



Stress MRI of the Spine, Revisited

When the routine scan looks too good for the symptoms – load the spine and look again

A 43-year-old man came to me with left lumbar radiculopathy that had dragged on for two years. He had had an MRI in 2024 that showed only disc degeneration with a mild bulge at L4-5 – nothing that quite explained two years of leg pain. His symptoms were classic and reproducible: the pain flared with prolonged sitting and eased when he stood up. That mismatch – convincing symptoms, an underwhelming scan – is exactly the situation a **stress MRI** is built for.

The principle is simple. With the patient lying in the magnet, an axial compression device straps across the shoulders and applies a load through the limbs equal to roughly half the body weight – for this 99 kg man, about 22 kg through each leg (Fig. 1). The load simulates the effect of gravity on the upright spine. We scan first at rest, then under load, and compare.

At rest, his study looked much like 2024 – a mild posterior bulge at L4-5. Under load, the picture changed completely: a left postero-lateral disc herniation appeared, compressing the exiting nerve root (Figs. 2, 3). The axial compressive force opens up the annular tear and the disc “pops out” – visible only when the spine is loaded.

The load does more than reveal hidden disc herniations. It is especially useful in lumbar canal stenosis, where standing narrows the canal in a way that a recumbent scan cannot capture. A 2024 study in *Skeletal Radiology* (Fang et al, 2025) quantified this with a new axial-loading device in 40 patients: loading significantly reduced the dural-sac cross-sectional area, the sagittal canal diameter and disc height at all lumbar levels, and loading in extension aggravated stenosis the most – though at some cost to patient comfort. In other words, the load can convert a borderline canal into an unmistakably stenotic one.

This is not new. From a presentation I gave back in 2008: a 45-year-old woman with bilateral lower-limb radiculopathy whose routine scan was equivocal.

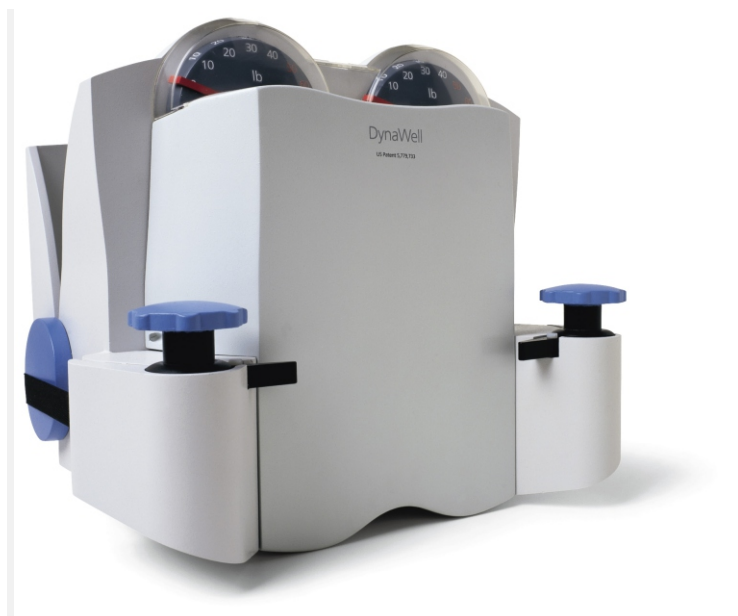


Fig. 1 – Axial loading device. Straps across the shoulders with the load applied through the limbs at roughly half the body weight, simulating the upright spine. The original DynaWell device is shown.

