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Giant Long-Standing Median Nerve Schwannoma Requiring Segmental Resection and Immediate Microsurgical Reconstruction Using a Reversed Autologous Sural Nerve Graft: A Case Report

Running Title: *Median Nerve Schwannoma Reconstructed with Sural Nerve Graft*

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Abstract: ***Introduction and importance**: Schwannomas are benign encapsulated peripheral nerve sheath tumours originating from Schwann cells and represent the most common benign neoplasms of peripheral nerves. Median nerve schwannomas are uncommon and usually present as slowly enlarging painless masses. Their eccentric growth generally permits nerve-preserving intracapsular enucleation; however, giant long-standing lesions may produce extensive distortion of the parent nerve, making preservation of functional fascicles impossible. In such circumstances, segmental nerve resection followed by immediate microsurgical reconstruction may be required to restore nerve continuity and function.[1–4] **Case presentation**: A 60-year-old right-hand-dominant woman presented with a gradually enlarging swelling over the volar aspect of the right distal forearm that had been present for approximately 30 years. During the preceding few months, she developed intermittent pain and paraesthesia in the median nerve distribution without motor weakness or impairment of grip or pinch strength. Clinical examination revealed a firm, well-defined 6 × 3 cm swelling with restricted transverse mobility and a positive Tinel's sign. Ultrasonography demonstrated a well-defined benign-appearing soft-tissue lesion in continuity with the underlying median nerve, suggestive of a benign peripheral nerve sheath tumour. Owing to financial constraints, magnetic resonance imaging could not be performed. Surgical exploration under an axillary brachial plexus block demonstrated circumferential involvement of the median nerve with complete distortion of the fascicular architecture, precluding safe intracapsular enucleation. Complete tumour excision resulted in a 4-cm nerve defect, which was reconstructed using a single reversed 4.5-cm autologous sural nerve graft. Microsurgical epineural neurorrhaphy was performed under loupe magnification using four interrupted 6-0 polypropylene (Prolene) sutures at each coaptation site. Histopathological examination confirmed a benign schwannoma characterized by Antoni A and Antoni B areas with focal Verocay body formation. At one-year follow-up, the patient demonstrated Medical Research Council Grade 4/5 motor recovery, restoration of protective sensation, satisfactory hand function, and no evidence of tumour recurrence. **Clinical discussion**: Although most median nerve schwannomas can be treated successfully by intracapsular enucleation, giant long-standing tumours may completely disrupt normal fascicular anatomy. In these uncommon situations, complete excision followed by immediate autologous nerve grafting provides a biologically favourable conduit for axonal regeneration and can achieve meaningful neurological recovery.[3–7] **Conclusion**: Long-standing median nerve schwannomas requiring segmental nerve excision are rare. When preservation of the parent nerve is not technically feasible, immediate microsurgical reconstruction using a reversed autologous sural nerve graft represents a reliable reconstructive option capable of restoring useful neurological function while maintaining excellent local disease control.*

Keywords: Schwannoma, Median Nerve Sural Nerve Nerve Grafting Microsurgery Peripheral Nerve Injuries

1. Introduction

Schwannomas, also known as neurilemmomas, are benign, encapsulated neoplasms arising from Schwann cells of the peripheral nerve sheath. They constitute the most common benign tumours of peripheral nerves and account for approximately 5% of all benign soft-tissue tumours. Owing to their slow growth and eccentric relationship to the parent nerve, schwannomas typically displace adjacent fascicles rather than infiltrating them, allowing preservation of neurological function even after prolonged periods of growth.[1–4]

Although schwannomas may occur along any myelinated peripheral, cranial, or autonomic nerve, involvement of the median nerve is uncommon. Patients usually present with a slowly enlarging painless swelling that may remain asymptomatic for several years before developing pain, paraesthesia, or compressive neurological symptoms. Because of their indolent clinical course, these lesions are frequently mistaken for ganglion cysts, lipomas, giant-cell tumours of the tendon sheath, or other benign soft-tissue masses, often resulting in delayed diagnosis.[2,4,8]

Magnetic resonance imaging (MRI) is regarded as the imaging modality of choice for evaluating peripheral nerve sheath tumours because it accurately delineates tumour morphology and its relationship to the parent nerve. However, MRI may not be available in resource-limited settings because of financial or logistical constraints. In such situations, careful clinical examination supplemented by ultrasonography can provide valuable diagnostic information, while definitive diagnosis ultimately depends on histopathological examination.[4,9-11]

