Diffuse Neurosarcoidosis Involving Only the Leptomeninges of the Brainstem and Spinal Cord

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Abstract

MRI findings of sarcoidosis are usually intraparenchymal granuloma with leptomeningeal lesions. This appearance is dependent upon leptomeningeal lesions subsequently infiltrating to parenchyma. We describe a 52-year-old man with slowly progressive paresthesias and weakness in his legs. MRI showed diffuse leptomeningeal lesions throughout the brainstem and spinal cord without intraparenchymal lesions. A diagnosis of sarcoidosis was confirmed by cervical lymph node biopsy which detected noncaseating granuloma. Only leptomeningeal lesions throughout the brainstem and spinal cord could be observed in sarcoidosis.

Key words: neurosarcoidosis, spinal sarcoidosis, magnetic resonance imaging, leptomeningeal lesions


Introduction

Sarcoidosis is an idiopathic inflammatory systemic disease characterized by the formation of the non-caseating granulomas. The prevalence of nervous system involvement is estimated to be about 5%, and postmortem studies revealed that one-fourth of the systemic sarcoidosis patients have histological evidence of central nervous system involvement. The disease can affect the nervous system as well as the anterior uvea, lungs and lymph nodes (1). Clinical symptoms of neurosarcoidosis are headache, cranial nerve palsy, seizures, paresis and paresthesias. The diagnosis of neurosarcoidosis requires a compatible clinical picture of sarcoidosis and histological confirmation of non-caseating granuloma. In the absence of histological proof of systemic sarcoidosis, the diagnosis can be supported by typical chest radiography, whole body gallium (Ga) scanning or elevated serum angiotensin converting enzyme (ACE) levels.

MRI of the brain and spinal cord sarcoidosis is useful for a diagnosis of sarcoidosis, and is characterized by enhanced parenchymal lesions with nearby leptomeningeal lesions (2, 3). The lesion usually preferentially affects the basilar meninges of the brain and cerebral or upper thoracic spinal cord, and subsequently spread to parenchyma (2). Herein, we report a patient of neurosarcoidosis presenting peculiar lesions involving only leptomeninges throughout the brainstem and spinal cord without parenchymal lesions.

Case Report

A 52-year-old man noticed paresthesias in the distal part of his right leg, which slowly spread to both of his whole leg over 2 years. Neurological examinations showed right dominant sensory disturbances of all modalities combined with slight flexor dominant weakness and extensor plantar reflexes in his legs and urinary excretion difficulty. Cranial nervous examinations were normal in visual acuity, eye movement, facial movement and sensation, articulation, pharynx and tongue movement. His arms were normal in muscle strength and sensation. The whole spinal T2-weighted images, which were obtained two years after onset, showed neither mass lesions nor edematous lesions within the spinal cord parenchyma, whereas post-contrast T1-weighted images revealed diffuse linear enhanced leptomeningeal lesions along the spinal cord with some nodular lesions on the surface at the lumbar spinal cord, which extended to parenchyma, and the lesions extended to the lower part of the medulla oblongata (Fig. 1). Brain fluid attenuation inversion recovery (FLAIR) images showed high signal intensity lesions along the surface of the medulla oblongata, and post-contrast T1-weighted MR images showed...
Figure 1. A sagittal T2-weighted image shows no abnormal parenchymal lesions (A), but post contrast sagittal and axial T1-weighted images show diffusely enhanced leptomeningeal lesions along the spinal cord surface without parenchymal lesions (B and C). Lesions partly appear nodulous on the lumbar spinal cord (D). Note that leptomeningeal lesions spread to the lower medulla.

Discussion

Spinal cord sarcoidosis is relatively uncommon manifestation of sarcoidosis. It occurs in less than 1% of sarcoidosis cases, and often causes severe neurologic sequelae. Spinal sarcoidosis usually appears as fusiform enlargement of the spinal cord in the cervical or upper thoracic cord. It is hypothesized that spinal cord sarcoidosis progresses in four phases with possible histological stages of the disease: phase 1, early inflammation showing linear leptomeningeal enhancement after gadolinium administration along spinal cord surface; phase 2, secondary centripetal spread of the leptomeningeal inflammatory process through the Virchow-Robin spaces, showing parenchymal involvement with faint enhancement and diffuse swelling; phase 3, less prominent swelling and possible normal sized spinal cord, associated with focal or multiple enhancement; phase 4, resolution of the inflammatory process with normal size or atrophy of the spinal cord and no enhancement (5). Leptomeningeal sarcoidosis infiltration is present in up to 60% of spinal cord sarcoidosis (2). As discussed above, MRI of the spinal cord usually appears as fusiform enlargements with a high signal intensity on T2-weighted images and patchy enhancing lesions after contrast administration, accompanied by nearby thin linear and nodulous enhanced leptomeningeal lesions. A previous report of 7 patients with spinal sarcoidosis showed...
that all 7 patients had intramedullary lesions with leptomeningeal involvement (6).

