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(CASE REPORT)

Imaging diagnosis of post-amputation neuroma of the sciatic nerve in a patient with osteosarcoma: A case report and literature review

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Abstract

Background: Post-amputation neuroma is a benign, non-neoplastic proliferation resulting from abnormal regeneration of injured peripheral nerves. In oncologic patients, these lesions may mimic tumour recurrence, posing a significant diagnostic challenge.

Case presentation: We report the case of a 13-year-old boy treated for proximal tibial osteosarcoma with neoadjuvant chemotherapy followed by limb amputation. Follow-up imaging revealed a well-defined lesion at the distal end of the sciatic nerve. MRI demonstrated a characteristic fascicular pattern with signal intensity similar to muscle on T1-weighted images and intermediate-to-high signal on T2-weighted images. The lesion showed homogeneous enhancement initially and subsequent cystic changes without enhancement on follow-up imaging. These findings favoured the diagnosis of presumed post-amputation neuroma.

Conclusion: Recognition of the imaging features of post-amputation neuroma is essential to avoid misdiagnosis as tumour recurrence. MRI plays a central role in characterization, allowing accurate diagnosis and preventing unnecessary invasive procedures.

Keywords: Neuroma; Osteosarcoma; Amputation; Sciatic nerve; MRI; Tumour recurrence

1. Introduction

Traumatic neuroma is a benign, non-neoplastic proliferation resulting from disorganized regeneration of a partially or completely transected peripheral nerve [1]. Two major subtypes are recognized: terminal neuroma, which arises at the proximal end of a transected nerve, and spindle neuroma, which develops along the course of an injured but non-transected nerve [2]. Clinically, neuromas may present with pain, numbness, discomfort, or electric shock-like sensations, although some lesions remain asymptomatic [3,4].

In oncologic patients, any new postoperative soft-tissue mass raises concern for local recurrence. Distinguishing benign lesions such as neuromas from recurrent malignancy is therefore critical, as misclassification may lead either to unnecessary invasive procedures or to delayed oncologic management. Imaging, particularly magnetic resonance imaging (MRI), plays a central role in this distinction [1].

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Here, we present a case of post-amputation neuroma of the sciatic nerve in a patient with a history of osteosarcoma. This case report and literature review aim to emphasize the radiological characteristics of this benign lesion in order to enhance detection, reduce patient and clinician anxiety, and minimize the need for biopsy.

2. Case presentation

A 13-year-old boy with histologically confirmed right proximal tibial osteosarcoma underwent neoadjuvant chemotherapy followed by limb amputation.

A postoperative contrast-enhanced computed tomography (CT) scan performed 3 weeks after surgery, prior to adjuvant chemotherapy, revealed a small, well-defined soft-tissue lesion in the posterior compartment of the right thigh, located in continuity with the transected sciatic nerve, a few centimetres proximal to the amputation stump. The lesion measured approximately 18 × 11 × 16 mm (transverse × anteroposterior × craniocaudal) and demonstrated homogeneous contrast enhancement (Figure 1).

The lesion was incidentally detected on routine postoperative imaging. No associated stump pain, palpable mass, or neurologic symptoms were reported.

Subsequent MRI performed one month after the CT examination showed a well-defined ovoid lesion arising from the distal stump of the sciatic nerve. The lesion displayed signal intensity similar to skeletal muscle on T1-weighted images and intermediate-to-high signal intensity on T2-weighted images, with a characteristic fascicular pattern. After contrast administration, homogeneous enhancement was observed. No evidence of surrounding tissue invasion, oedema, or aggressive features was noted (Figure 2).

Given the lesion's location at the transected sciatic nerve stump, preserved fascicular architecture, and lack of aggressive imaging features, a presumptive diagnosis of post-amputation neuroma was favoured, and conservative imaging surveillance was chosen.

On follow-up CT performed 3 months later, the lesion persisted without interval enlargement and showed interval cystic transformation with loss of enhancement (Figure 3). The absence of interval growth and the subsequent cystic evolution further supported a benign process, favouring the diagnosis of neuroma over recurrence.