Complete surgical excision remains the treatment of choice for symptomatic schwannomas. In most cases, meticulous intracapsular enucleation permits preservation of the parent nerve because the tumour originates from a single fascicle and grows eccentrically. Nevertheless, giant long-standing lesions may produce marked distortion of the normal fascicular architecture, rendering nerve-preserving excision technically impossible. When complete tumour excision

necessitates segmental nerve resection, immediate tension-free reconstruction using an autologous nerve graft remains the accepted standard for restoration of nerve continuity.[3],[12-15]

Reports describing giant median nerve schwannomas requiring immediate microsurgical reconstruction are exceedingly uncommon. We report a 60-year-old woman with a 30-year history of a giant median nerve schwannoma managed by complete tumour excision followed by reconstruction with a single reversed autologous sural nerve graft. This case highlights the importance of individualized intraoperative decision-making, meticulous microsurgical technique, and timely nerve reconstruction in achieving favourable functional recovery.

2. Case Presentation

A 60-year-old right-hand-dominant woman presented to the Department of General Surgery, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, India, with a progressively enlarging swelling over the volar aspect of the right distal forearm extending to the wrist. The swelling had initially been noticed approximately 30 years earlier as a small painless nodule and had gradually increased in size over the ensuing decades. Because the lesion remained largely asymptomatic, the patient did not seek medical attention during this period.

Over the preceding few months, she developed intermittent pain associated with paraesthesia in the median nerve distribution. There was no history of preceding trauma, rapid increase in tumour size, constitutional symptoms, or nocturnal pain. She denied weakness of grip, difficulty performing fine motor tasks, or loss of hand dexterity. There was no personal or family history suggestive of neurofibromatosis or other hereditary peripheral nerve tumour syndromes.

On examination, a solitary, firm, well-circumscribed, non-tender swelling measuring approximately **6 × 3 cm** was present over the volar aspect of the distal forearm along the anatomical course of the median nerve (Figure 1A). The swelling demonstrated restricted mobility perpendicular to the long axis of the forearm with minimal longitudinal mobility, a characteristic finding of peripheral nerve sheath tumours. Percussion over the lesion elicited a positive **Tinel's sign**, producing paraesthesia in the radial three-and-a-half digits. Sensory examination was otherwise unremarkable. Thenar muscle bulk was preserved, and thumb opposition, abduction, grip strength, and pinch strength were clinically normal. No intrinsic muscle wasting was evident. Distal vascular examination was normal.

Routine haematological and biochemical investigations were within normal limits.

Ultrasonography of the right distal forearm demonstrated a well-defined, benign-appearing soft-tissue lesion in continuity with the underlying median nerve, favouring a benign peripheral nerve sheath tumour. Owing to the patient's limited socioeconomic circumstances, magnetic resonance imaging could not be performed. Based on the clinical findings and ultrasonographic appearance, a benign peripheral nerve sheath tumour was considered the most likely diagnosis. The differential diagnoses included neurofibroma, intraneural ganglion cyst, giant-cell tumour of the tendon sheath, lipoma, and other benign soft-tissue tumours of the distal forearm.[4,9]

After detailed counselling regarding the possibility of neurological deficits and the potential need for nerve reconstruction, written informed consent was obtained for surgical exploration and excision.

The procedure was performed under an **axillary brachial plexus block** with the patient in the supine position and the affected limb placed on a hand table. Following sterile preparation and application of an upper-arm pneumatic tourniquet, a longitudinal incision was made over the volar aspect of the distal forearm centred on the palpable swelling.

Dissection was carried out under **surgical loupe magnification**. The median nerve was identified both proximal and distal to the lesion before manipulation of the tumour. Intraoperatively, a well-encapsulated fusiform tumour measuring approximately **6 × 3 cm** was found to arise from the median nerve. Unlike the typical eccentric schwannoma, the lesion circumferentially involved the parent nerve, resulting in complete distortion of the normal fascicular architecture. (figure 2 and 2a)

