NEUROSARCOIDOSIS: A PATIENT’S JOURNEY

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Outline

• Brief initial patient presentation
• Review Anatomy of the Ventricular system and Cisterns
• Radiologic Tests for Evaluating Neurosarcoidosis
• Highlight Patient’s course through presentation and diagnosis
• Brief review of Sarcoidosis and different organ manifestations
• Brief overview Neurosarcoidosis and typical presentations
• Discuss Differential diagnosis of Neurosarcoidosis
• Discuss criteria for diagnosis of Neurosarcoidosis
• Treatment of Neurosarcoidosis and patient’s outcome
Initial Patient Presentation

40 year old woman presents with 5 days of dizziness, headache with associated confusion, nausea and vomiting. Denies double or blurry vision, numbness, weakness or tingling.

PMH: Vestibular Neuritis, Depression

Physical Exam: Vitals signs are normal. Exam notable for lethargy but easily arousable. Non focal neurological examination.

CBC and metabolic panel are normal.
Anatomy of the Ventricle

Felten et al 2015

Lee and Srinivasan 2014
Anatomy of the Subarachnoid Cisterns

Felten et al 2015

Felten et al 2015
Our Patient: Hydrocephalus on Head CT

1. There is severe dilation of the lateral ventricles, and global effacement of sulci consistent with severe hydrocephalus

2. There is also periventricular white matter hypodensities representing transependymal migration of CSF due to acute dilation and increased pressures in ventricles

3. No definite obstructing mass seen
Our Patient: MRI s/p VP Shunt

1. Marked decreased enlargement of lateral ventricles post shunt placement

2. VP Shunt tip seen in right lateral ventricle
Second Presentation of Our Patient

- 7 months later, our 42 year old patient with history of hydrocephalus s/p VP shunt placement now presents with progressive cognitive decline, gait difficulties, and intermittent diplopia for several weeks.

- MRI of Head was obtained

- After imaging, Lumbar puncture was obtained with CSF findings remarkable for lymphocytic pleocytosis, low glucose and high protein. CSF showed negative culture and normal ACE levels.
Our Patient: MRI showing Leptomeningeal enhancements

Contrast-enhanced Axial T1 weighted images

Extensive nodular leptomeningeal enhancements in bilateral Sylvian fissures, along subarachnoid cisterns.
Our Patient: MRI showing Leptomeningeal enhancements

Contrast-enhanced Sagittal T1-weighted

Extensive nodular enhancements along the cerebellar folia and subarachnoid cisterns adjacent to brain stem. Not shown in this image are enhancements in the third and fourth ventricles.
Differential Diagnosis of Leptomeningeal Enhancements

• Leptomeningeal Carcinomatosis (from carcinoma of breast, lung, melanoma)
• Leptomeningeal Lymphomatosis (from Lymphoma)
• Bacterial Meningitis
• Viral Meningitis
• HIV Meningitis
• Tuberculous Meningitis
• CNS Cryptococcus
• Neurosyphilis
• Neurosarcoidosis
Menu of Radiologic Tests for diagnosis

- Radiographs
- CT
- MRI
- MRCP
- PET-CT
Our Patient: Normal Chest Radiograph

There are NO opacities, nodules, hilar lymphadenopathy, pleural effusion.
Our Patient: Normal Chest CT

There are NO hilar or mediastinal lymphadenopathy, no nodules or masses in the lungs.
Our Patient: Lesion in Periportal Area on CT Abdomen

There is a 1.5 cm by 2.7 cm well-circumscribed hypodense cystic lesion within the porta hepatitis.

There is an enlargement of the aortocaval lymph node.
Because the periportal lesion seen on CT Abdomen was difficult to characterize, MRCP was recommended and obtained.
Our Patient: Normal Biliary System seen on MRCP

There is no intra or extrahepatic biliary duct dilation. The gallbladder is normal. No stones are identified.
There are enlarged lymph nodes in the periportal area and in gastrohepatic ligament.
Our Patient: Focal Lesions along Spinal Nerve Roots

There are T2 hypointense foci along the nerve roots in the lumbar spine.
Given concerning focal lesions seen on MRCP, whole spine MRI was obtained.
Our Patient: Nodular Lesions on Lumbar Spine

MRI

Sagittal T2-weighted

Sagittal T1-weighted post contrast

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There are multiple nodular **enhancing** lesions along cord and cauda equina.
Our Patient: Nodular lesions on Cerv./Thor. Spine MRI

There are extensive nodular enhancing lesions along the cervical and thoracic spinal cords. No cord compression.

Cervical Sagittal T1 weighted post contrast
Cervical Sagittal T2 weighted
Thoracic Sagittal T1 weighted post contrast
Thoracic Sagittal T2 weighted

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Given leptomeningeal enhancements on imaging, leptomeningeal carcinomatosis from a primary malignancy needed to be ruled out. Lung, pancreatic and colon cancers were unlikely based on CT and MRI obtained. Full skin exam was negative for melanoma-like lesions.

A diagnostic Mammogram was ordered to assess her breast for any malignancy.
Our Patient: Normal Diagnostic Mammogram

There is no dominant mass, unexplained architectural distortion or suspicious grouped microcalcifications. No evidence of malignancy. Bi-
To further evaluate for any metastatic processes, PET-CT was obtained
Our Patient: FDG avid Lymphadenopathy on PET-CT

There are periportal, gastrohepatic and aortocaval lymphadenopathy with increased FDG.
Increased FDG avidity is seen throughout the course of the spinal cord extending from the cervical cord down to the cauda equina, consistent with leptomeningeal disease as characterized by the prior MRI.
Summary of Imaging Findings

• Extensive nodular enhancements in leptomeninges of brain and throughout spinal cord seen on MRI, and lymphadenopathy in periportal, gastrohepatic and aortocaval areas with increased FDG uptake on PET-CT in those nodes.

