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When the Scar Speaks: Multimodality Imaging of a Post-Traumatic Neuroma

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Abstract: ***Post-traumatic neuromas are benign, non-neoplastic lesions that arise from disorganized nerve regeneration following peripheral nerve injury. Although, uncommon, they are an important cause of persistent pain, paresthesia, and functional impairment after trauma, often mimicking other soft tissue lesions and posing a diagnostic challenge. We present the case of a 32-year-old male who developed persistent pain, paresthesia, and extension deformity of the left index and middle fingers following a penetrating glass injury to the left hand that had been managed conservatively. Clinical examination revealed a tender palpable nodule along the course of the median digital nerve with a positive Tinel's sign. High-resolution ultrasonography demonstrated a well-defined hypoechoic lesion in continuity with the affected nerve, showing loss of normal fascicular architecture and no internal vascularity. Magnetic resonance imaging further characterized the lesion as isointense on T1-weighted images and hyperintense on T2-weighted images with minimal post-contrast enhancement, findings highly suggestive of a traumatic neuroma. Electromyography and nerve conduction studies revealed severe left-sided median nerve sensorimotor axonal neuropathy, supporting the diagnosis. Correlation of the patient's clinical history with multimodality imaging findings enabled accurate diagnosis and exclusion of other peripheral nerve sheath tumors. This case highlights the pivotal role of high-resolution ultrasound and magnetic resonance imaging in the evaluation of post-traumatic peripheral nerve lesions. Early recognition of characteristic imaging features is essential for timely diagnosis, appropriate surgical planning, symptom relief, and prevention of long-term functional disability.***

Keywords: Traumatic Neuroma, Peripheral Nerve Injury, Magnetic Resonance Imaging, Nerve Conduction Studies, Tinel's sign

1. Introduction

Post-traumatic neuromas are benign, non-neoplastic lesions that arise as a consequence of disorganized axonal regeneration following partial or complete peripheral nerve injury [1]. Rather than representing true neoplasms, they are reactive proliferations composed of regenerating nerve fibers, Schwann cells, and fibrous connective tissue that develop when normal nerve healing is disrupted [1,2]. These lesions typically manifest within months of injury and are most frequently encountered in the upper extremities, particularly involving the digital nerves of the hand [1].

Patients typically present with localized neuralgic pain, tenderness, paresthesia, hypersensitivity at the site of injury and a painful nodule at the site of injury. Patients may feel burning, stabbing, raw, gnawing, or sickening sensations. These symptoms could lead to psychological distress and a severe decrease in the quality of life.

Based on their pathogenesis, traumatic neuromas are broadly classified into ***spindle neuromas*** and ***terminal neuromas***. Spindle neuromas result from chronic irritation, traction injury, or repetitive microtrauma to an intact nerve, whereas terminal neuromas, also known as stump neuromas, occur following complete nerve transection, such as after amputation or surgical injury [1,3].
Neuromas mostly occur when normal nerve conduction is damaged by injury, inadequate surgical repair, or in some cases, chronic fibro-inflammatory irritation. Failure of orderly axonal regeneration and disruption of neural continuity also contribute to their formation.

Clinically, patients commonly present with localized pain, tenderness, paresthesia, hypersensitivity, or a palpable nodular swelling at the site of injury [3]. Neuropathic symptoms may significantly impair hand function and quality of life. Because these manifestations overlap with those of ganglion cysts, inclusion cysts, schwannomas, neurofibromas, and other soft tissue masses, clinical diagnosis alone may be challenging [3,4].

Imaging plays a pivotal role in the assessment of peripheral nerve injuries and post-traumatic neuromas. High-resolution ultrasonography provides dynamic evaluation of nerve continuity, fascicular architecture, and lesion morphology, while magnetic resonance imaging (MRI) offers superior soft tissue contrast and detailed anatomical characterization [2,5].

Clinical diagnosis may be challenging due to overlap with other soft tissue lesions such as ganglion cysts, inclusion cysts, and benign nerve sheath tumors. Radiological imaging plays a pivotal role in the diagnosis of traumatic neuromas. Diagnosis of traumatic neuromas primarily depends on clinical history and physical examination however, radiologically, high resolution Ultrasound (US) evaluation allows dynamic evaluation of peripheral nerves and identification of nerve continuity, and magnetic resonance imaging (MRI) provides superior soft tissue contrast and lesion characterization.