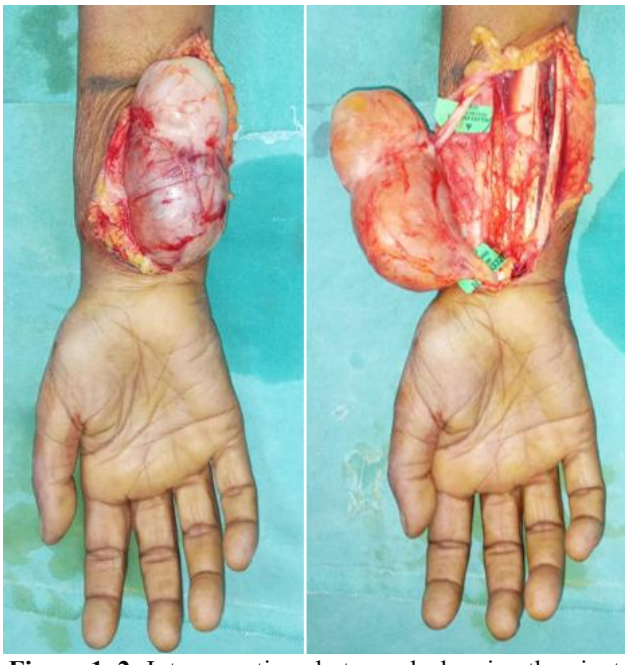

Figure 1, 2: Intraoperative photograph showing the giant median nerve schwannoma with circumferential involvement of the parent nerve and marked distortion of the normal fascicular architecture.

Meticulous microsurgical dissection was undertaken in an attempt to identify a cleavage plane that would permit intracapsular enucleation while preserving functional fascicles. Despite careful dissection, no safe plane could be established because the tumour was inseparable from the surrounding fascicles. Consequently, complete tumour excision required segmental resection of the involved median nerve, leaving an approximately **4-cm nerve defect**.

Reconstruction was performed immediately using a **single reversed 4.5-cm autologous sural nerve graft** harvested from the ipsilateral leg (Figure 3). The graft was reversed before implantation and interposed without tension between the healthy proximal and distal nerve ends. Epineural neurorrhaphy was completed under loupe magnification using **four interrupted 6-0 polypropylene (Prolene) sutures** at each coaptation site(Figure 4). No fibrin glue or nerve conduit was used.

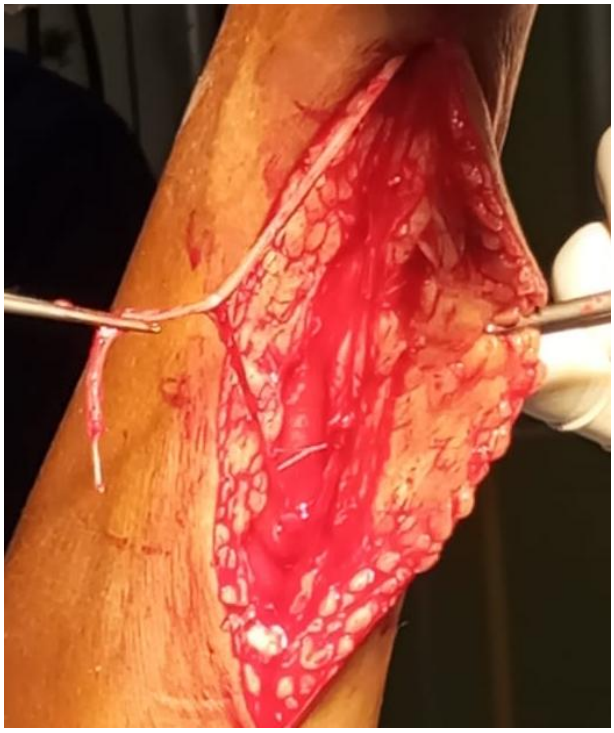

Figure 3: Harvest of the ipsilateral sural nerve through the posterior aspect of the leg for autologous nerve grafting.

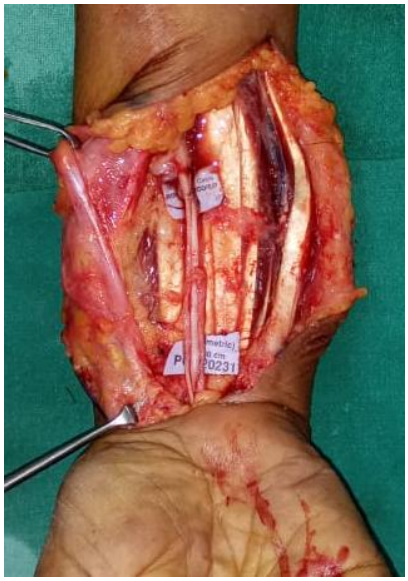

Figure 4: Immediate reconstruction of the 4-cm median nerve defect using a reversed autologous sural nerve graft secured with interrupted 6-0 polypropylene epineural sutures.