• CT-guided biopsy of periportal lymph nodes was obtained
Under CT guidance, a **19 gauge coaxial needle** was introduced into the lesion. An 20 gauge core biopsy device with a 11 mm throw was used to obtain four core biopsy specimens, which were sent to pathology.
Our Patient: Periportal Lymph Node Biopsy Result

- Periportal Lymph Node Biopsy showed Non-Necrotizing Granulomas.

- Biopsy was negative for fungal infections and lymphoma.
Companion slide: Photomicrographs (H&E 20X) in a patient with Neurosarcoidosis reveal leptomeningeal inflammation (arrowheads) and granuloma formation (arrows) (a) along with perivascular spread of the disease (arrowheads) (b).
Sarcoidosis

• Idiopathic non-infectious inflammatory disorder characterized by formation of non-caseating granulomas
• Commonly affects African-Americans and persons of Scandinavian descent.
• Female predominance, often seen in females between ages of 30-40s.
• Pathophysiology is still elusive but may involve an antigen provoked inflammatory response with CD4 lymphocyte predominance. CD4+ T cells interact with APC to form and maintain granulomas.
• Multisystem disorder with varying presentations depending on organ(s) involved
Companion Patients: Radiologic Manifestations of sarcoidosis

Pulmonary Sarcoidosis. Chest radiograph showing Bilateral Hilar lymphadenopathy (arrows)

Ocular Sarcoidosis: Axial contrast-enhanced fat-suppressed T1-weighted MR image shows diffuse, prominent enhancement of the lacrimal glands (arrows).

Splenic Sarcoidosis. Contrast-enhanced abdominal CT scan shows multiple, hypoattenuating nodules scattered diffusely throughout the spleen.

Hepatic Sarcoidosis. Contrast-enhanced abdominal CT scan shows multiple, irregularly shaped nodules of variable size in the liver.
Muscle Sarcoidosis. T2-weighted and contrast-enhanced MR images demonstrate a nodular type muscle lesion (arrows), with a central area of decreased signal intensity and periphery demonstrating prominent enhancement.

Bone sarcoidosis. Close-up view from a radiograph of the right hand reveals a radiolucent lesion in the middle phalanx of the third finger. The lesion has a lacelike appearance and is accompanied by a soft-tissue mass (arrowheads).

Neurosarcoidosis

• Neurosarcoidosis occurs in 5-15% of those with sarcoidosis.

• It may represent the first manifestation of sarcoidosis.

• Presentation of neurosarcoidosis varies widely depending on the part of CNS involved.

• Presenting signs and symptoms include: seizures, meningitis, hydrocephalus, peripheral neuropathy, psychiatric symptoms, endocrinal disturbances.
Companion Patients: Radiologic Manifestations of Neurosarcoidosis

Intraparenchymal. Solitary Granulomatous Lesion on Axial T2WI

Contrast-enhanced sagittal T1WI reveals diffuse thickening and enhancement involving the pituitary–infundibulum–hypothalamus axis (arrow), extending posteriorly along the clivus (arrowhead).

Cranial Nerve Involvement. Contrast-enhanced axial T1WIs reveals diffuse thickening and enhancement of bilateral optic (arrowheads in a) and trigeminal nerves (arrows in b).

Differential diagnosis for Neurosarcoidosis

(1) Infectious diseases: Tuberculosis, Progressive multifocal leukoencephalopathy

(2) Granulomatous diseases: GPA, Churg–Strauss syndrome

(3) Tumors: Neurolymphomas, Meningioma, Leptomeningeal metastases

(4) Vasculopathies: Vasculitis, Behcet’s disease

(5) Systemic diseases: Amyloidosis

(6) Neurological diseases: Multiple sclerosis, Acute demyelinating encephalomyelitis
Diagnostic criteria for neurosarcoidosis

Zajicek criteria

I. Definite diagnosis if presence of positive nervous system histology

II. Probable diagnosis if evidence of CNS inflammation on MRI or CSF AND positive histology for a systemic lesion, or at least 2 positive tests on indirect indicators such as chest films, FDG-PET, Gallium scan, serum ACE.

III. Possible diagnosis if above criteria are not met but other inflammatory pathologies were ruled out.

Treatment for Neurosarcoidosis

• Corticosteroids are the drugs of first choice.
• Immunomodulating and cytotoxic agents such as Methotrexate, Cyclophosphamide, Azathioprine, Infliximab.
• When refractory to medications, neurosurgery and radiation therapy may be appropriate for certain lesions.
Our Patient’s Outcome

• Imaging findings of CNS leptomeningeal enhancements and positive histology of Sarcoidosis in lymph nodes were consistent with a probable diagnosis of Neurosarcoidosis according to Zajicek criteria

• Our patient received corticosteroids with some resolution of her symptoms.
Conclusion

• Examined a case from presentation to diagnosis of Neurosarcoidosis
• Reviewed Anatomy of the Ventricular system and Cisterns Menu of Radiologic Tests for Evaluating Neurosarcoidosis
• Discussed Sarcoidosis and different organ manifestations
• Brief Overview of Neurosarcoidosis and typical presentations
• Listed differential diagnosis of Neurosarcoidosis
• Listed criteria for diagnosis of Neurosarcoidosis
• Treatment of Neurosarcoidosis and patient’s outcome
References

• Lee TC, Mukundan S. Netter’s Correlative Imaging: Neuroanatomy 2014.
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