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# Cervical Nerve Root Neurolymphomatosis Detected on F-18 FDG PET/CT

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A 65-year-old woman was treated with chemotherapy for diffuse large B-cell lymphoma (DLBCL) after presenting with sharp pain of the left arm. She had complete remission of the DLBCL, and symptoms disappeared. One year after treatment, she developed sharp pain in the first through third fingers that extended to the left arm. F-18 FDG PET/CT showed linear increased FDG uptake along the cervical nerve roots and plexus at the C4-C7 levels, suggesting neurolymphomatosis. Gadolinium-enhanced MRI showed enhancement and enlargement of the cervical nerve root and plexus. Fine needle aspiration biopsy of the left cervical nerve confirmed DLBCL.

**Key Words :** Cervical nerve, FDG, Lymphoma, Neurolymphomatosis, PET

## Introduction

Neurolymphomatosis (NL) is a rare entity which is defined as an infiltration of cranial or peripheral nerves, nerve roots or nervous plexuses by haematological malignancy. It is known, that non-Hodgkin lymphoma may rarely cause peripheral neuropathies, mainly through direct infiltration of peripheral nerves or nerve roots (neurolymphomatosis). The differential diagnosis comprises different indirect local and remote effects of lymphoma such as compression of neural structures, viral infections, autoimmune reactions, vasculitis, nerve infarction, drug toxicity, cryoglobulinemia, paraproteinemia, or amyloidosis [1,2]. NL is occasionally difficult to diagnose using conventional imaging modalities. Although nerve biopsy is the main method for histological diagnosis, a blind nerve biopsy may not be

diagnostic since the involvement may be patchy [3].

Since the NL is a rare entity, physicians often do not think about the opportunity of it being behind the complaints of the patient, therefore it remains often undiagnosed until becoming obvious. Also, morphologic imaging modalities such as magnetic resonance imaging (MRI) or computed tomography (CT) may suffer from a limited sensitivity for the detection of nerve infiltration. F-18 fluoro-deoxy-glucose (FDG) positron emission tomography combined with computed tomography (PET/CT) is increasingly being applied for the diagnosis, staging and assessing of the response to treatment in lymphoma. Up to the present only few papers, mainly case reports, have been published in the literature demonstrating the utility of F-18 FDG PET/CT in NL [4-7]. Here, I present a rare case of recurrent NL diagnosed by F-18 FDG PET/CT.

## Case Report

A 65-year-old woman developed a left supraclavicular mass and presented with sharp pain of the left arm. She was diagnosed with diffuse large B-cell lymphoma (DLBCL) and was treated with rituximab plus cyclophosphamide, doxorubicin, vincristine, and prednisone. She had complete remission of the DLBCL, and the symptoms disappeared. One year after treatment, she developed sharp pain in the first through third fingers that became progressively worse and extended to most of the left arm. F-18 FDG PET/CT was performed after a normal blood glucose level was ensured. The patient fasted for at least 6 hours prior to PET/CT examination. The Patient received an intravenous injection of 370 MBq of FDG, and then rested for approximately 60 minutes before image acquisition. Image acquisition was performed with an integrated PET/CT device (Discovery STE-16, GE Healthcare, Milwaukee, WI, USA). Seven table positions were used for adequate coverage from head to pelvic floor with an acquisition time of 5 minutes per table position. PET image data were reconstructed iteratively by using an ordered set expectation maximization algorithm. CT data were used for attenuation correction. F-18 FDG PET/CT scan suggested NL (Fig. 1). It shows linear increased FDG uptake along the cervical nerve roots and plexus at the C4-C7 levels with SUVmax of 7.6. Gadolinium-enhanced MRI of the C-spine provided a presumptive diagnosis of NL (Fig. 2). MRI shows enhancement and enlargement of the cervical nerve roots and plexus at the C4-C7 levels. Fine needle aspiration biopsy of the left cervical nerve revealed malignant cells, characterized as DLBCL.

