

Primary Neurolymphoma of the Tibial Nerve: A Case Report with Characteristic MRI Findings

경골신경에 발생한 원발성 신경림프종: 특징적인 자기공명영상 소견을 가진 증례 보고

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Primary neurolymphoma (NL) involving the peripheral nervous system is a rare disease that involves the invasion of a nerve or nerve plexus by neoplastic lymphocytes. Although there have been a few reported clinical and pathological cases presenting as primary NL involving the peripheral nerve, the detailed radiological features of NL have not yet been discussed. In this report, we present a case of primary NL involving the tibial nerve and describe the detailed imaging findings on MRI including features used for differential diagnosis.

Index terms

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INTRODUCTION

Neurolymphoma (NL) is rare neurologic manifestation of hematologic malignancy and involves by infiltration of neoplastic lymphocytes in non-Hodgkin's lymphoma (NHL) or leukemia (1-3). Its accurate frequency is not known, but it is estimated to occur in 0.2% of NHL cases (4).

NL of the central nervous system is well documented and relatively common, but NL involving the peripheral nervous system occurs even more rarely. Most NLs involving the peripheral nervous system occur secondary to hematogenous spread from systemic NHL or direct infiltration from adjacent structures (5). In contrast, primary lymphoma arising from the peripheral nervous system is quite rare and detailed radiologic information is not readily available since the few previous reports are limited to clinical descriptions (6). We report a case of primary NL mainly involving the tibial nerve and describe its imaging features on

magnetic resonance imaging (MRI) and differential points with those of malignant peripheral nerve sheath tumor. This report was approved by our Institutional Review Board.

CASE REPORT

A 77-year-old male patient complained of pain in the left popliteal area after sitting for a couple of hours. A past medical history and systematic review were unremarkable. On physical examination, he had mild numbness along the left lower leg. Plain radiography showed a bulging contour with increased soft tissue density at the posterior aspect of the left knee without bony abnormality. On MR examination, he had a lobulated globular mass measuring approximately $7.2 \times 6.7 \times 2.0$ cm in the popliteal fossa between the gastrocnemius medial and lateral heads (Fig. 1). The mass was fusiform shape by diffuse thickening along the tibial nerve tapering up and down. It also extended

superiorly to the distal portion of the sciatic nerve and involved the proximal portion of the common peroneal nerve. In total, the lesion had two components: a globular portion and a fusiform portion. The globular portion appeared as a mass enveloping the thickened continuous nerve bundle. The entire length of the above lesion along the nerve bundle was approximately 18 cm. On both T1-weighted [repetition time (TR)/echo time (TE), 758/13] and T2-weighted (TR/TE, 4043/105) axial imag-

es, the lesion was of intermediate signal intensity with multiple dark signal foci within the mass. The dark signal foci revealed two patterns. In the globular portion, the dark signal foci were irregular and relatively short. In contrast, in the fusiform portion as well as the center of the globular portion, which continued to the fusiform portion, the dark signal foci were fine and dot-like on axial images and linear or striated on coronal and sagittal images, suggestive of displaced nerve fascicles by inter-