Figure 1 Coronal (A), sagittal (B), and axial (C) contrast-enhanced CT images obtained during postoperative pre-chemotherapy evaluation show a small soft-tissue lesion in the posterior compartment of the right thigh, in continuity with the transected sciatic nerve stump (blue arrow), a few centimetres proximal to the amputation stump, with homogeneous enhancement (red arrow)

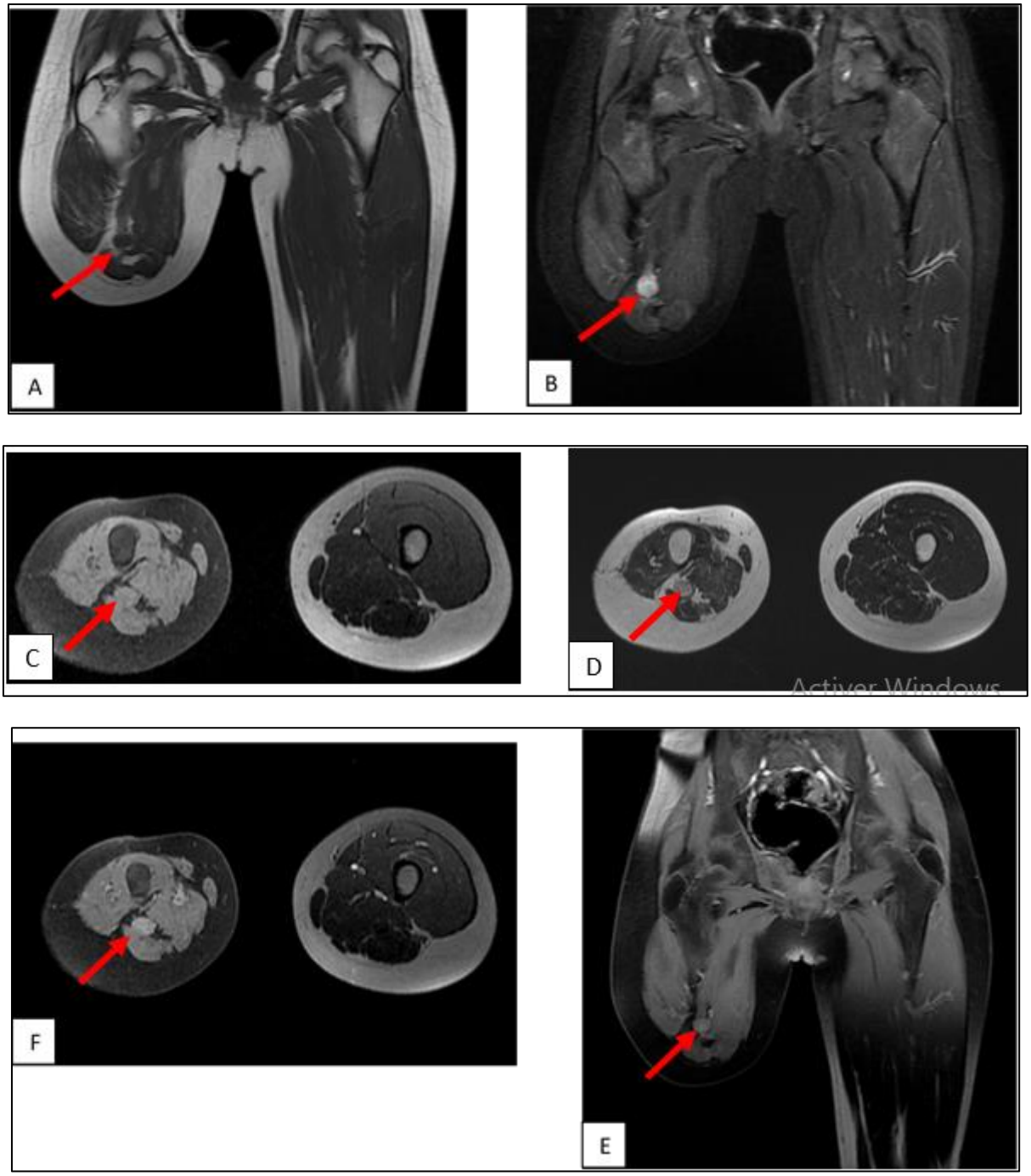

Figure 2 Coronal T1-weighted (A), coronal STIR (B), axial fat-suppressed T1-weighted (C), axial T2-weighted (D), axial contrast-enhanced fat-suppressed T1-weighted (E), and coronal contrast-enhanced fat-suppressed T1-weighted (F) MR images obtained after CT demonstrate a well-defined ovoid lesion arising from the distal sciatic nerve (red arrow). The lesion is isointense to muscle on T1-weighted images and shows intermediate-to-high signal intensity with a fascicular pattern on T2-weighted images, with homogeneous post-contrast enhancement

