# Clinical and Neuroimaging Features of Sarcoid Associated Myelopathy


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## Introduction

Sarcoidosis is a multisystem granulomatous disorder of unknown etiology that affects individuals worldwide. It is characterized pathologically by the presence of non-caseating granulomas in involved organs. In sarcoidosis, granulomatous disease involves mostly lungs and lymph nodes but other organs may be affected. Neurosarcoidosis (NSC), the clinical involvement of the nervous system occurs approximately in 5-10% of patients with sarcoidosis, and granulomatous inflammation, may affect the meninges, hypothalamus, pituitary gland, and cranial nerves. Although NSC is often suspected in patients with systemic sarcoidosis who develop neurological symptoms, approximately half of patients with neurological involvement present as new onset sarcoidosis, which makes it difficult to diagnose as NSC. Spinal sarcoidosis is a rare manifestation of the disease appearing as intramedullary, intradural extramedullary or extradural lesions as well as cauda equina syndrome, and arachnoiditis. The main goal of our study is to present the clinical, neuroimaging and natural history features of a large series of patients with spinal cord NSC.

## Material and Methods

This is a descriptive retrospective analysis of patients with myelopathic forms of NSC diagnosed and followed at the Johns Hopkins Transverse Myelitis Center, from 2000 to August 2012. The diagnosis of neurosarcoidosis was based on the Johns Hopkins diagnostic criteria. Patients with definite, probable and possible diagnosis of NSC and myelopathic forms were included. The clinical and neurological profile, diagnostic imaging, CSF and laboratory findings were evaluated. Particular attention was given to the temporal evolution of symptoms and presentation (e.g., hyperacute <6 hours; acute 6-48 hours; Subacute 48 hours-21 days; chronic >21 days), clinical manifestation (e.g., motor, sensory or sphincters involvement) and overlap with other neurological involvement (e.g., cranial nerves, meningitis, and encephalitis). The disability outcome was determined by the ASIA scale in the outpatient clinic as a minimum six months after the first manifestation of myelitis, the pattern of relapses and cause of relapses in those patients with at least 18 months of follow up. The magnitude, extension and level of spinal cord involvement were based on examination of the MRIs available or description by the medical records. We extracted the characteristic of the CSF when available and analyzed the cytochemical characteristics as well as oligoclonal band and IgG index when possible.

**TABLE 1. Johns Hopkins criteria for Neurosarcoidosis**

| | |
|---|---|
| **1-Definite:** | Clinical neurological syndrome supported by histologic documentation in nervous tissue of inflammatory changes consistent with granulomatous inflammatory disease<br>and<br>Exclusion of other pathologies associated to neoplastic, rheumatologic or neurological infectious diseases by CT scan or FDG-PET scan and/or serological studies. |
| **2-Probable:** | Clinical neurological syndrome supported by findings in MRI and/or CSF and plus:<br>a- Histologic evidence of sarcoidosis in other organ.<br>b- Exclusion of other pathologies such as rheumatologic or neurological infectious diseases by CT scan or FDG-PET scan and/or serological studies. |
| **3-Possible:** | Clinical neurological syndrome supported by findings in MRI and/or CSF and plus:<br>a- Clinical systemic involvement suggestive of sarcoidosis without histologic confirmation<br>b- - Exclusion of other pathologies such as rheumatologic or neurological infectious diseases by CT scan or FDG-PET scan and/or serological studies. |
| **4-Suspected:** | Clinical neurological syndrome supported by findings in MRI and/or CSF and plus:<br>a-Not clear evidence of systemic involvement suggestive of sarcoidosis<br>b-- Exclusion of other pathologies such as rheumatologic or neurological infectious diseases by CT scan or FDG-PET scan and/or serological studies. |


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## Results

**Table 2. Clinical Profile**

| Demographics Characteristics | Number (%) |
|---|---|
| Patients | 49 (100%) |
| Age (median) | 48.3 (range 33-67) |
| Gender | |
| •Male | 26 (53.1) |
| Ethnicity | |
| •White | 18 (36.8) |
| •Afro-American | 31 (63.3) |
| **Temporal Profile** | |
| •Hyperacute | 0 |
| •Acute | 4 (8.2) |
| •Subacute | 5 (10.2) |
| •Chronic | 40 (81.6) |
| **Diagnosis** | |
| •Definite | 5 (10.2) |
| •Probable | 39 (79.6) |
| •Possible | 5 (10.2) |
| **First presenting symptoms** | |
| •Sensitive | 30 (61.2) |
| •Motor | 23 (46.9) |
| •Sphincter | 5 (10.2) |
| **Other associated neurosarcoidosis syndromes** | |
| •Isolated myelopathy | 25 (51) |
| •Encephalitic | 14 (28.6) |
| •Cranial neuropathy | 13 (26.5) |
| •Meningeal | 8 (16.3) |
| •Neuro-endocrinologic | 6 (12.2) |
| •Peripheral nervous system | 4 (8.2) |
| **Other organ involved** | |
| •Lung and/or perihilar lymph nodes | 38 (77.5) |
| •Skin | 4 (8.2) |
| •Testicles | 4 (8.2) |
| •Gastrointestinal | 2 (4.1) |
| •Eyes | 1 (2.0) |
| **Period between systemic manifestations and onset of neurological manifestations (12 patients)*** | 106 months (324-6) |
| **Myelopathy as a first manifestation of neurosarcoidosis** | 42 (85.7) |
| **Neurosarcoidosis as first manifestation of sarcoidosis** | 37 (75.5) |
| **ASIA SCORE** | |
| • A | 5 (10.2) |
| • B | 5 (10.2) |
| • C | 18 (36.7) |
| • D | 16 (32.6) |
| • E | 5 (10.2) |