Table 1: Comparison & contrast of USG and MRI in the traumatic damage to peripheral nerves

	Ultrasonography	Magnetic Resonance Imaging
Contrast Resolution	Good	Excellent
Scan Times	Short	Long
Nerve Assessment	Dynamic	Static
Assessing deeper structures	Limited	Possible
Patient Compliance	Good	Poor
Cost	Lower	Higher
Operator Dependence	High	Less

Early and accurate identification of the lesion is essential for determining prognosis, facilitating surgical planning, and improving functional outcomes.

We present a case of post-traumatic neuroma involving the median digital nerve of the left hand following a penetrating glass injury. This case highlights the complementary role of ultrasonography and MRI in establishing the diagnosis and differentiating traumatic neuroma from other peripheral nerve sheath lesions.

2. Case Report

A 35-year-old male with nil comorbidities, presented with complaints of persistent pain, paresthesia, and extension deformity over the volar aspect of the left forefinger & middle finger since three months. The patient had a history of a penetrating glass injury to the left hand four months prior, which was managed conservatively with suturing. No surgical nerve exploration was performed at that time.

On physical examination, the left forefinger and middle finger were extended and a small, tender, palpable subcutaneous nodule was noted along the course of the median digital nerve of the left index finger. Tinel's sign was positive over the lesion.

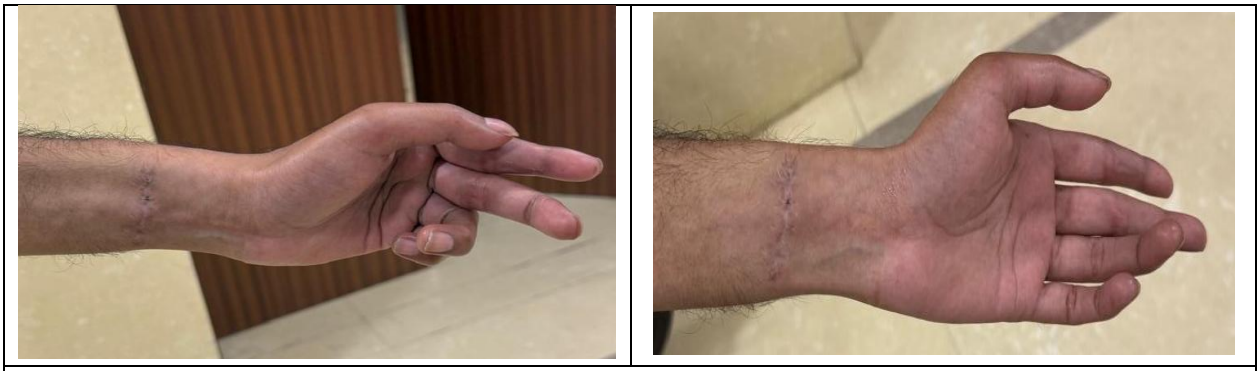

IMAGE 1 (a) and (b): Clinical Image of the patient, constant hyperextension of the forefinger and middle finger with hand deformity and scar site

Ultrasound Examination: High-resolution ultrasound was performed using a high frequency, linear, probe (4-15 Hz). It revealed thickened median nerve along its course in the forearm with a round, well-defined hypoechoic lesion measuring approximately 1.4 x 0.8 cm, which was seen in continuity with the median nerve. The lesion showed loss of normal fascicular architecture. No internal vascularity was detected on color doppler imaging.

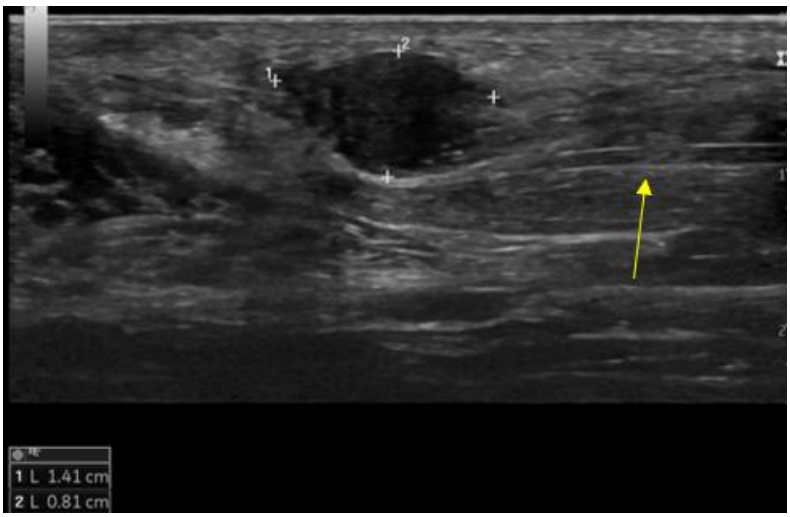

Image 2: Ultrasonography image revealed a well-defined hypoechoic cystic lesion as shown.