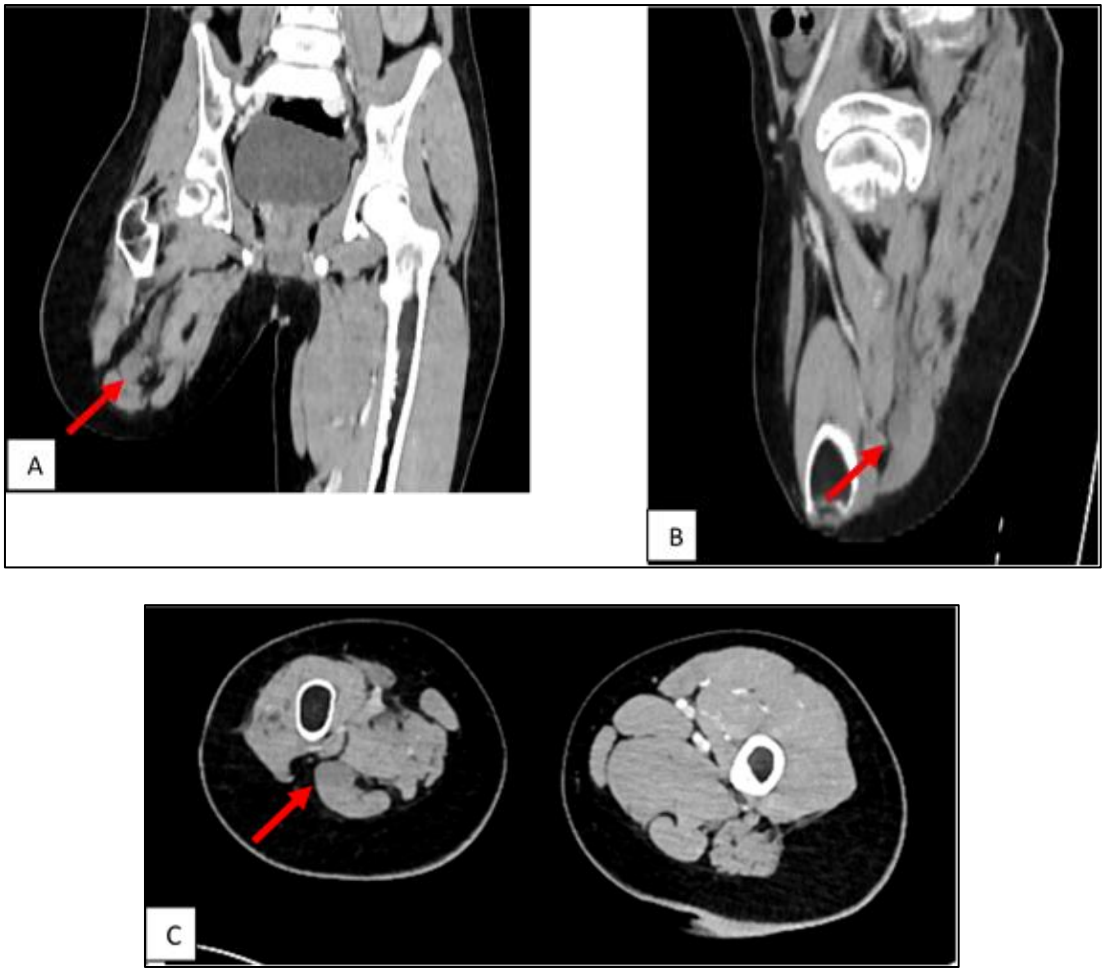

Figure 3 Coronal (A), sagittal (B), and axial (C) contrast-enhanced CT images obtained 3 months later demonstrate persistence of the lesion at the distal sciatic nerve stump, with interval cystic transformation and absence of enhancement (red arrow)

3. Discussion

Osteosarcoma is the most common primary malignant bone tumour in children and adolescents. Despite advances in multimodal treatment combining surgery and chemotherapy, local recurrence remains a significant concern, occurring in approximately 4–10% of cases [5–7]. In this context, the detection of a new soft-tissue mass within the surgical field must be considered suspicious for recurrence until proven otherwise. However, benign entities such as post-amputation neuroma should be included in the differential diagnosis.

