AJNR

Imaging spinal osteomyelitis and epidural abscess with short TI inversion recovery (STIR).

R E Bertino, B A Porter, G K Stimac and S J Tepper

AJNR Am J Neuroradiol 1988, 9 (3) 563-564
http://www.ajnr.org/content/9/3/563.citation

Imaging Spinal Osteomyelitis and Epidural Abscess with Short TI Inversion Recovery (STIR)

Raymond E. Bertino,[1] Bruce A. Porter,[2] Gary K. Stimac,[1, 2] Stewart J. Tepper[3]

MR imaging, primarily the spin-echo technique, is increasingly important in evaluating spinal disease [1–3]. We have found, however, that short TI inversion recovery (STIR) in conjunction with spin-echo techniques provides higher tissue contrast images in shorter imaging times while minimizing imaging degradation due to motion and pulsation. The STIR sequence suppresses the signal from fat [4], allowing clear separation of tumor or infection from normal structures in the spine and abdomen. When used in conjunction with T1-weighted spin-echo imaging, the examination provides high sensitivity (from STIR) with excellent anatomic detail (from the T1-weighted spin-echo images). We describe the application of this approach to a case of spinal osteomyelitis with epidural abscess.

Case Report

A 72-year-old diabetic woman with a history of recurrent pyelonephritis developed thoracolumbar back pain 3 days before admission. Pyelonephritis and Klebsiella pneumonia with bacteremia were subsequently diagnosed. The patient had increasing leukocytosis and persistent fever despite antibiotic therapy.

A bone scan performed 16 days after admission showed increased uptake at T12, the sacrum, and in the right sternoclavicular joint. Neurologic consultation was obtained. The history of back pain and incontinence coupled with motor and sensory signs suggested a lower thoracic or upper lumbar spinal level. Because of suspicion of vertebral osteomyelitis and epidural abscess, MR imaging was then performed. Imaging was done on a 0.15-T system* and T1-weighted 600/30/4 (TR/TE/excitations) (256 × 256 matrix) and STIR 1400/100/40/4 (256 × 128 matrix) sagittal and axial images were obtained of the lower thoracic and upper lumbar spine. The acquisition time for each scan was about 10 min.

A T1-weighted image is shown in Figure 1A. The STIR images (Fig. 1B) clearly defined the abscess because of the high signal of the long T1, long T2 pyogenic material within the T11, T12, and L1 vertebral bodies, and in the paraspinous mass. This finding was only visible on the STIR images. Unusually high signal in the T11–T12 and T12–L1 intervertebral disks on STIR was also strongly suggestive of an infectious rather than a neoplastic process.

A myelogram confirmed the epidural impression of the thecal sac anteriorly at T12. A posterior contour defect of the thecal sac from the T9–T10 interspace to T12 was also seen, which correlated exactly with the area of high signal seen on STIR images. Thin-section CT was performed after myelography (Figs. 2A and 2B). The cortical destruction and paraspinous mass at T12 were indicative of osteomyelitis.

A vertebral body resection from an anterior approach was performed, revealing osteomyelitis of T12 with associated abscess. Pus was drained from the epidural space anteriorly. Because of the anterior approach, the posterior epidural region could not be directly evaluated but was thought to be involved contiguously. The patient's postoperative course was complicated only by persistent bladder dysfunction.

Discussion

MR has proved highly sensitive for detecting lesions in the CNS and spine. Not only is there excellent delineation of the spinal canal and cord, but the method also allows detection of abnormalities in the marrow, paraspinous tissues, and, as shown here, the epidural space. This case demonstrates some advantages of the STIR sequence over conventional spin-echo imaging.

We have had extensive experience in MR imaging of marrow and spinal pathology [5, 6] and have used STIR in more than 250 of these cases. Early in our experience, it became evident that the contrast between pathologic and normal tissue was significantly greater with STIR than with T2-weighted spin-echo sequences in almost all cases. The T2-weighted spin-echo sequences also were more time-consuming and motion-sensitive than STIR. As a result, we no longer use T2-weighted spin-echo sequences to evaluate tumor and infection in the spine.

A T2-weighted sequence to produce this degree of contrast would have required a TR of 1600–2400 and a TE of 80–120 with our system. At least two signal averages, perhaps four, would have been necessary to detect the epidural abnormality. It is also likely that the high CSF signal in such a sequence would have obliterated the contrast between the epidural

* Picker International, Northfield, CT.

Received July 28, 1987; accepted after revision November 1, 1987.
[1] Department of Radiology, University of Washington Hospital, 1959 E. Pacific St., Seattle, WA 98195.
[2] First Hill Diagnostic Imaging Center, 1001 Boylston, Seattle, WA 98104. Address reprint requests to G. K. Stimac.
[3] The Polyclinic, 1200 Harvard Ave., Seattle, WA 98122.

