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Lumbar Spinal Stenosis with Exacerbation of Back Pain with Extension: Potential Contraindication For Supine MRI With Sedation

Alan Kuramoto¹, Linda Chang², Jon Graham³, and Stephen Holmes⁴

¹John A. Burns School of Medicine, University of Hawaii at Manoa, Honolulu, HI, 96813

²Department of Medicine, Division of Neurology, John A. Burns School of Medicine, University of Hawaii at Manoa, and The Queen's Medical Center, Honolulu, HI, 96813

³Surgery Department, The Queen's Medical Center, Honolulu, HI, 96813

⁴Imaging Department, The Queen's Medical Center, Honolulu, HI, 96813

Abstract

A 71-year-old male with lumbar spinal stenosis developed exacerbation of lower back pain and leg paresthesias while attempting to undergo a spinal MRI scan in the supine position. After undergoing sedation for the MRI, he developed an acute cauda equina syndrome that required surgical decompression. MRI may be contraindicated in the supine position for patients with spinal stenosis and back pain exacerbated by mild to moderate extension, since it may further compress the neural tissue.

Keywords

spinal stenosis; cauda equina syndrome; MRI

INTRODUCTION

Lumbar spinal stenosis is a narrowing of the spinal canal by a combination of bone and soft tissues resulting in mechanical compression of nerve root canals or tunnels of the intervertebral foramina, leading to symptoms of radiculopathy, claudication, or other neurologic symptoms [1,2]. The condition can be inherited or acquired. Inherited or primary spinal stenosis is rare and presents between ages 30 and 40 years. Causes include congenital lumbar stenosis, scoliosis, and achondroplasia. Acquired or secondary spinal stenosis typically results from degenerative changes, posttraumatic, iatrogenic, or metabolic causes, involving bone and/or ligament hypertrophy, and occurs during the fifth and sixth decades of life.

Symptoms are categorized as either neurogenic intermittent claudication or radiculopathy. Neurogenic claudication involves pain, paresthesias, and cramping of one or both extremities exacerbated by standing or walking and relieved by leaning forward, crouching, or sitting [3]. These symptoms likely result from mechanical irritation of the cauda equina or exercise-induced ischemia of the cauda equina. Radiculopathy produces symptoms of

Please address all correspondences to: Linda Chang, M.D., Dept. of Medicine, John A. Burns School of Medicine, The Queen's Medical Center University Tower, 1356 Lusitana Street, Honolulu, HI 96813, Tel: (808) 586-7468; FAX (808) 586-7486; lchang@hawaii.edu.

weakness, sensory loss, reflex loss, and sharp, burning pain that radiates in a dermatomal distribution as a result of nerve root impingement or irritation.

New onset low back pain in an older individual (>50 years) or neurologic symptoms consistent with disease of the lumbosacral spine are considered indications for a neuroimaging study. Plain radiographs are fast, simple, and can lend support for the diagnosis of lumbar canal stenosis and reveal underlying bony pathology, but lack detail of soft tissues and neural elements. Computed tomography (CT) may in fact, be preferable to MRI for bony anatomy [4,5]; however, MRI remains the modality of choice for diagnosis, as it defines bony anatomy, soft tissues, and neural structures such as the conus medullaris and spinal nerve roots both within the canal and the neural foramina with little risk of complications. For these reasons, MRI remains the gold standard in evaluation of spinal cord stenosis, and serious complications of non-contrast imaging have rarely been reported. Here, we present a case of lumbar canal stenosis which showed paraplegia.

CASE REPORT

A 71 year-old male with a history of cervical and lumbar stenosis, presented with symptoms of quadriparesis due to cervical myelopathy. He underwent C4-5 anterior discectomy and fusion with significant improvement, and was able to resume ambulation. One year later, he noted bilateral leg weakness and buttock pain, due to the worsening of his lumbar stenosis. The symptoms progressed and he was not able to ambulate more than 5–10 feet. On lumbosacral MRI, he had significant spinal stenosis, most severe at L4-5, and less severe at L3-4 and L5-S1 (Figure 1A, 1B and Figure 2). The patient then underwent minimally invasive decompression at these levels, after which he slowly improved and was able to ambulate with assistance. While undergoing physical therapy, he noted increased back pain associated with back extension range of motion exercises. On examination, despite his complaints of bilateral leg weakness, he demonstrated normal motor function, but loss of fine touch and position sense in the bilateral lower extremities below the L2 level (including the anterior surface of the thigh), and bilateral babinski responses, trace ankle jerk and 4+ knee jerk reflexes. Upper extremity neurologic function appeared normal. A repeat MRI of the spine was unsuccessful due to worsening back pain and increasing paresthesias in his lower extremities while in the supine position. Therefore, MRI with sedation was performed using propofol 1.5 mg/kg for induction and 100 mcg/kg/min maintenance. After sedation, the patient was kept in the supine position for the duration of MRI studies of the cervical and lumbar regions and during the anesthesia recovery period, for a period of approximately 3 hours. The study showed increased stenosis at L1-2 and L4-5 with tethering of the nerve roots between these two levels of stenosis (Figure 1C–F), which was different from the preoperative imaging of the lumbosacral spine performed three months earlier in which the nerve roots were dispersed and scattered between L2 to S1 and taut above the level of stenosis at L1-2 (Figure 1A & B). The conus medullaris appeared to terminate at the level of the mid to upper L1 vertebral body just above the level of the L1-2 spinal stenosis (Figure 1. G, H & I). There was no evidence of compression of the spinal cord or conus medullaris. There was also no evidence of cord compression in the cervical regions on cervical MRI. The areas of surgical decompression were unremarkable with no evidence of arachnoiditis on the contrast enhanced images. Immediately post-MRI, the patient was noted to be markedly weaker in both his lower extremities with strengths of 1/5 in iliopsoas, 1/5 quadriceps, 4/5 in tibialis anterior, and 1/5 in the gastrocnemius. Bilateral babinski reflexes were still present. He also developed urinary retention. The rapid progression of these neurologic deficits was consistent with a cauda equina syndrome due to exacerbation of his spinal stenosis at L1-2. Upper extremity examination remained normal. The patient underwent emergency decompressive surgery of the L1-2 stenosis, approximately 2.5 hours later, and the surgery lasted approximately 6 hours. Postoperatively, the patient regained

