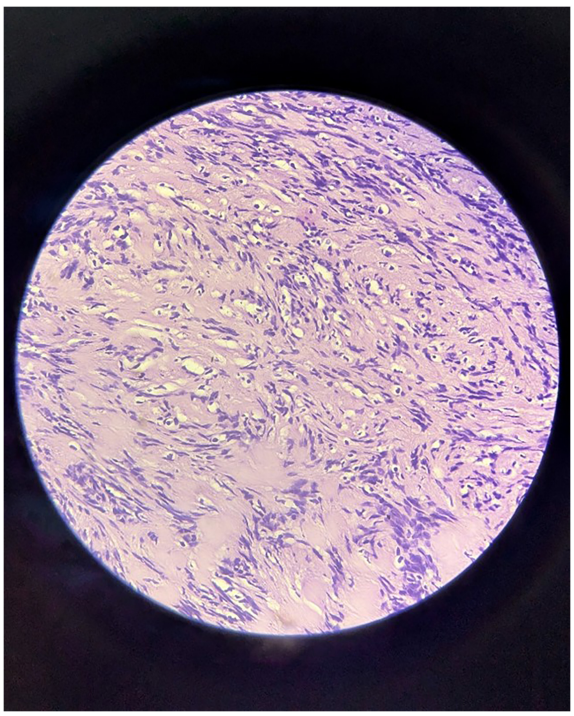

FIGURE 5 | Histological image showing spindle cells arranged in short fascicles containing more densely cellular areas with nuclear palisading (Antoni A) alternating with paucicellular areas (Antoni B) and Verrucay bodies noted.

tumor relation to adjacent structures, and visualization of the nerve entering or exiting the tumor (it helps to differentiate from soft tissue tumors). However, MRI is inconclusive in differentiating schwannoma from neurofibroma, and the final diagnosis depends on histopathological examination.

Schwannomas do not infiltrate nerve fibers; therefore, complete surgical removal is the treatment of choice (7). Using neuromonitoring (recent advances) made this procedure more convenient and safer, allowing for easy tumor removal with low risk of damaging the underlying nerves (8, 9). In this case, the tumor mass was excised with the capsule from the PIN under constant neuromonitoring (9).

Conclusion

Schwannoma of PIN is a rare condition. To date, only 3–4 cases (1–4) have been reported. A large schwannoma requires meticulous attention to detail, as there is risk of fascicular injury. The use of magnification and microsurgical technique with neuromonitoring makes it more convenient and prevents damage to the underlying nerve (8, 9). We wrote this article to draw clinicians' attention to this rare case.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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