

Absent Inferior Vena Cava resulting in Exercised Induced Epidural Venous Plexus Congestion



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BACKGROUND: Epidural venous abnormalities are a relatively rare etiology for nerve root compression syndromes. Such cases have been described in patients with absent inferior vena cava secondary to thrombosis. We are unaware of any previously described cases of absent inferior vena cava with a primary route of venous return through the epidural venous plexus, resulting in symptoms in the absence of thrombosis.

OBJECTIVE: To describe a unique etiology for a patient presenting with exercise induced lower extremity numbness found to have agenesis of the infrarenal inferior vena cava and a large vein draining the confluence of the iliac veins through the L4-L5 foramen into the epidural plexus.

METHODS: A 34-year-old male military officer presented to a hospital-based chiropractic clinic with complaint of six years of exercise induced numbness of his lower extremity. He experienced this anesthesia in bilateral toes which gradually extended up his lower extremities to involve his perineal region at which point he would discontinue exercising. Decreased control of distal lower extremity muscle groups was also reported during these episodes. After ten minutes of rest, his symptoms would completely resolve. His military career necessitated his continuance of running despite these symptoms. After six years of these symptoms, he also developed symptoms of sciatica which prompted his chiropractic appointment. The patient acknowledged one episode of fecal incontinence and mild urinary retention. On presentation his exam was benign and he had no other known medical problems. An MRI was ordered and a referral to neurosurgery was made.

The MRI showed absence of the infrarenal IVC and no evidence of thrombosis. The bilateral common iliac veins joined to form an anomalous draining vein which ascended to the L4 level where it entered the L4-L5 vertebral foramen and drained into the epidural plexus. This vein also had communication with the zygous system. Neuroradiology recommended functional MRI studies to compare pre and post-exercise size of the epidural plexus. The patient was placed supine for 30 minutes in the MRI suite and then a gadolinium-enhanced MRI of the lumbosacral spine was performed to determine the baseline size of the plexus. After this scan the patient exercised with a recumbent bicycle that had been transported to the MRI suite until symptomatic. Immediately following exercise a subsequent gadolinium-enhanced MRI was performed for comparison. The study prior to exercise displayed congestion of the epidural veins. After exercise there was a notable increase in the volume of the plexus, and the caliber of the thecal sac was reduced by greater than 50%. This was best appreciated by comparing equivalent post-gadolinium T1-weighted axial images.

RESULTS: Post-exercise MRI showed notable increase in the volume of the epidural venous plexus of the lower lumbar spine. The increased post-exercise volume was sufficient to reduce the caliber of the thecal sac by more than 50%. The patient was referred to neurosurgery and vascular surgery which did not intervene.

CONCLUSION: This case demonstrates the breadth of anatomical and physiological understanding a clinician must draw on when approaching patients with nerve root compression symptoms.

DISCUSSION: Absent IVC resulting in epidural venous plexus engorgement is a rare cause of nerve root compression syndrome. However, other phenomena can cause symptomatic epidural venous plexus enlargement. These include vascular malformations,¹⁴ superior vena cava or IVC thrombosis,¹⁵ Budd-Chiari syndrome,¹⁶ portal hypertension,¹⁷ intracranial hypotension,¹⁸ pregnancy,¹⁹⁻²⁰ and abdominal malignancy.¹⁵ The epidural plexus system has no valves, allowing much collateral flow. This, however, predisposes to congestion and engorgement of the plexus. Hanley et al described the three observed variants of epidural plexus engorgement as:

1. Thrombosed dilated epidural vein
2. Patent dilated epidural vein
3. Submembranous, epidural contained hematoma

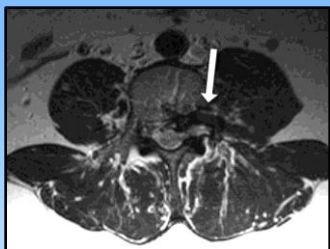
Gadolinium-enhanced MR imaging is the best modality to differentiate these entities from each other and from other causes of nerve root compression syndrome.¹ The actual mechanism producing the symptoms may not be direct nerve root compression from distended veins, but possibly ischemia caused by the venous congestion.²¹ Cauda equina symptoms have only been described in three other cases of absent IVC,²² and these in the presence of thrombosis.²¹⁻²³ Although rare, a study of 9640 patients who received lumbar MRIs to evaluate back pain and sciatica revealed engorgement of epidural venous plexus causing nerve root compression in 0.13% of cases.¹⁵ It is possible for a busy spinal care practitioner to see this condition several times in a career.

Acknowledgements

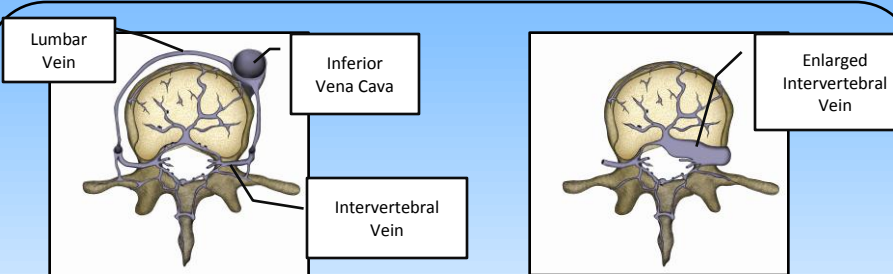
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Axial MRI image of the L4 vertebra. Note the enlarged intervertebral vein identified by the white arrow.



Normal anatomical relationships of venous drainage and the L4 vertebra.

Schematic of the anomalous anatomy presented in this case report. Note the absence of the inferior vena cava and engorgement of the intervertebral vein.



Sagittal image of the lumbar spine revealing dilation of the intervertebral vein and congestion of the epidural plexus. The enlarged intervertebral vein is visible at the L4-5 interspace (a disc remnant is visible between S1 and S2 indicating transitional anatomy).



Sagittal image of the lumbar spine taken after patient had laid supine for 30 minutes in the MRI suite.



Sagittal view of the lumbar spine taken immediately following exercising on a recumbent exercise bike until symptomatic, twenty minutes. Note the congestion of the epidural veins identified by white arrows.