some strength, with 3–4/5 in his lower extremities bilaterally, voided without difficulty, but still had increased tone and residual numbness before being discharged to a rehabilitation hospital.

DISCUSSION

This patient with a history of lumbar stenosis and worsening of back pain during physical therapy with back extension exercises appeared to have suffered worsening of his lumbar stenosis after the forced extension of his spine during the lumbar spinal MRI. Although the patient had indicated worsening of his back pain while attempting to lie in the supine position, the supine MRI was obtained with the patient sedated. With the worsening of the spinal stenosis at the L1-2 level, and possible adhesion from prior surgery or worsening of the stenosis at the lower L4-5 level, the nerve roots were pulled between L1-2 and L4-5 causing the cauda equina syndrome. This was confirmed radiographically by the apparent reversal of the tension on the spinal cord versus the tethering of nerve roots of the cauda equina. Pre-MRI, the spinal cord was taut above the level of the L1-2 stenosis and the nerve roots were somewhat loose below this level. This was accompanied by symptoms of bilateral radicular leg pain and weakness with lower extremity strength 4+ to 5–/5 and inability to ambulate. Post-MRI, the cauda equina nerve roots appear to be pulled superiorly to the L1-2 stenosis resulting in a stretched or tethered appearance below the L1-2 stenosis and a less taut or redundant appearance of the spinal cord above the L1-2 level. This was accompanied by marked symptoms of cauda equina syndrome with urinary retention and marked reduction in lower extremity strength to only 1/5 bilaterally.

Classically, symptoms of lumbar stenosis are improved with either flexion (bending forward) or extension (bending backward) of the spine, while exacerbation of back pain or claudication while standing or walking is common [6]. However, exacerbation of back pain with back extension is unusual, and may reflect tethering of the nerve roots at the lower lumbar levels that might have resulted from either the stenotic L4-5 region or further degenerative diseases at the foramina of these nerve roots.

This case illustrates that in a patient with known or suspected spinal stenosis, back pain associated with extension of the spine, such as lying on the back or back extension exercise as in our patient, MRI in the supine position may be contraindicated. Sedation should be avoided in such patients in order to monitor symptom progression, such as worsening of the back pain. A pre-MRI screening questionnaire to assess the symptoms of low back pain and possible aggravating factors, or the use of an upright spinal MR scanner may minimize the complication of exacerbating the spinal stenosis. Upright (dynamic) MRI has been shown to be effective in evaluating occult spinal disease dependent on true axial loading, the unmasking of kinetic-dependent spinal disease and the ability to scan the patient in the position of clinically relevant signs and symptoms [7], and its utility may also be extended to patients with spinal stenosis that are exacerbated by extension or the supine position.

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Figure 1.

Preoperative sagittal T1-weighted MR images (A) and sagittal T2-weighted MR images (B) demonstrating spinal canal stenosis and some traction of the spinal cord above the L1-2 level (arrow) and loose cauda equina below that level (turquoise brackets). Sedated imaging of the lumbar spine performed with the patient in a supine position 3 months postoperatively: sagittal images, T1-weighted (C), T2-weighted (D), proton density (E) and STIR (F), showing no tension on the spinal cord above L1-2, but tethering of the nerve roots between the two stenotic levels, L1-2 and L4-5 (turquoise brackets). Magnification of the axial T2-weighted MR images (G) show the tip of the conus medullaris (arrow) at the mid to upper L1 vertebral body cranial to the L1-2 stenosis. Axial images (H & I) show the tip of the conus medullaris (arrow in H) and caudally, distal nerve roots with the terminal filum (arrow in I) visible still cranial to the L1-2 stenosis.

Figure 2.

Axial T2 weighted images (TE/TR = 115/8600 ms) obtained during sedation with the patient in a supine position. Left image demonstrates severe spinal canal stenosis at L1-2 with minimal surrounding CSF. Middle image shows relatively normal non-stenotic spinal canal at L2-3 with hyperintense CSF surrounding the cauda equina. Right image shows moderate spinal stenosis at L4-5, with residual AP diameter of the thecal sac approximately 9.0 mm.