Magnetic Resonance Neurography of Peripheral Nerve Tumors and Tumorlike Conditions

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KEYWORDS

• Peripheral nerve tumors • Schwannoma • Neurofibroma • Perineurioma
• Peripheral nerve tumor mimics • Neurolymphoma • Malignant peripheral nerve sheath tumor • MR

KEY POINTS

- MR imaging characteristics of many lesions in and around the peripheral nerves are unique and a confident diagnosis of such lesions including lipoma, fibrolipoma, ganglion cyst and perineurioma can be prospectively suggested.
- Multiple MR imaging findings can suggest the possibility of a neurogenic tumor but do not reliably distinguish between schwannoma and neurofibroma.
- Although there are certain MR features that increase the likelihood of MPNST, biopsy is still necessary to confirm the diagnosis.
- Understanding of the clinical features of a broad range of neuropathy conditions and a multidisciplinary approach is essential for proper and timely patient management.

INTRODUCTION

Patients with signs and symptoms of focal neuropathy are often referred for nerve imaging, which may consist of regional magnetic resonance (MR) imaging of different areas of the body. The imaging may be designed to provide an overview of tumor burden (whole-body MR [WBMR] imaging) or detailed anatomy of a specific nerve (MR neurography [MRN]). When peripheral nerve enlargement is seen, there is a common differential that includes benign peripheral nerve sheath tumors (PNSTs), malignant PNSTs (MPNSTs), hereditary or inflammatory neuropathy, posttraumatic neuroma, intraneural ganglion or other secondary nonneurogenic malignancies such as neurolymphoma and other intraneural epithelial or mesenchymal tumors (**Table 1**).

Neurofibromas account for 5% of all benign soft tissue tumors with 95% occurring sporadically.[1] Schwannomas also account for 5% of all benign soft tissue tumors and 95% also occur sporadically.[1] The remainder of neurofibromas and schwannomas are related to genetic neurocutaneous syndromes, including neurofibromatosis

Disclosure: A. Chhabra, research grants from GE-AUR, Siemens, Integra Life Sciences; Gatewood fellowship, MSK CAD; consultant, Siemens.

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Neuroimag Clin N Am 24 (2014) 171–192
http://dx.doi.org/10.1016/j.nic.2013.03.035

Table 1
Differential diagnosis of peripheral nerve mass–like enlargement on MR imaging

	Clinical Features	Imaging Features
Neurogenic Lesions		
Benign PNST		
Neurofibroma	Young to middle age Solitary slow-growing lesion Incidental discovery Mild to moderate sensory or motor symptoms and signs Isolated or associated with neurocutaneous syndromes (can occur at early age)	Continuity with nerve (tail sign) and/or multiple fascicles, can be centrally located Target sign Split fat sign Fascicular sign Unencapsulated Homogeneous or targetoid enhancement High ADC (min) on DTI >1.1–1.2 $\times$ 10^{-3} mm/s^2 Low SUV_{max} (<2–3) on early and delayed F^{18} FDG-PET scan
Schwannoma	Young to middle age Solitary slow-growing lesion Incidental discovery or painful lesion Mild to moderate sensory or motor symptoms and signs Isolated or associated with neurocutaneous syndromes (can occur at early age)	Continuity with nerve (tail sign) and/or 1 or 2 fascicles, can be eccentrically located Target sign Split fat sign Fascicular sign Encapsulated Cystic changes, hemorrhage, calcification (10%–20%) Homogeneous or targetoid or heterogeneous enhancement High ADC (min) on DTI >1.1–1.2 $\times$ 10^{-3} mm/s^2 Low SUV_{max} (<2–3) on early and delayed F^{18} FDG-PET scan
Perineurioma	Young to middle age Isolated Slowly progressive mononeuropathy with few or no sensory symptoms or signs	Continuity with nerve (tail sign) and/or multiple fascicles Most commonly in lower limbs, and in sciatic or femoral distributions Uniform homogeneous fascicular enlargement and hyperintensity (Honeycomb pattern) High ADC (min) on DTI >1.1–1.2 $\times$ 10^{-3} mm/s^2 Low SUV_{max} (<2–3) on early and delayed F^{18} FDG-PET scan
Malignant PNST	New-onset sensory and/or motor deficit New or intensified pain Rapid enlargement of a known PNST	Irregular or round shape Usually larger than 5 cm Perilesional edema Intratumoral nodularity, necrosis/cystic change or hemorrhage T1 heterogeneity and lack of targetoid appearance Heterogeneous enhancement Restricted diffusion: low ADC (min) on DTI <1.1 $\times$ 10^{-3} mm/s^2 Increased SUV_{max} (>3–4) on early and delayed F^{18} FDG-PET scan
Neurocutaneous syndromes	Younger age of presentation and family history	—
NF1	Cutaneous lesions Skeletal deformities Glioma Lisch nodule First-degree relative	Plexiform neurofibroma or multiple PNSTs (usually NF) Multifocal diffuse nerve thickening(s) and nodularity Malignant PNST

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