**Table 3. MRI characteristic of 31 acute patients**

| Spinal Cord Lesion Characteristic | N (%) | Spinal cord distribution | | | leptomeningitis | |
|---|---|---|---|---|---|---|
| | | Diff | CC | PL | lamellar | nodular |
| Longitudinal extensive (LE) | 14 | 2 | 9 | 3 | 4 | 3 |
| • Tumefactive | 8 | 1 | 7 | 0 | 3 | 2 |
| • Non-tumefactive | 6 | 1 | 2 | 3 | 1 | 1 |
| Non-LE | 17 | 4 | 3 | 11 | 6 | 7 |
| • Monofocal | 8 | 1 | 2 | 5 | 3 | 0 |
| • Patchy | 9 | 3 | 0 | 6 | 3 | 7 |

**Figure 1. Frequency of lesion localization based on vertebral level**

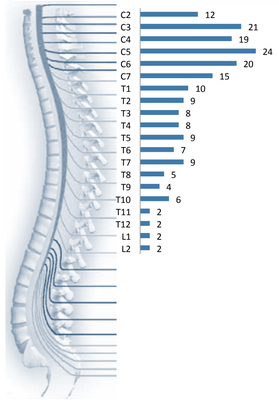



**Figure 2. Patients followed up more than 18 months**

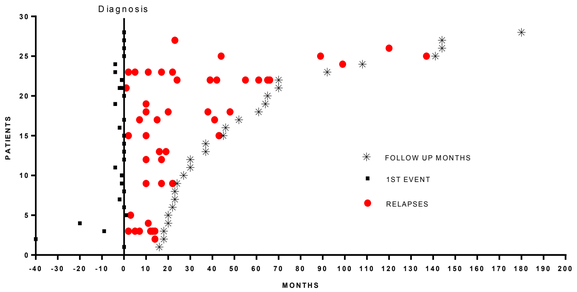
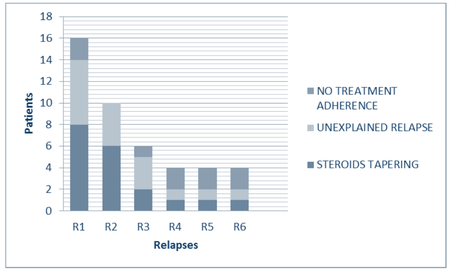



**Figure 3. Suspected cause of the relapsing disease**



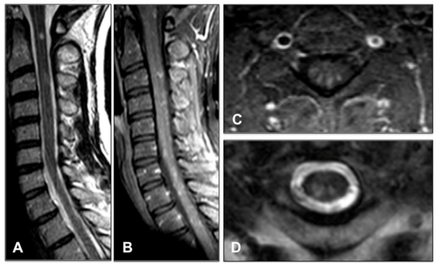




Fig 4. A sagittal T2w image, B sagittal contrast enhanced STIR image, C axial enhanced STIR image and D axial T2w image, showing multifocal spinal cord lesions and patchy enhancement pattern.

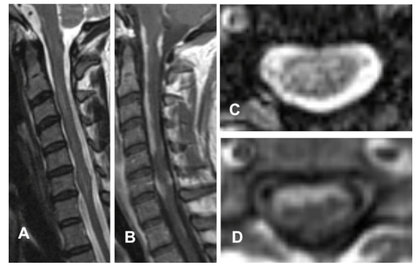



Fig 5. A sagittal T2w image, B sagittal contrast enhanced T1w image, C axial T2w image and D axial enhanced T1w image, showing spinal cord intensity changes, cord edema and meningeal thickening with contrast enhancement.

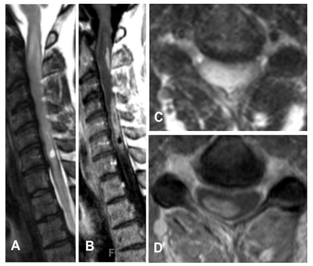



Fig 6. A sagittal T2w image, B sagittal contrast enhanced T1w image, C axial enhanced T1w image and D axial T2w image, showing a tumefactive spinal cord lesion.

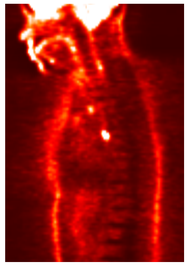


Fig 7. Sagittal FDG-PET-CT scan showing radiotracer uptake in spinal cord and lymph nodes.

## Conclusions

- **The clinical profile of spinal cord sarcoidosis is predominantly a chronic, progressive myelopathy and principally manifests with sensitive symptoms.**
- **Usually one of two MRI patterns are identified, a tumefactive central cord lesion or patchy multilevel lesions, almost all of them with contrast enhancement during the symptomatic phase and some with nodular meningeal enhancement.**
- **In this series of patients neuroarcoidosis was diagnosed as a first manifestation of sarcoidosis in 75% of the cases and in 85.7%, myelopathy was the first manifestation of the disease.**
- **Most patients with neurosarcoidosis showed abnormalities in standard CSF analysis. Specific pattern were not found, but in most of them we observed a lymphocytic predominant pleocytosis with increased proteinorachia**
- **In most of the cases the relapses were presented during the steroids tapering or were due to lack of adherence to the immunosuppressive treatment.**