The excised specimen was submitted for histopathological examination. Gross examination revealed a well-encapsulated grey-white mass measuring **6 × 3 cm**. Microscopy demonstrated alternating Antoni A and Antoni B areas with focal Verocay body formation, composed of bland spindle cells with elongated nuclei and without necrosis, increased mitotic activity, or significant cytological atypia, confirming the diagnosis of a **benign schwannoma**[5]. (Figure 5)

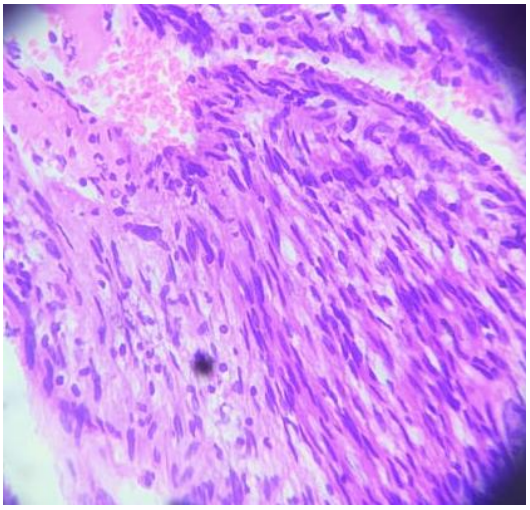

Figure 5: Histopathological examination (hematoxylin and eosin stain) demonstrating Antoni A and Antoni B areas with focal Verocay body formation consistent with benign schwannoma.

The postoperative period was uneventful. The wrist was immobilized in a protective splint for five days, after which supervised physiotherapy, gradual range-of-motion exercises, and sensory re-education were initiated. At the one-year follow-up, both the forearm and donor-site wounds had healed satisfactorily without complications. The patient had regained protective sensation within the median nerve distribution, demonstrated **Medical Research Council Grade 4/5** motor recovery, and retained functional grip and pinch strength sufficient for independent performance of activities of daily living. There was no clinical evidence of local recurrence, and the patient expressed a high level of satisfaction with the functional outcome.

3. Discussion

Peripheral nerve schwannomas are benign, slow-growing neoplasms derived from Schwann cells and represent the most common benign tumours of peripheral nerves. They are usually solitary, encapsulated lesions that arise eccentrically from a single nerve fascicle and displace rather than infiltrate adjacent fascicles. This characteristic anatomical relationship explains why most schwannomas can be excised while preserving the parent nerve and why significant neurological deficits are uncommon despite prolonged tumour growth.[1–5]

Schwannomas of the median nerve are uncommon, accounting for only a small proportion of upper-extremity peripheral nerve tumours. Their clinical presentation is frequently subtle, consisting of a slowly enlarging painless mass that may remain asymptomatic for several years. Neurological symptoms such as pain, paraesthesia, or sensory impairment usually develop only after progressive

enlargement causes compression or displacement of adjacent fascicles. Consequently, diagnosis is often delayed, and these lesions are frequently mistaken for ganglion cysts, lipomas, giant-cell tumours of the tendon sheath, or other benign soft-tissue masses.[2,4,8]

The present case is noteworthy because of its **exceptionally prolonged clinical duration of approximately 30 years** and the requirement for **segmental median nerve resection with immediate microsurgical reconstruction**. Although giant schwannomas have occasionally been described, most reported median nerve schwannomas are treated successfully by intracapsular enucleation with preservation of nerve continuity. Cases requiring nerve sacrifice and immediate graft reconstruction are exceedingly uncommon, making the present report an important contribution to the literature.[2,8]

Imaging and preoperative evaluation

Magnetic resonance imaging is widely regarded as the imaging modality of choice for peripheral nerve sheath tumours because it delineates tumour morphology, its relationship to the parent nerve, and the extent of fascicular involvement.[4,9,10] Nevertheless, MRI may not always be available in resource-constrained settings because of financial or logistical limitations.

In the present case, **ultrasonography** demonstrated a well-defined benign-appearing lesion in continuity with the median nerve, suggesting a benign peripheral nerve sheath tumour. Although ultrasonography cannot reliably distinguish schwannoma from other benign peripheral nerve tumours, it provided sufficient information to support operative planning when interpreted alongside the clinical findings. Definitive diagnosis was ultimately established by histopathological examination. This case reflects the realities of surgical practice in many low- and middle-income countries, where treatment decisions often rely on careful clinical assessment supported by the most accessible imaging modality.