Magnetic Resonance Imaging: MRI of the left hand & forearm was performed on a 3.0 Tesla machine. It demonstrated thickened median nerve of the left forearm along with a fusiform dilatation / lesion along its distal aspect. The said lesion was isointense on T1-weighted images and hyperintense on T2-weighted and STIR images, approximately 4.5 cm proximal to the left wrist joint. No muscle atrophy was noted, strongly supporting the diagnosis of a traumatic neuroma.

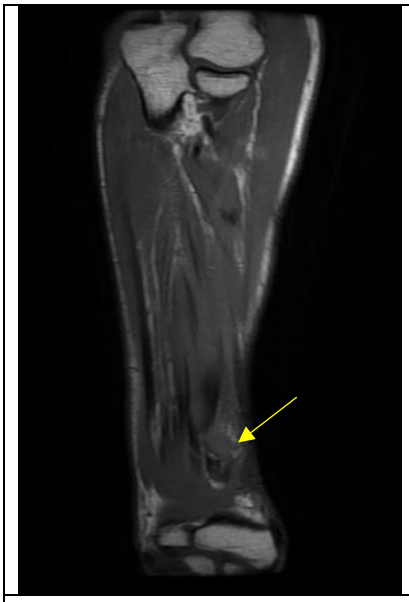

Image 3 (a): 1.5 x 0.7 cm sized fusiform dilatation which is isointense on T1-weighted images.

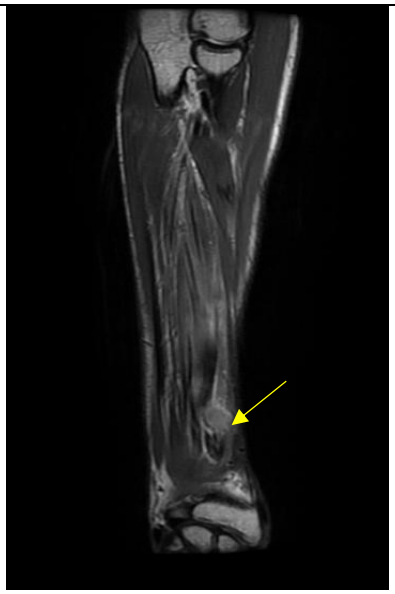

Image 3 (b): Lesion / fusiform dilatation which is hyperintense on T2-weighted images.

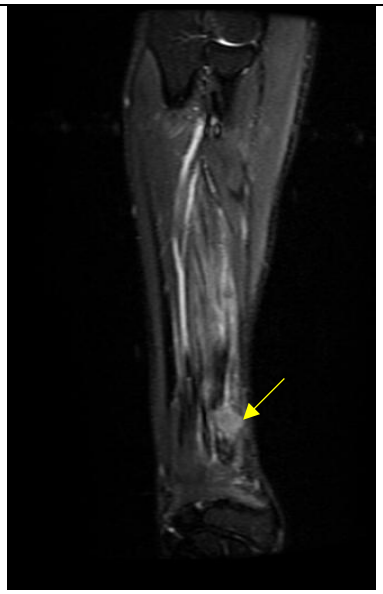

Image 3 (c): Lesion / fusiform dilatation which is hyperintense on STIR images.

EMG & Nerve Conduction Studies: Nerve conduction study & Electromyography of the left hand and forearm was abnormal suggestive of left sided severe median nerve sensory motor axonal neuropathy.

3. Conclusion

Post-traumatic neuroma should be considered in patients presenting with persistent pain, paresthesia, or functional impairment following peripheral nerve injury. This case underscores the importance of correlating clinical history with multimodality imaging findings for accurate diagnosis. High-resolution ultrasonography and MRI are complementary imaging modalities that enable precise lesion localization, assessment of nerve continuity, and differentiation from other soft tissue masses. Early radiological recognition facilitates timely surgical planning, improves patient outcomes, and helps prevent long-term neurological disability. Awareness of this uncommon but clinically significant entity is essential for both radiologists and clinicians involved in the management of peripheral nerve injuries.