AJNR 9:563–564, May/June 1988 0195–6108/88/0903–0563

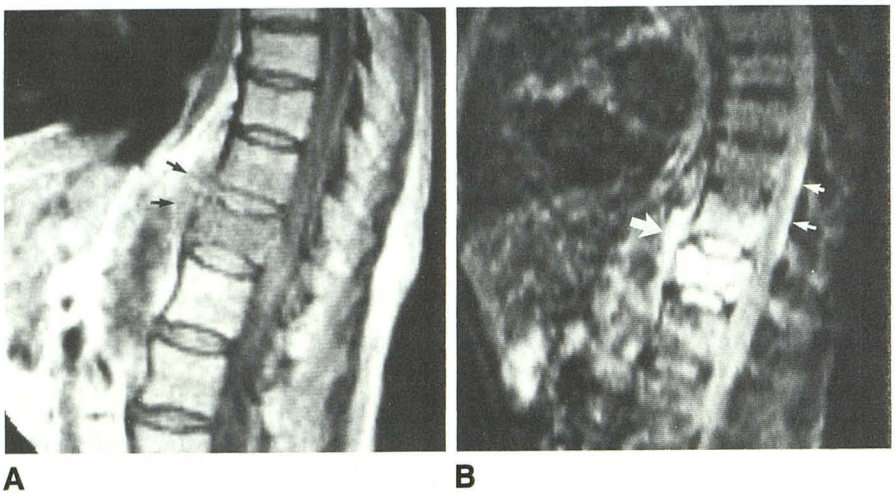

Fig. 1.—*A*, Sagittal T1-weighted MR image, 600/30, demonstrates decreased marrow signal in T12 and to lesser extent in T11. An anterior paraspinal mass (*arrows*) is present. Compression of thecal sac is also seen.

***B*, Corresponding sagittal STIR image, 1400/100/40, shows greatly increased signal in T11, T12, and L1. A linear zone of increased signal is visible posterior to thecal sac from T9 to T12 (*small arrows*), representing an infectious or inflammatory epidural process. The paraspinal mass (*large arrow*) is well shown.**

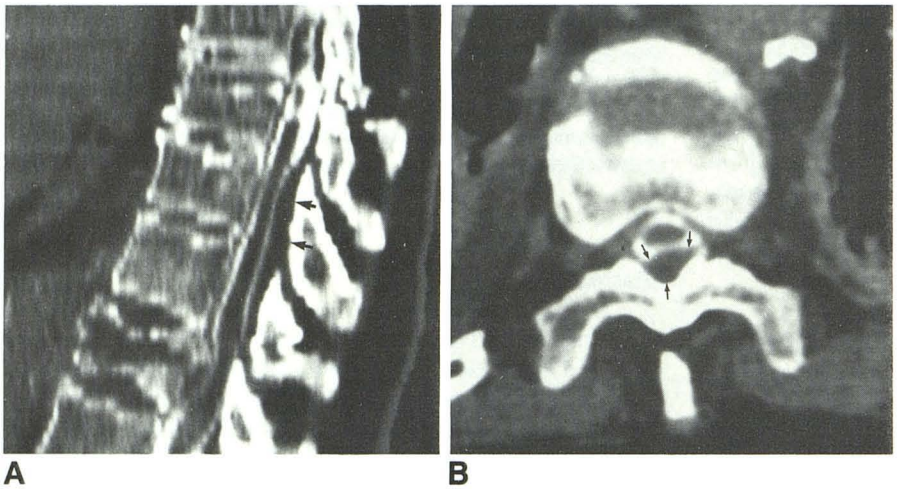

Fig. 2.—*A*, Sagittal reformatted CT myelogram confirms posterior deformation of thecal sac from T9 to T12 (*arrows*). Destruction of T12 and ventral compression of thecal sac are well shown.

***B*, Transaxial CT myelogram at T10 shows posterior deformation (*arrows*).**

process and the fluid [2]. Our experience with STIR imaging in spinal pathology indicates that contrast between CSF and adjacent pathology is best, at our field strength, when a relatively short TR of 1400 is used. Longer TR images using STIR produce intense CSF signal and are subject to the same contrast limitation as heavily T2-weighted spin-echo sequences. The very high contrast of STIR imaging allows use of a 256 × 128 matrix, which, together with a shorter TR, results in short imaging time. By substituting STIR for T2-weighted spin-echo sequences, we decrease total imaging time by 20–40%.

Because STIR suppresses high signal intensity from subcutaneous and abdominal fat, motion degradation of areas of pathology is also diminished [4]. Ghosting, which is common in spinal and abdominal imaging, arises predominately from fat with high signal intensity outside the area of interest. Ghosting and motion artifacts are significantly less troublesome at lower field strength and are further diminished by STIR.

In the case illustrated, epidural spread of infection or inflammation was detected noninvasively in a relatively short imaging time. All relevant pathology seen by the other three imaging methods—bone scan, myelography, and CT—was detected by MR.

REFERENCES

1. Paushter DM, Modic MT, Masaryk TJ. Magnetic resonance imaging: applications and limitations. *Radiol Clin North Am* **1985**;23:551–562
2. Modic MT, Masaryk TJ, Paushter DM. Magnetic resonance imaging of the spine. *Radiol Clin North Am* **1986**;24:229–245
3. Modic MT, Feighlin DH, Piraino DW, et al. Vertebral osteomyelitis: assessment using MR. *Radiology* **1985**;157:157–166
4. Bydder GM, Young IR. MR imaging: clinical use of the inversion recovery sequence. *J Comput Assist Tomogr* **1985**;9:659–675
5. Porter BA, Shields AF, Olson DO. Magnetic resonance imaging of bone marrow disorders. *Radiol Clin North Am* **1986**;24:269–289
6. Olson DO, Shields AF, Schewrich CJ, Porter BA, Moss AA. Magnetic resonance imaging of the bone marrow in patients with leukemia, aplastic anemia, and lymphoma. *Invest Radiol* **1986**;21:540–546