

# Multiple Sclerosis Presenting with Bilateral INO in a Patient with History of Dural Arteriovenous Fistula, Neurocysticercosis and Implanted Cardiac Pacemaker

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## Introduction

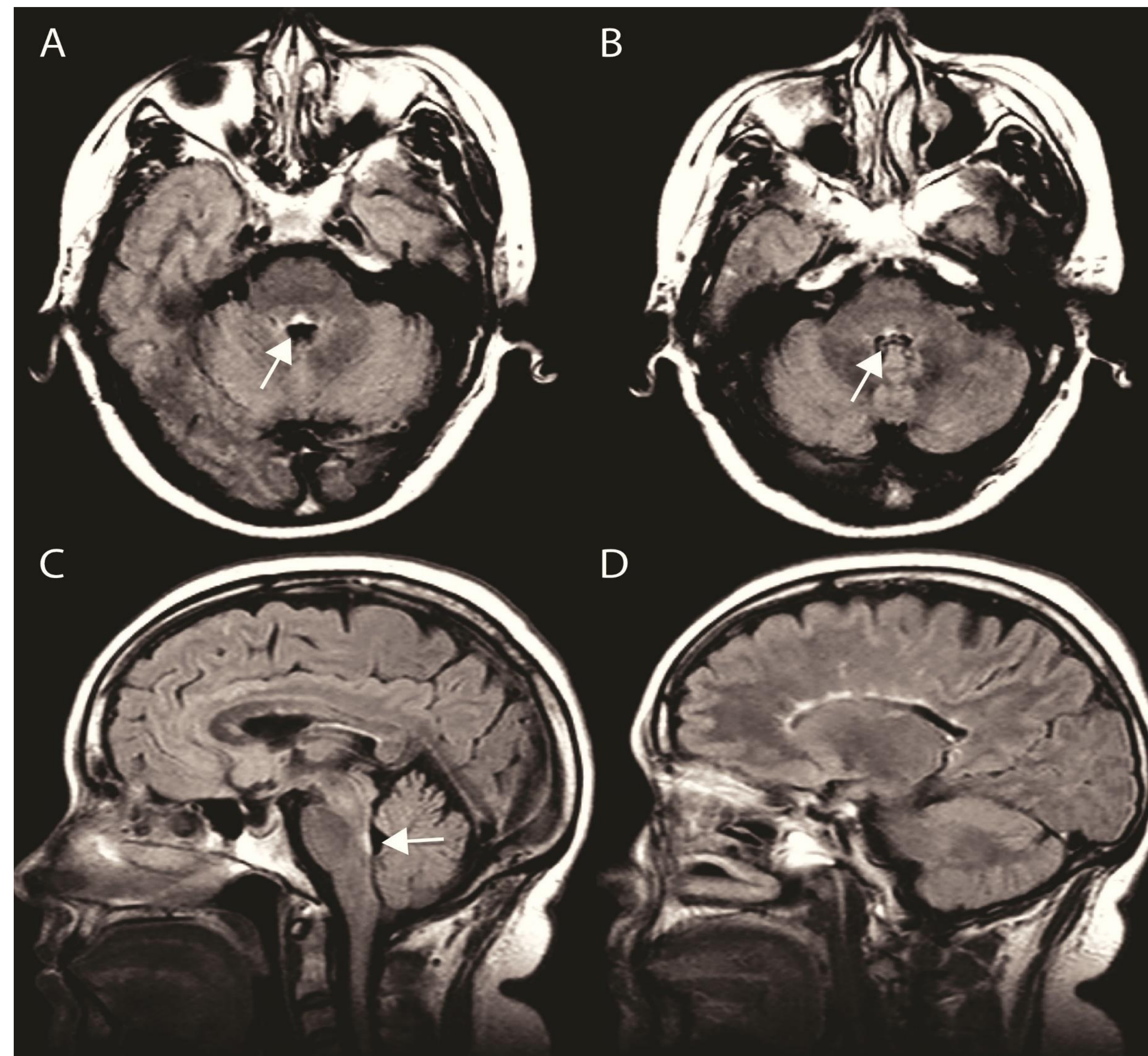
- Internuclear ophthalmoplegia (INO) results in the slowing, limitation or inability to adduct one eye associated with nystagmus in the abducting eye and is caused by a lesion in the medial longitudinal fasciculus.
- While history is crucial (age, acuity of onset, comorbidities), brain magnetic resonance imaging (MRI) is the diagnostic test of choice for determining the underlying cause.