Histopathological correlation

Histopathological examination remains the gold standard for diagnosing schwannoma. Typical microscopic features include encapsulation, alternating Antoni A and Antoni B areas, and Verocay bodies formed by nuclear palisading. The absence of necrosis, significant cytological atypia, increased mitotic activity, or infiltrative growth distinguishes benign schwannoma from malignant peripheral nerve sheath tumour.[5,16]

Although immunohistochemistry was not performed in the present case, the characteristic microscopic findings were sufficient to establish the diagnosis. In cases where the diagnosis is uncertain, diffuse S-100 and SOX10 positivity may provide additional confirmation of Schwann cell differentiation.[16]

Surgical decision-making

Complete surgical excision remains the treatment of choice for symptomatic schwannomas. Whenever technically feasible, intracapsular enucleation should be attempted because preservation of uninvolved fascicles minimizes postoperative neurological deficits.[3,17]

During surgery, meticulous microsurgical dissection under loupe magnification was undertaken with the intention of preserving the parent nerve. However, the tumour circumferentially involved the median nerve and had completely distorted the normal fascicular architecture. No safe dissection plane could be identified despite careful exploration. Under these circumstances, attempting incomplete excision solely to preserve nerve continuity would have risked residual tumour and persistent symptoms. Segmental resection therefore represented the most appropriate surgical option.

Among the published reports summarized in Table 2, nearly all patients underwent nerve-preserving enucleation. In contrast, our patient required segmental median nerve resection because of complete circumferential fascicular involvement, making this report one of the few describing immediate autologous nerve graft reconstruction following schwannoma excision.

Rationale for sural nerve grafting

Peripheral nerve reconstruction should always be performed without tension because excessive tension adversely affects intraneural blood flow, axonal regeneration, and ultimate functional recovery.[12,13] Direct end-to-end repair is preferred whenever possible; however, nerve gaps greater than approximately 2–3 cm generally require interposition grafting to avoid excessive tension.[3,12]

The sural nerve remains the most commonly used donor nerve because it provides adequate length, favourable fascicular architecture, minimal donor-site morbidity, and reliable clinical outcomes.[3,6] In the present case, a **single reversed 4.5-cm sural nerve graft** was selected to bridge a **4-cm median nerve defect** without tension. Reversing the graft is a well-recognized technique that may reduce axonal escape through collateral branches while preserving appropriate fascicular continuity.[3]

Microsurgical epineural neurorrhaphy using interrupted **6-0 polypropylene sutures** provided stable coaptation while minimizing additional manipulation of the nerve ends. No fibrin glue or synthetic conduit was required because a tension-free repair was achieved.

Functional outcome

Meaningful functional recovery following peripheral nerve reconstruction depends on several factors, including patient age, defect length, timing of repair, quality of nerve coaptation, and adherence to postoperative rehabilitation.[3,6] Although the patient was older than the typical population undergoing nerve reconstruction, she achieved **Medical Research Council Grade 4/5 motor recovery**, restoration of protective sensation, preserved grip and pinch function, and excellent functional independence at one-year follow-up. This favourable outcome likely reflects immediate reconstruction, meticulous microsurgical technique, preservation of a tension-free repair, and structured postoperative rehabilitation.

Clinical implications

This case highlights several important clinical lessons. First, peripheral nerve schwannoma should remain an important

differential diagnosis in any patient presenting with a slowly enlarging forearm or wrist mass accompanied by intermittent paraesthesia or a positive Tinel's sign. Second, even in the absence of MRI, careful clinical evaluation supported by ultrasonography may provide sufficient diagnostic confidence to proceed with surgery in resource-limited settings. Finally, surgeons managing giant long-standing schwannomas should be prepared to perform immediate nerve reconstruction when preservation of the parent nerve is not technically feasible. Early reconstruction using an autologous sural nerve graft remains a dependable method for restoring nerve continuity and optimizing neurological recovery.

4. Strengths and limitations

The principal strength of this report is the documentation of a **30-year giant median nerve schwannoma** requiring **segmental excision and immediate reconstruction with a single reversed sural nerve graft**, a combination that is rarely described. Detailed intraoperative photographs, operative findings, and one-year functional follow-up further enhance the educational value of the report.

The principal limitation is the absence of preoperative MRI because of financial constraints and the lack of standardized patient-reported outcome measures such as the QuickDASH questionnaire. Nevertheless, the diagnosis was confirmed histopathologically, and the clinical outcome was documented over one year, providing meaningful evidence of successful functional recovery.