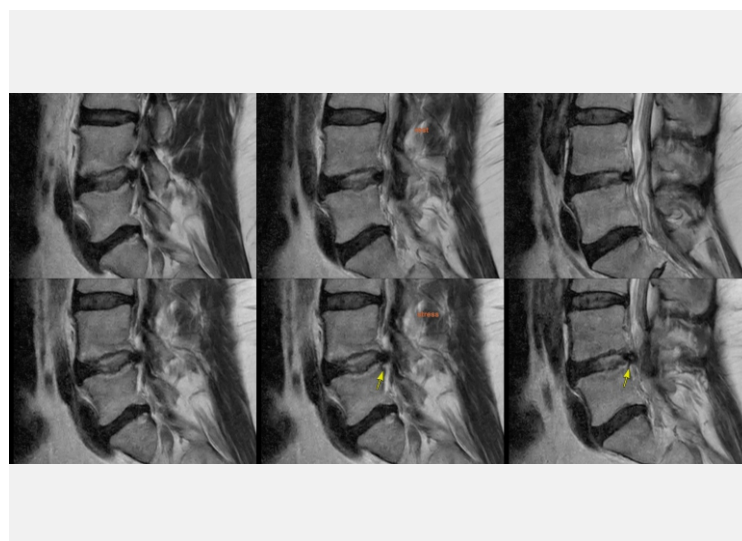


Fig. 2 – Sagittal T2: rest (top row) vs stress (bottom row). On axial loading, the mild L4-5 bulge becomes a frank postero-lateral disc herniation (arrows). The lesion is occult on the resting scan.



At a glance

- ◆ Stress (axial-loading) MRI applies about half the body weight to mimic standing, and can reveal pathology that is hidden on a routine recumbent scan.
- ◆ It earns its place when the symptoms outstrip the routine MRI –

Under load, an anterolisthesis of L4 over L5 with degenerative canal stenosis declared itself and clearly worsened (Fig. 4).

Long-time readers will recognise the theme. I first wrote about stress MRI in Inner Spaces in November 2007, and returned to it in July 2012 – that time to show how loading can unmask facet synovial cysts. After a flurry of papers and RSNA presentations up to around 2012, the field went quiet; the original DynaWell device is no longer made and the company appears to have folded. Now a new axial-loading device has come to market, and the 2024 data above suggests the question is worth reopening. Standing (upright) MRI would, in theory, solve the problem outright – but the low spatial resolution of those machines has kept them from taking off.

The bottom line for the referring physician. When the clinical signs and symptoms are convincing but a routine MRI does not show the expected pathology, a stress MRI with an axial-loading device may uncover it – a disc that herniates only under load, a canal that narrows only on standing, instability from a spondylolisthesis, or a facet synovial cyst. It is a small extra step that occasionally changes the whole picture.

Reference: Fang X, Cui M, Wang Y, et al. Effects of axial loading and positions on lumbar spinal stenosis: an MRI study using a new axial loading device. Skeletal Radiology 2025;54:199–208.

- dynamic disc herniation, canal stenosis, spondylolisthesis-related instability, and facet synovial cysts.
- ◆ The technique went quiet after 2012, but a new loading device and fresh 2024 evidence have revived interest.

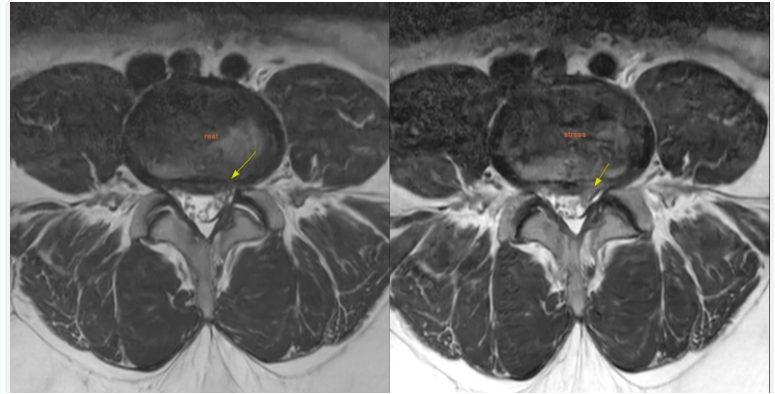


Fig. 3 – Axial T2 at L4-5: rest (left) vs stress (right). Loading reveals a left postero-lateral disc herniation compressing the traversing nerve root (arrow) that is not appreciable at rest.



Fig. 4 – Historical case (2008): rest (left) vs stress (right). 45-year-old woman with bilateral lower-limb radiculopathy. Anterolisthesis of L4 over L5 with degenerative canal stenosis that increases on the stress study.

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