4. Discussion

Post-traumatic neuromas represent a well-recognized but often underdiagnosed consequence of peripheral nerve injury. They develop when regenerating axons fail to establish normal continuity with the distal nerve segment, resulting in a disorganized proliferation of neural and fibrous tissue [1]. Although traumatic neuromas may occur anywhere in the body, the upper extremity remains one of the most commonly affected sites because of its frequent exposure to penetrating injuries and surgical interventions [1, 5].

The clinical presentation is variable and depends on the site and extent of nerve involvement. Patients typically complain of persistent pain, paresthesia, hypersensitivity, or functional impairment following a previous traumatic event [1,3]. In the present case, the patient developed progressive pain, sensory disturbances, and finger deformity following a penetrating glass injury, raising suspicion of an underlying peripheral nerve lesion.

Imaging plays a central role in confirming the diagnosis and excluding alternative soft tissue pathologies. High-resolution ultrasonography is often the initial imaging modality because it is inexpensive, readily available, and capable of providing dynamic assessment of nerve continuity [2]. Typical sonographic findings include a hypoechoic nodular lesion arising in continuity with the affected nerve and loss of normal fascicular architecture, as observed in our patient.

MRI serves as an excellent complementary modality owing to its superior soft tissue contrast and multiplanar capabilities [3]. Post-traumatic neuromas typically appear isointense to skeletal muscle on T1-weighted images and hyperintense on T2-weighted sequences, with variable post-contrast enhancement [3,5]. Minimal enhancement, as demonstrated in our case, may help differentiate traumatic neuromas from schwannomas and neurofibromas, which frequently exhibit more pronounced enhancement patterns and characteristic imaging features.

Electrophysiological studies provide additional functional information regarding the severity of nerve damage. The severe median nerve sensorimotor axonal neuropathy demonstrated on nerve conduction studies in our patient correlated well with the imaging findings and clinical symptoms, further supporting the diagnosis.

Management depends on symptom severity and functional impairment. While asymptomatic lesions may be managed conservatively, symptomatic neuromas often require surgical intervention, including excision, neurolysis, or nerve reconstruction, to alleviate pain and restore function [1]. Early diagnosis is therefore essential to prevent chronic neuropathic pain, progressive disability, and deterioration in quality of life.

References

[1] Yang H, Dong Y, Wang Z, Lai J, Yao C, Zhou H, et al. Traumatic neuromas of peripheral nerves: Diagnosis, management and future perspectives. Front Neurol. 2023; 13: 1039529. doi:10.3389/fneur.2022.1039529.
[2] Padua L, Di Pasquale A, Liotta G, Granata G, Pazzaglia C, Caliandro P, et al. Post-traumatic neuroma due to closed nerve injury: Is recovery after peripheral nerve trauma related to ultrasonographic neuroma size? Clin Neurophysiol. 2016;127(1):561-566. doi:10.1016/j.clinph.2015.03.031.
[3] Giannatos V, Ierodiakonou S, Koutas K, Argyropoulou E, Tsoumpos P, Kokkalis Z. Post-traumatic neuroma in continuity of the median nerve in a child: A case report. Cureus. 2023;15(5). doi:10.7759/cureus.38537.
[4] Tagliafico A, Bignotti B, Martinoli C. Update on ultrasound-guided interventional procedures on peripheral nerves. Semin Musculoskelet Radiol. 2016; 20 (5): 453-460. doi:10.1055/s-0036-1594291.
[5] Chhabra A, Andreisek G, Soldatos T, Wang KC, Flammang A, Belzberg AJ, et al. MR neurography: Past, present, and future. AJR Am J Roentgenol. 2011;197(3):583-591. doi:10.2214/AJR.11.6784.
[6] Gaillard F, Knipe H, Feger J, Bell D, El-Feky M, Weerakkody Y, et al. Traumatic neuroma. Radiopaedia.org. Available from: https://radiopaedia.org/articles/traumatic-neuroma
[7] Spinner RJ, Wang H, Amrami KK. Traumatic neuroma. Hand Clin. 2021;37(3):345-356. doi:10.1016/j.hcl.2021.03.004.
[8] Martinoli C, Bianchi S, Dahmane M, Pugliese F, Bianchi-Zamorani MP, Valle M. Ultrasound of the peripheral nerves. Radiol Med. 2007;112(3):438-450. doi:10.1007/s11547-007-0156-8.