Traumatic neuroma, also referred to as amputation or stump neuroma, is a benign, non-neoplastic proliferation resulting from disorganized regeneration of injured peripheral nerve fibres. It is classified as a pseudotumour in the World Health Organization classification of peripheral nerve sheath tumours [8]. Two main subtypes are described: terminal neuromas, arising at the proximal end of a transected nerve, and spindle neuromas, developing along the course of a partially injured nerve. Histologically, neuromas consist of non-encapsulated proliferations of axons, Schwann cells, and fibroblasts embedded in fibrous tissue.

Radiological assessment is essential in the evaluation of postoperative masses, particularly in oncologic patients where diagnostic uncertainty has direct therapeutic implications. Neuromas smaller than 1 cm are often difficult to detect, and reported lesions typically range between 1 and 3.5 cm when identified on imaging [1].

A multimodal imaging approach is required for accurate characterization. Ultrasound may demonstrate a hypoechoic lesion in continuity with a peripheral nerve, showing a fascicular pattern, although its diagnostic value is limited for deep-seated lesions. CT findings are non-specific and may reveal a soft-tissue mass with variable enhancement, often insufficient for reliable differentiation from recurrence.

MRI remains the cornerstone for evaluation. Typical features of neuroma include a fusiform lesion aligned along the course of the nerve, direct continuity with the parent nerve (entering/exiting nerve sign), signal intensity similar to muscle on T1-weighted images, intermediate-to-high signal intensity on T2-weighted images, and preservation of a fascicular architecture. However, these features are not pathognomonic, and significant overlap exists with both benign and malignant peripheral nerve sheath tumours [2,9].

The primary diagnostic challenge lies in differentiating neuroma from local tumour recurrence or malignant peripheral nerve sheath tumours. While malignant lesions more commonly demonstrate heterogeneous signal, ill-defined margins, necrosis, and invasive behaviour, early or small recurrences may lack these features, limiting the reliability of individual imaging criteria. Therefore, the presence of nerve continuity alone should not be considered sufficient to establish a benign diagnosis [10].

In the present case, the lesion initially demonstrated homogeneous contrast enhancement, followed by cystic transformation with loss of enhancement on follow-up imaging. In contrast to benign peripheral nerve sheath tumours such as schwannomas, in which cystic degeneration is a well-recognized feature, cystic evolution is not commonly emphasized in the imaging description of post-amputation neuromas in the available literature. This observation may therefore represent a diagnostic pitfall, as such evolution could be misinterpreted as necrosis suggestive of malignancy. The underlying mechanism remains uncertain but most likely reflects progressive degenerative or remodelling changes within the neuroma [11–13].

The most reliable elements favouring neuroma are the combination of a typical anatomical location at the site of nerve transection, preservation of internal fascicular architecture, absence of progressive growth, and stability on serial imaging. This case highlights the importance of integrating temporal evolution into imaging interpretation, particularly in early postoperative settings where diagnostic uncertainty is highest.

From a practical standpoint, biopsy should be considered when a lesion shows interval growth, marked heterogeneity, loss of fascicular architecture, irregular margins, or other aggressive features. Conversely, when a lesion is centred at the site of nerve transection, remains in direct continuity with the parent nerve, preserves fascicular architecture, and lacks interval growth, short-interval follow-up over 6 to 12 weeks may be a reasonable alternative to immediate tissue sampling, allowing early detection of progression while avoiding unnecessary invasive procedures. Nevertheless, in the absence of follow-up, imaging findings alone may not be sufficient to confidently exclude malignancy, particularly in oncologic patients.

4. Conclusion

Post-amputation neuroma should be systematically considered in the differential diagnosis of any new postoperative soft-tissue mass in an oncologic patient. Although MRI provides key diagnostic clues, imaging findings alone may be insufficient in equivocal cases. Recognition of less typical patterns, including early enhancement followed by cystic evolution, together with short-interval follow-up when appropriate, may help avoid both overdiagnosis of recurrence and unnecessary biopsy.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Statement of ethical approval

This work is a retrospective, single-patient case report. In accordance with the policy of our institution, formal ethical committee approval was not required; the study was conducted in accordance with the principles of the Declaration of Helsinki, and patient anonymity was preserved throughout.

Statement of informed consent

Written informed consent was obtained from the patient's legal guardian for publication of this case report and the accompanying images.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) for language editing and improvement of clarity. The authors critically reviewed, revised, and approved the final version of the manuscript and take full responsibility for its content.

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