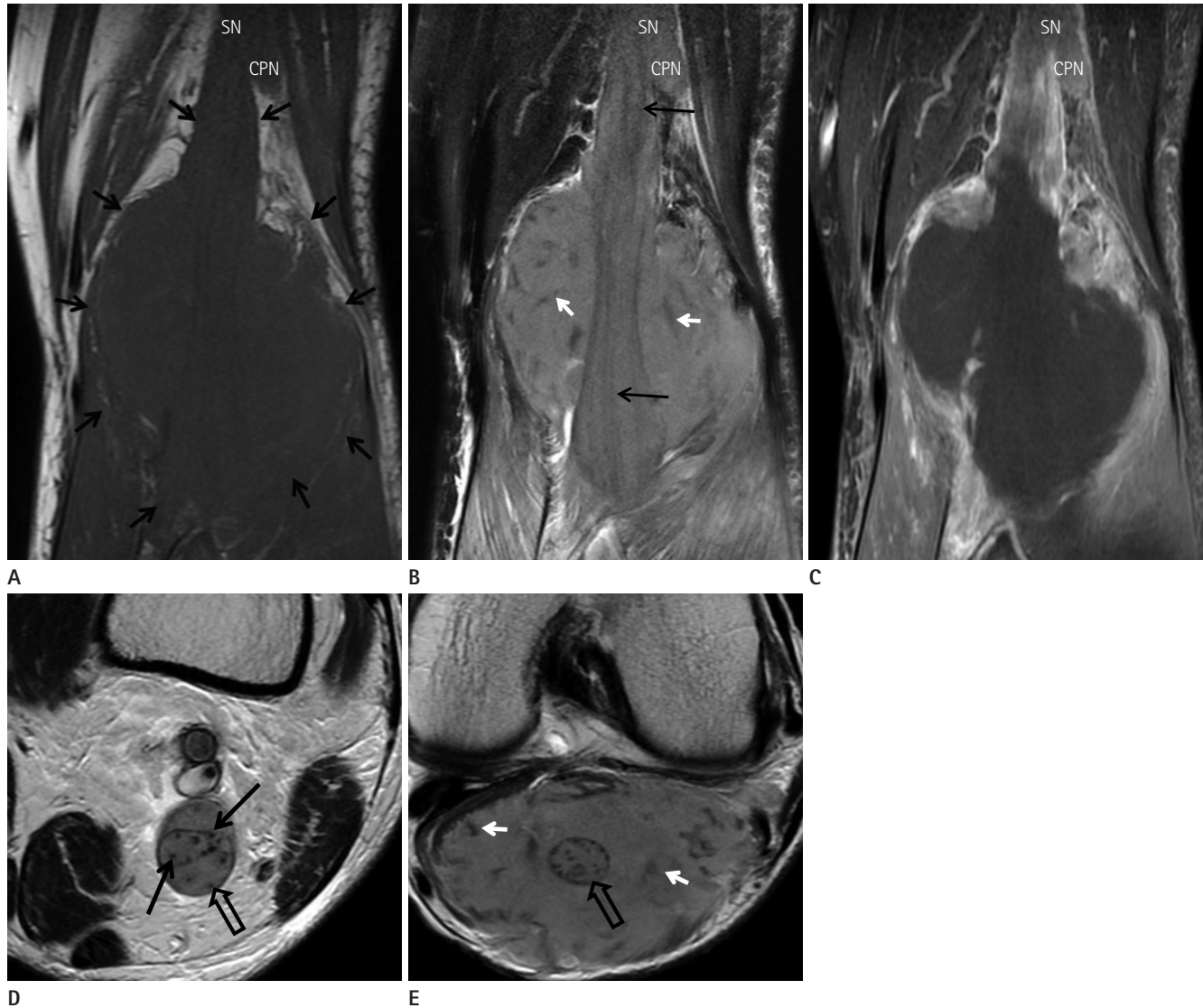


Fig. 1. Coronal T1-weighted (**A**), fat-suppressed T2-weighted (**B**), and fat-suppressed enhanced T1-weighted (**C**) images show a well-defined, peripherally enhancing mass (short black arrows on **A**) involving the tibial nerve at the popliteal fossa. The lesion extended cranially to the distal sciatic nerve and the proximal part of the common peroneal nerve manifesting as diffuse fusiform thickening of the nerve with mild homogeneous enhancement. On T2-weighted axial image scanning the level of fusiform thickening (**D**), multiple dot-like dark signal foci within the lesion suggest displaced nerve fascicles (black arrows) by interspersed tumor infiltration. These foci appear as dark signal striation (black arrows) along the nerve course on coronal image (**B**). On T2-weighted axial image scanning at the level of mass formation (**E**), numerous irregular low signal foci (white arrows also seen on **B**) scattered within the mass are observed, suggesting fibrous components. Note the distended epineurium (blank arrows on **D** and **E**) with a low signal peripheral rim. The popliteal vessels are totally encased and severely collapsed, but thrombosis was absent. CPN = common peroneal nerve, SN = sciatic nerve

spersed tumor infiltration. After injection with gadolinium, subtle peripheral enhancement of the mass was demonstrated. The adjacent popliteal artery and vein were totally encased by the mass at the knee joint level, and there was no deep vein thrombosis. The surrounding fat layer and proximal calf muscles showed mild edematous change. ^{18}F -fluorodeoxyglucose (FDG)-positron emission tomography was performed to evaluate the metabolic activity of the lesion and the presence of metastases (Fig. 2). The lesion showed marked FDG uptake [maximum standardized uptake value (maxSUV) 15.8] at the

peripheral enhancing portion of the mass and the expected path of the tibial nerve. In addition, small left external iliac and porta hepatis lymph nodes showed FDG activity (maxSUV 6.1 and 8.6, respectively) compatible with metastases.