## Discussion

NL is a rare manifestation of lymphoma characterized by infiltration of the peripheral nerves by malignant cells, leading to neuropathy at multiple sites [1]. NL may occur in various structures in the central and peripheral nervous system, including the cervicobrachial plexuses, the brachial nerves, the sacral plexuses, sciatic nerves, and trigeminal nerve roots [8-11]. The clinical and radiologic diagnosis of NL is challenging. Approximately 60% of patients with NL have abnormal cerebrospinal fluid findings that typically include an elevated protein level and cell count [2]. While MRI is clinically useful for evaluating nerve or root involvement, MRI findings are not specific for NL [12].

F-18 FDG PET is widely used with proven accuracy for staging and restaging many non-Hodgkin's lymphoma [13]. It utilizes the

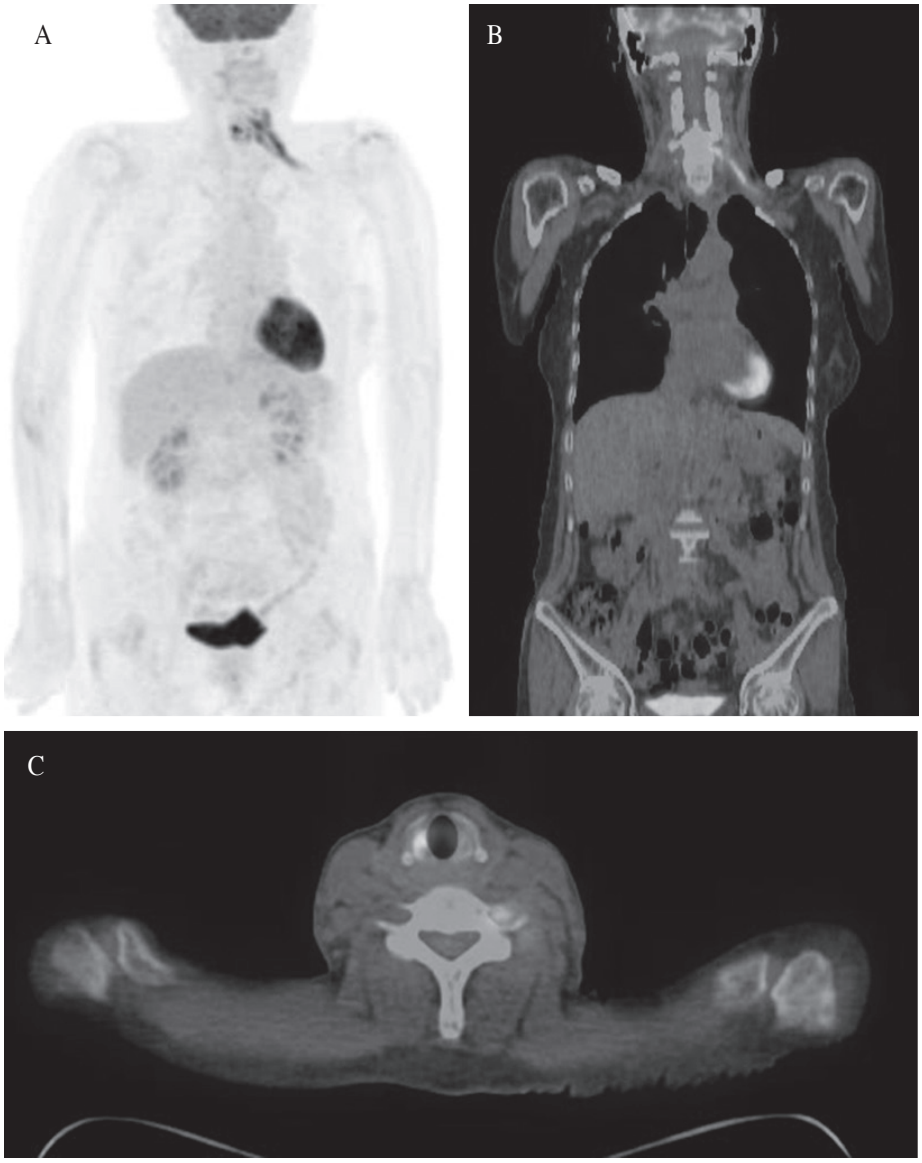


**Fig. 1.** F-18 FDG PET/CT image in a patient with cervical nerve root neurolymphomatosis. Maximum intensity projection (A), coronal (B), and axial (C) PET/CT images show linear increased FDG uptake along the cervical nerve roots and plexus at the C4–C7 levels with SUVmax of 7.6.

