Neurolymphomatosis: an uncommon manifestation of lymphoma – detection and therapeutic monitoring through 18F-fluorodeoxyglucose positron-emission tomography and computed tomography imaging

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DESCRIPTION
A woman in her 30s presented with progressive right facial droop, difficulty swallowing, right eye lagophthalmos and abnormal liver function test (alanine aminotransferase – 219 units/L). Liver lesion biopsy showed diffuse large B cell lymphoma (DLBCL). Staging MRI brain and whole spine demonstrated no abnormal enhancing lesion. Staging fluorine-18-fluorodeoxyglucose (18F-FDG) PET/CT was suggestive of stage IV lymphoma with neurolymphomatosis (NL), emphasised by hypermetabolism of the left cervical 6 nerve root. This finding was incidental as there was no report of distributive symptoms regarding the upper limb at the time of staging.

The patient proceeded to undergo two lines of chemotherapy along with intrathecal dosing. Hyper-CVAD (Part A: cyclophosphamide, dexamethasone, methotrexate, doxorubicin, vincristine and cytarabine and Part B: methotrexate and cytarabine) was administered to treat systemic disease. The patient subsequently developed diplopia followed by left upper limb weakness in the C6 distribution. Chemotherapy with rituximab, methotrexate, procarbazine and vincristine was administered to treat central nervous system involvement of lymphoma.

Following treatment, the initial neurological symptoms had improved; however, the patient had developed bilateral upper and lower limb paraesthesia, likely treatment related. Remission was observed on immediate post-treatment FDG-PET.

Due to further symptomatic progression (diplopia), early re-assessment with PET/CT and MRI was performed. FDG-PET demonstrated hypermetabolism at the right cranial nerve (CN) XII, left C8, right L2 and left S1 nerve roots, highlighted in figure 1. MRI showed enhancement in the right CN XII and bilateral VI nerves, shown in figure 2.

A physical assessment correlated with some of the findings seen on imaging which included left ophthalmoplegia, deviation of tongue towards the right, pattern of left upper extremity weakness involving C8 (thumb extension) and T1 (finger extension) nerve roots and bilateral lower extremity weakness.

Figure 1 Recurrence of diffuse large B cell lymphoma following treatment. (A) Maximum intensity projection highlighting fluorodeoxyglucose-avid left C8 (green arrow), right L2 (orange arrow) and left S1 (red arrow) nerve roots. (B) Axial PET/CT highlighting left C8 nerve root. (C) Axial PET/CT highlighting right L2 nerve root. (D) Axial PET/CT highlighting left S1 nerve root.

Figure 2 Intracranial recurrence on PET and MRI. (A) Fluorodeoxyglucose-avid right cranial nerve (CN) XII nerve root on axial PET/CT. (B) T1-weighted image fat-saturation postcontrast showing asymmetrical enhancement in the right hypoglossal nerve. (C) T1-weighted image fat-saturation postcontrast showing bilateral enhancement in CN VI. (D) Maximum intensity projection of PET data highlighting right CN XII nerve root involvement.
Images in...

radiculopathy with weakness involving L2 and S1 nerve roots. Additionally, cerebral spinal fluid flow cytometry results were also suspicious for NL recurrence as CD19(+) and CD29(-) and kappa surface light chains were identified. Given these findings, the treating team decided to commence rituximab, ifosfamide, etoposide and cytarabine immediately with consideration for autologous stem cell transplant and whole brain radiation therapy.

Neurolymphomatosis is characterised by infiltration of lymphoma cells into the nervous system. It is most often affiliated with DLBCL, and it occurs in approximately 5% of the patients with lymphoma. Diagnosing NL is difficult due to the variety of differential diagnosis. A nerve biopsy is the gold standard for the diagnosis of NL; however, it is an invasive procedure with a risk of permanent nerve damage. Therefore, imaging plays a crucial role in diagnosing NL, guiding biopsy sites and for therapeutic monitoring.

FDG-PET imaging is the most sensitive modality for detecting NL and it excels in identifying extracranial disease. Although some discordance between PET and MRI results may exist, both modalities are recommended as they are complementary.5

Learning points

► The gold standard of diagnosing neurolymphomatosis (NL) is nerve biopsy. Due to the complexity and risks of the region of interest, both 18F-fluorodeoxyglucose (FDG) PET/CT and MRI of the central nervous system are complementary for early diagnosis and monitoring of NL as seen in this case study.
► NL is a rare condition and 18F-FDG PET/CT excels in detecting extracranial NL, where MRI is superior in detecting intracranial involvement.
► Identifying NL on 18F-FDG PET/CT and MRI may allow for treatment option selection.

Figure 1 shows extracranial disease on FDG-PET which were not present on MRI whole spine. On FDG-PET imaging, physiological uptake of the brain may potentially mask any existing intracranial nerve disease where MRI is superior. Despite MRI having poor specificity, it is a useful tool for imaging intracranial NL. This is highlighted in figure 2 where enhancement of CN VI and XII nerve roots were observed on MRI.

This case demonstrates how imaging plays a key role in detecting and monitoring NL where the outcome may affect treatment option selections.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

REFERENCES