An approximately $2.0 \times 2.0 \times 1.0$ cm aggregating specimen was obtained from surgical biopsy of the main mass. Microscopic examination revealed diffuse proliferation of atypical lymphoid cells with irregular nuclear folding and occasional prominent nucleoli and pleomorphic nuclei. Immunohistochemical staining showed BCL-6 (+), BCL-2 (+), CD10 (-), CD20 (+), and CD3 (-). The final diagnosis was high grade B-cell lymphoma (diffuse large B-cell lymphoma). The patient was referred to the department of oncology and treated with a chemotherapy protocol [rituximab, cytoxan, hydroxydaunorubicin, oncovin, and prednisolone (R-CHOP)] with radiotherapy. After 2 months of treatment, the main mass and metastatic lymph nodes decreased in size and activity.

DISCUSSION

NL of the peripheral nerve is a rare disease; its precise incidence is not well known. NL usually occurs as secondary or systemic involvement related to previously known hematologic malignancies such as lymphoma or leukemia (1). It is almost always related to NHL and the most common type of lymphoma is diffuse large B-cell lymphoma, followed by follicular lymphoma. Although the involvement of peripheral nerves as disseminated systemic lymphoma or direct extension from contiguous lymphoma has been previously described, primary lymphomas of the peripheral nerve are quite rare (6, 7). The most frequently involved site of primary lymphoma of the peripheral nerve is the sciatic nerve, but it is unclear why there is a predilection for the sciatic nerve (8). Quiñones-Hinojosa et al. (9) postulated that B-cells may stay or originate in the sciatic nerve and a specific cell adhesion molecule expansion may be the basis for tissue targeting, but these molecules have not been identified. In addition, those a few cases were reported in the brachial plexus, ulnar, median, and radial nerves and the sympathetic chain (8). Our case was the first report of a primary NL originating from the tibial nerve and its MRI findings.

Clinical diagnosis with physical examination can be difficult because NL can mimic many other conditions and its present-



Fig. 2. ^{18}F -fluorodeoxyglucose (FDG)-positron emission tomography shows marked FDG uptake at the lesion involving the tibial nerve (black arrow), corresponding to enhancing portions on MRI. Note additional FDG activity of the left external iliac and porta hepatis lymph nodes suggestive of metastases (white arrows).

ing symptoms are diverse depending on the sites involved. Such symptoms include painful or painless mononeuropathy, painful radioculopathy, cranial neuropathy, and polyneuropathy (1-3); there are also cases without symptoms. Our patient had only mild numbness and pain of involved area after being in the sitting position for a long period of time. Given the unclear clinical manifestations and rare incidence of NL, radiologic evaluation and histologic examination are required for appropriate diagnosis and proper management. Radiological evaluation using MRI can be helpful for differential diagnosis from other masses and assessment of the extent of the lesion, though surgical biopsy of the involved structure is the gold standard (3). Appropriate diagnosis of NL and early management will prevent complications and perhaps morbidity (2).

Imaging features of NL include diffuse enlargement of the peripheral nerve and mass formation along the course of the involved nerve with or without contrast enhancement (1, 2). Wadhwa et al. (1) reported NL often shows areas of interspersed minimal heterogeneous hypointensity (dark spots) within the mass on T2WI, although the cause of these findings is unclear. Our case also showed fine dot-like dark signal foci on axial image and these showed linear structures that continued to the nerve fascicles along the fusiform portion of the lesion on coronal and sagittal images. We can speculate that these findings may be related to the characteristics of lymphoma, which tend to preserve the shape or contour of the involved structure or encase the adjacent structures rather than invade or destroy the tissue. In the same way, the findings of the popliteal artery and vein that was encased in the mass can also help characterize the lymphoma. On MRI, therefore, diffuse enlargement of the peripheral nerve and mass formation with findings suggesting relatively preserved nerve fascicles and vascular structures are important to distinguish lymphoma from other diseases such as malignant peripheral nerve sheath tumors, which usually show characteristic destruction of the nerve architecture within the lesion and heterogeneous features due to their complex components (10).