Table 1: Chronological order of events

Timeline	Clinical Event
30 years ago	Small painless swelling noticed
Progressive	Slow enlargement
Recent 6 months	Pain and paraesthesia
USG	Benign lesion communicating with median nerve
Surgery	Excision + sural graft
Histopathology	Schwannoma
12 months	MRC 4/5

Table 2: Summary of the Literature and Comparison with the Present Case

Study	Study Design	Key Findings	Comparison with Present Case
Donner et al., 1994	Case series of benign peripheral nerve sheath tumours	Most schwannomas were successfully excised with preservation or improvement of neurological function.	Our patient required **segmental nerve resection**, which was uncommon in this series.
Kim et al., 2005	Large institutional series	Schwannomas generally arose eccentrically and could usually be removed while preserving nerve continuity.	In contrast, our tumour circumferentially involved the median nerve, preventing nerve preservation.
Adani et al., 2008	Upper-extremity schwannoma series	Microsurgical enucleation produced excellent functional outcomes in most patients.	Enucleation was attempted but was not technically feasible because of complete fascicular distortion.
Padasali et al., 2015	Median nerve schwannoma case report	Median nerve schwannoma successfully treated with excision and preservation of the parent nerve.	Unlike that report, our patient required immediate reconstruction using a reversed sural nerve graft.
Benign tumours affecting the median nerve (2017)	Case series	Schwannoma was the commonest benign median nerve tumour. Most were treated by microsurgical enucleation; only one required division of the involved fascicle.	Our case is more extensive because it required **segmental median nerve resection** and **4-cm nerve reconstruction**.
Present case	Case report	Giant (6 × 3 cm), 30-year median nerve schwannoma requiring segmental excision and immediate reversed sural nerve grafting.	One of the few published cases requiring immediate autologous nerve reconstruction.

5. Conclusion

Median nerve schwannomas are uncommon benign peripheral nerve sheath tumours that often present as slowly enlarging masses with subtle neurological symptoms, resulting in delayed diagnosis. Although most lesions can be managed successfully by intracapsular enucleation with preservation of the parent nerve, giant long-standing schwannomas may cause extensive distortion of the fascicular architecture, making nerve-preserving excision technically impossible.

The present case demonstrates that complete tumour excision followed by immediate microsurgical reconstruction using a **single reversed autologous sural nerve graft** can achieve satisfactory neurological recovery even after segmental median nerve resection. Careful intraoperative assessment, meticulous microsurgical technique, and structured postoperative rehabilitation remain the cornerstones of successful management in such complex cases.

6. Learning Points

- Median nerve schwannoma should be considered in the differential diagnosis of any slowly enlarging forearm or wrist swelling, particularly when associated with intermittent paraesthesia or a positive Tinel's sign.
- In resource-limited settings, ultrasonography combined with careful clinical examination can provide valuable diagnostic information when MRI is unavailable, although histopathological examination remains the gold standard for definitive diagnosis.
- Preservation of the parent nerve should remain the primary objective during schwannoma surgery; however, extensive long-standing lesions may completely distort fascicular anatomy and preclude safe intracapsular enucleation.

- Immediate tension-free reconstruction using an autologous sural nerve graft remains the preferred reconstructive option for segmental median nerve defects when primary repair is not feasible.
- Successful functional recovery depends on meticulous microsurgical technique, accurate epineural coaptation, early rehabilitation, and long-term follow-up.

Key Clinical Message

Although most median nerve schwannomas can be excised while preserving nerve continuity, surgeons should anticipate the possibility of segmental nerve resection in giant long-standing lesions with extensive fascicular involvement. Immediate reconstruction using a reversed autologous sural nerve graft can restore nerve continuity and provide satisfactory functional recovery when meticulous microsurgical principles are followed.

Ethical Approval

According to the institutional policy of Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, formal ethical committee approval was not required for publication of a single anonymized case report. The report has been prepared in accordance with the CARE 2023 reporting guidelines.

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Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions (CRediT)

Prem Shanker: Conceptualization, surgical management, supervision, manuscript review and editing.

Shashank Khandelwal: Literature review, data collection, manuscript preparation, operative documentation, final drafting.

Geetika Anand: Histopathological interpretation, critical revision of the manuscript.

All authors read and approved the final manuscript.

Data Availability

The data supporting the findings of this case report are available from the corresponding author upon reasonable request.

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