## Case presentation

- A 39 year-old woman with past history of neurocysticercosis and a sub-arachnoid hemorrhage secondary to a dural arteriovenous fistula (DAVF), presented with sudden onset vertigo and bilateral INO.
- 5 years ago, after presenting with left body numbness, she was diagnosed with neurocysticercosis. 4 years before the current presentation, she was diagnosed with intracranial dural arteriovenous fistula after presenting with a severe headache due to subarachnoid hemorrhage.
- Sudden onset of symptoms along with her history of DAVF status post endovascular and surgical intervention raised our suspicion for an acute vascular event.
- Head CT and CT angiography were unremarkable.
- After collaboration with colleagues from cardiology and radiology departments, a brain MRI was obtained and was supportive of a diagnosis of multiple sclerosis.

**Table 1. Causes of internuclear ophthalmoplegia (INO)**

<b>Multiple sclerosis:</b> often bilateral
<b>Ischemic stroke:</b> usually unilateral
<b>Infectious:</b> syphilis, Lyme, Whipple, AIDS, cysticercosis, brucellosis, meningitis or encephalitis
<b>Metabolic:</b> Wernicke or hepatic encephalopathy, maple syrup urine disease, Fabry disease
<b>Autoimmune:</b> vasculitis, brainstem encephalitis/paraneoplastic
<b>Head trauma</b>
<b>Herniation:</b> usually secondary to epidural, subdural, or intraparenchymal hematomas
<b>Brainstem of fourth ventricle tumors or vascular malformations</b>
<b>Drug intoxications:</b> phenothiazines, tricyclic antidepressants
<b>INO mimics:</b> Miller-Fisher syndrome, myasthenia gravis or other neuromuscular disorder



Brain magnetic resonance imaging of our patient with a pacemaker who presented with bilateral internuclear ophthalmoplegia. Fluid attenuated inversion recovery sequences are shown. Arrows indicate lesion. A and B) Consecutive axial views through the pons revealing bilateral T2 hyperintensities within the posterior pons that involve both medial longitudinal fasciculi. C) Sagittal view through the brainstem. The demyelinating lesion extends approximately 7mm. D) Sagittal view demonstrating multiple periventricular T2 hyperintensities consistent with demyelination.

## Important elements of a protocol for obtaining MRI in a patient with cardiovascular implantable electronic devices

information obtained should be important and only obtainable through an MRI scan

Documenting informed consent

Pacemaker-dependent patients' pacemakers programmed to asynchronous pacing

Nonpacemaker-dependent patients' pacemakers programmed to monitor-only mode

Use of a transmit-receive coil where possible

Continuous monitoring during the scan

Interrogation of the device immediately prior to and after the scan

Scan time limited to the minimum amount

Presence of a person experienced in device programming

Presence of personnel trained in advanced cardiac life support

## Discussion

- INO is caused by a lesion in the internuclear component of ocular motor system, traversing in the medial longitudinal fasciculus (MLF) and connecting the abducens nerve nucleus to the subnucleus of the medial rectus in the nuclear complex of the third cranial nerve.
- Stroke and demyelinating disorders (most commonly multiple sclerosis (MS)) are the most common causes of INO. Stroke is the most common cause of unilateral INO and MS is the most common cause of bilateral INO. Stroke is more common in patients older than 45, while MS is more common in those younger than 45.
- Brain MRI is the best tool for differentiating between ischemic stroke and MS.
- MRI is relatively contraindicated for patients with standard PMs. Radiofrequency field, static magnetic field and gradient magnetic field can potentially cause movement of device and fracture or dislodgment of the leads, lead tip heating, current induction, over and under sensing and permanent device damage.
- Brain MRI can be performed in selected group of patients with cardiac pacemaker when the information obtained from the MRI would change the clinical management

## References

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