There is still debate regarding the standard treatment regimen for NL. Generally, systemic chemotherapy alone or a combination of chemotherapy with intrathecal chemotherapy or radiotherapy is performed (3, 4). Our patient was treated with R-CHOP with radiotherapy after surgical biopsy, and the metastatic

nodes as well as the mass showed positive therapeutic response after 2 months. The general prognosis of patients with NL is poor in spite of treatment, which may be caused by the lack of a standard regimen (3). Thus, large randomized clinical trials will be needed to establish a standard treatment regimen, and appropriate diagnosis using MRI will contribute to long-term outcomes.

In conclusion, we report the first case of NL involving tibial nerve in association with characteristic MRI findings including homogeneous internal contents for tumor size and preservation of adjacent structures such as interspersed nerve fascicle, which might be useful to differentiate NL from other neurogenic tumors of malignant peripheral nerve sheath tumor.

REFERENCES

1. Wadhwa V, Thakkar RS, Maragakis N, Höke A, Sumner CJ, Lloyd TE, et al. Sciatic nerve tumor and tumor-like lesions - uncommon pathologies. *Skeletal Radiol* 2012;41:763-774
2. Muslimani AA, Spiro TP, Daw HA, Chan V, Bambakidis P. Neurolymphomatosis: The challenge of diagnosis and treatment. *Commun Oncol* 2008;5:339-341
3. Choi YJ, Shin JA, Kim YH, Cha SJ, Cho JY, Kang SH, et al. Neurolymphomatosis of brachial plexus in patients with non-Hodgkin's lymphoma. *Case Rep Oncol Med* 2013; 2013:492329
4. Baehring JM, Damek D, Martin EC, Betensky RA, Hochberg FH. Neurolymphomatosis. *Neuro Oncol* 2003;5:104-115
5. Roncaroli F, Poppi M, Riccioni L, Frank F. Primary non-Hodgkin's lymphoma of the sciatic nerve followed by localization in the central nervous system: case report and review of the literature. *Neurosurgery* 1997;40:618-621; discussion 621-622
6. Kahraman S, Sabuncuoglu H, Gunhan O, Gurses MA, Sirin S. A rare reason of foot drop caused by primary diffuse large b-cell lymphoma of the sciatic nerve: case report. *Acta Neurochir (Wien)* 2010;152:125-128
7. Misdraji J, Ino Y, Louis DN, Rosenberg AE, Chiocca EA, Harris NL. Primary lymphoma of peripheral nerve: report of four cases. *Am J Surg Pathol* 2000;24:1257-1265
8. Descamps MJ, Barrett L, Groves M, Yung L, Birch R, Murray NM, et al. Primary sciatic nerve lymphoma: a case report and review of the literature. *J Neurol Neurosurg Psychiatry*

2006;77:1087-1089

9. Quiñones-Hinojosa A, Friedlander RM, Boyer PJ, Batchelor TT, Chiocca EA. Solitary sciatic nerve lymphoma as an initial manifestation of diffuse neurolymphomatosis. Case report and review of the literature. *J Neurosurg* 2000;92:165-169

10. Li CS, Huang GS, Wu HD, Chen WT, Shih LS, Lii JM, et al. Differentiation of soft tissue benign and malignant peripheral nerve sheath tumors with magnetic resonance imaging. *Clin Imaging* 2008;32:121-127

경골신경에 발생한 원발성 신경림프종: 특징적인 자기공명영상 소견을 가진 증례 보고

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말초신경계에 발생한 원발성 신경림프종은 매우 드문 질환이다. 지금까지 이에 대한 몇 개의 임상적 또는 병리학적 증례 보고는 있었지만 영상 소견에 대하여 자세히 보고된 바는 없었다. 본 저자들은 경골신경에 발생한 원발성 신경림프종에 대해 자기공명영상 소견과 함께 보고하고자 한다.

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