The common lesion of brain sarcoidosis is multiple enhancing white matter lesions which may be mistaken for primary or metastatic tumor or tumafactive demyelination. Leptomeningeal lesion is also common in central nervous system sarcoidosis, seen in about 40-60% of cases (2, 3). This lesion usually appears as thickening and enhancement of the leptomeninges on contrast-enhanced T1-weighted MR images and there is a predilection for the basilar meninges such as hypothalamus and pituitary infundibulum (2). On brain MR imaging, parenchymal enhancing lesions are frequently associated with nearby leptomeningeal involvement and these lesions reflect a pathological feature of leptomeningeal granulomatous lesions spread along the perivascular spaces (7), which resemble the extension pattern of the granulomatous lesion of spinal sarcoidosis, as discussed above. This extension pattern is generally indistinguishable from that seen with lymphoma (8) or tuberculosis (9) involving the leptomeninges. Cranial nerve involvement may also occur along with leptomeningeal involvement although there is poor correlation between the imaging evidence of cranial nerve involvement and clinical neuropathy. Clinically, the most common cranial nerve deficit involves the facial nerve, whereas radiographically the optic nerves are most commonly abnormal (2). Hydrocephalus may occur due to altered cerebrospinal fluid absorption associated with leptomeningeal involvement, and/or due to adhesion of the ventricular system caused by leptomeningeal involvement.

The present case showed a unique distribution pattern of neurosarcoidosis lesion which was characterized by diffuse leptomeningeal lesions involved throughout the brainstem and spinal cord without apparent parenchymal lesions on post contrast MR images. It is uncertain why granulomatous sarcoidosis lesions in the present case affect only diffuse leptomeninges without parenchymal lesions. There might be “benign” sarcoidosis in which only a few granulomatous lesions infiltrate parenchyma. If lesions involving leptomeninges are found, which are similar to the present case, sarcoidosis should be listed as one of differential diagnoses, as well as tuberculosis, fungal meningitis, Wegener’s granulomatosis, leptomeningeal lymphoma, leptomeningeal carcinomatosis (10).

It is notable that only $^{18}$F-FDG PET could detect granulomatous lesions whereas $^{67}$Ga scintigraphy revealed no accumulation in our case. A previous study has reported that $^{18}$F-FDG PET detects active granulomatous foci with a higher sensitivity (87%) than $^{67}$Ga scintigraphy (67%) in patients with sarcoidosis (11). Inflammatory cells such as activated macrophages and neutrophil increase $^{18}$F-FDG uptake, causing important tracer accumulation in inflammatory process including sarcoidosis. In addition, accumulations of $^{18}$F-FDG was decreased or disappeared after oral prednisolone administration in assessing therapeutic efficacy (11). $^{18}$F-FDG PET is useful to detect sensitively active granulomatous foci, and is also a feasible tool to evaluate the effect of

![Figure 2. A sagittal FLAIR image shows diffuse high intensity lesions along the surface of the medulla oblongata and the upper cervical cord (A). Post contrast T1-weighted images reveal that these lesions are enhanced, however there were no intraparenchymal lesions (B and C).](image-url)
treatment.

In the present case, sensory disturbance combined with mild flexor dominant weakness and extensor plantar reflexes were observed in his legs. Urinary disturbance showed excretion disturbance probably due to contraction failure of the bladder detrusor muscle which might be caused by the pelvic nerve lesions. Furthermore, leptomeningeal lesions probably infiltrated the spinal cord parenchyma without obvious edema, partly affecting the corticospinal tract at the cervical or thoracic spinal cord. The neurological disturbances of the present case are considered to be caused by myeloradiculopathy involving the whole spinal cord.

In general, CSF findings of neurosarcoidosis are nonspecific, and sometimes there are mild pleocytosis, high protein concentration, and slight low glucose concentration (1). For example, in the previous case report of histologically proven neurosarcoidosis (12), the CSF glucose concentration was decreased (11-40 mg/dL). Lymphocytic pleocytosis with a low glucose concentration found in the presented case generally provokes suspicion of the diagnosis of tuberculosis, fungal infection and leptomeningeal carcinomatosis. Repeated CSF culture was negative for microorganism including mycobacterium tuberculosis and fungus, and repeated PCR analysis of CSF was negative for tuberculosis, and repeated CSF cytology was negative for malignant cells. Furthermore, regarding the clinical course, tuberculosis and fungal infection and leptomeningeal carcinomatosis usually show faster progression of neurologic symptoms than the present case with duration of two years. It was convinced that the diagnosis of tuberculosis and leptomeningeal carcinomatosis was successfully ruled out.

In conclusion, the present patient is characterized by peculiar diffuse lesions involving the leptomeninges throughout the spinal cord and the brainstem without parenchymal lesions. \textsuperscript{18}F-FDG PET may be a useful tool to improve the early diagnosis of sarcoidosis.

References

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