accelerated glucose metabolism of tumor cells that take up more F-18 FDG compared with normal cells. PET/CT further improves the accuracy of staging and response assessment over that of CT alone. In the above case, F-18 FDG PET/CT demonstrated linear increased FDG uptake along the cervical nerve roots and plexus with pathologic confirmation of NL. F-18 FDG PET/CT can be useful to guide biopsy of accessible sites with the most intense metabolic activity in order to reduce the rate of false negative results. This is similar in the way that PET complements bone marrow biopsy and identifies sites of focal involvement that would otherwise not be sampled by 'blind' bone

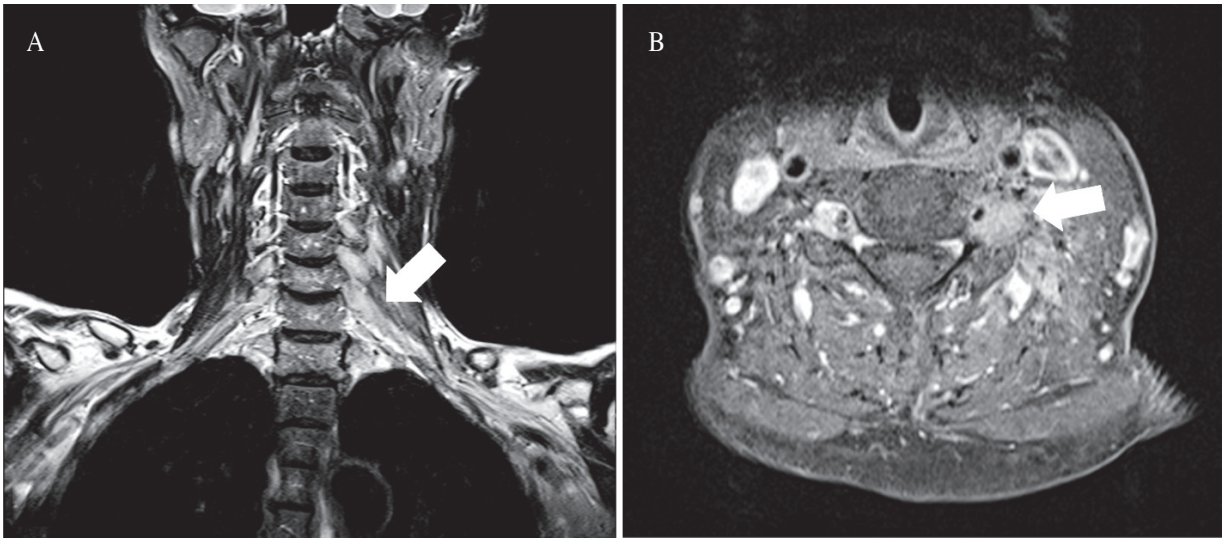


**Fig. 2.** Gadolinium-enhanced MRI in a patient with cervical nerve root neurolymphomatosis. Gadolinium-enhanced MRI of the C-spine provided a presumptive diagnosis of neurolymphomatosis (NL). MRI shows enhancement and enlargement of the cervical nerve roots and plexus at the C4–C7 levels (A) and (B) arrow.

marrow biopsy [14]. A few reports have suggested that F-18 FDG PET/CT may assist in diagnosing NL, defining a target for biopsy, monitoring progression, and evaluating response to treatment [4,6,15-17]. Here, we present a case of recurrent NL diagnosed by F-18 FDG PET/CT, which would be useful for monitoring lymphoma recurrence in patients with complete remission after chemotherapy.

## References

1. Baehring JM, Damek D, Martin EC, Betensky RA, Hochberg FH. Neurolymphomatosis. *Neuro Oncol* 2003;**5**:104-15.
2. Grisariu S, Avni B, Batchelor TT, van den Bent MJ, Bokstein F, Schiff D, *et al*. Neurolymphomatosis: an International Primary CNS Lymphoma Collaborative Group report. *Blood* 2010;**115**:5005-11.
3. van den Bent MJ, de Bruin HG, Bos GM, Brutel de la Riviere G, Sillevis Smitt PA. Negative sural nerve biopsy in neurolymphomatosis. *J Neurol* 1999;**246**:1159-63.
4. Salm LP, Van der Hiel B, Stokkel MP. Neurolymphomatosis diagnosed by (18) F-FDG PET-CT. *Clin Nucl Med* 2013;**38**:e261-2.
5. Dong Q, Wong KK, Avram AM. Sacral nerve root neurolymphomatosis diagnosed on FDG-PET/CT and magnetic resonance imaging. *Clin Nucl Med* 2008;**33**:30-1.
6. Strobel K, Fischer K, Hany TF, Poryazova R, Jung HH. Sciatic nerve neurolymphomatosis - extent and therapy response assessment with PET/CT. *Clin Nucl Med* 2007;**32**:646-8.
7. Tsang HH, Lee EY, Anthony MP, Khong PL. F18-FDG PET/CT diagnosis of vagus nerve neuro-lymphomatosis. *Clin Nucl Med* 2012;**37**:897-8.
8. Shima K, Ishida C, Okino S, Kotani T, Higashi K, Yamada M. A linear lesion along the brachial plexus on FDG-PET in neurolymphomatosis. *Intern Med* 2008;**47**:1159-60.
9. Miki M, Masaki Y, Nakamura T, Iwao H, Nakajima A, Sakai T, *et al*. Primary neurolymphomatosis of the cervical nerve root. *Rinsho Ketsueki* 2010;**51**:564-7.
10. Matsue K, Hayama BY, Iwama K, Koyama T, Fujiwara

H, Yamakura M, *et al*. High frequency of neurolymphomatosis as a relapse disease of intravascular large B-cell lymphoma. *Cancer* 2011;**117**:4512-21.

11. Vecchio D, Mittino D, Terazzi E, Nassi L, Conconi A, Monaco F. A case of cranial multinevritis: from the onset to the diagnosis of primary neurolymphomatosis. *BMJ Case Rep* 2012.doi:10.1136/bcr.06.2011.4299.
12. Moore KR, Blumenthal DT, Smith AG, Ward JH. Neurolymphomatosis of the lumbar plexus: high-resolution MR neurography findings. *Neurology* 2001;**57**:740-2.
13. Isasi CR, Lu P, Blaufox MD. A metaanalysis of 18F-2-deoxy-2-fluoro-D-glucose positron emission tomography in the staging and restaging of patients with lymphoma. *Cancer* 2005;**104**:1066-74.
14. Pakos EE, Fotopoulos AD, Ioannidis JP. 18F-FDG PET for evaluation of bone marrow infiltration in staging of lymphoma: a meta-analysis. *J Nucl Med* 2005;**46**:958-63.
15. Suga K, Yasuhiko K, Matsunaga N, Yujiri T, Nakazora T, Ariyoshi K. F-18 FDG PET/CT findings of a case of sacral nerve root neurolymphomatosis that occurred during chemotherapy. *Clin Nucl Med* 2011;**36**:73-6.
16. Yilmaz S, Sager S, Sen F, Halac M. Bilateral trigeminal nerve recurrence of non-hodgkin lymphoma revealed with FDG PET/CT. *Indian J Nucl Med* 2014;**29**:50-2.
17. von Falck C, Rodt T, Joerdens S, Waldeck S, Kiesel H, Knapp WH, *et al*. F-18 2-fluoro-2-deoxy-glucose positron emission tomography/computed tomography for the detection of radicular and peripheral neurolymphomatosis: correlation with magnetic resonance imaging and ultrasound. *Clin Nucl Med* 2009;**34**:493-5.