KEY QUESTIONS
UPRIGHT MRI

Background:
Standard, supine magnetic resonance imaging (MRI) is a widely used diagnostic method for evaluation of many musculoskeletal conditions, particularly to visualize soft tissue structures that are difficult to image with traditional radiographs and CT. MRI imaging requires patients to remain motionless for extended periods of time, although systems with more powerful magnets shorten the imaging time required. Standard, recumbent MRI (rMRI) systems also generally require that the patient be recumbent while sectional images are acquired. The patient lies on a bed that is moved through a magnetic field in order obtain sequential images. Standard rMRI systems employ magnets with the strength of 1.0-3.0 Tesla(T). Magnet strength is a major factor related to image quality and resolution as well as speed of image acquisition.

In recent years, developments in MRI equipment design have lead to scanners that are "open" which allows for greater flexibility in patient positioning and a reduced claustrophobic environment. Some newer open systems are open at the top and front, having repositioned magnets to allow imaging in upright, weight bearing positions (e.g., seated, standing). Proponents of these techniques postulate that weight bearing or positional imaging facilitates the evaluation of soft tissue anatomy that may be influenced by positional changes and may be less apparent with standard supine MRI. Obese and claustrophobic patients may fare better in an open MRI system.

Each of the key questions was addressed with respect to the following abnormalities/conditions:
1. Suspected degenerative spondylolisthesis (>25% slip)
2. Suspected spinal stenosis (moderate/severe central stenosis (>1/3 canal), lateral recess stenosis (displacing or compressing nerve root, disc extrusion)
3. Radicular pain (moderate /severe central stenosis, lateral recess stenosis, nerve root compression, disc extrusion)
4. Non-specific spine pain (moderate/severe central stenosis, lateral recess stenosis, nerve root compression, disc extrusion)
5. Extra-spinal joint pain/function loss (e.g narrowing, musculoskeletal only)

Key Question 1:
What is the evidence to describe the concordance (i.e., ability to detect clinically important findings associated with known conditions) of upright MRI compared with currently available diagnostic testing (e.g., standard MRI +/- loading, CT myelogram+/- upright, plain films [flexion and extension], discography, operative findings) in patients (including appropriate sub-populations) with conditions 1-5 above.
If a reference standard is available for any of these conditions, what are the test characteristics, PPV (positive predictive value), NPV (negative predictive value), sensitivity and specificity, of upright MRI compared with standard diagnostic testing?

Key Question 2:
What is the evidence to describe the reliability (i.e., test-retest, intra-reader, inter-reader performance) of upright MRI and how does this reliability compare with available diagnostic testing in patients with 1-5?

Key Question 3:
What is the evidence to describe the diagnostic impact (i.e., effect on additional diagnostic testing, effect on limiting the differential diagnosis) of upright MRI compared with available diagnosis testing in patients with conditions 1-5?

Key Question 4:
What is the evidence to describe the therapeutic and patient impact (i.e., effect on treatments received, efficiency of moving from diagnostic testing to treatment, outcomes [pain, function, adverse events] of test-directed treatment [operative and non-operative]) of upright MRI compared with available diagnostic testing in patients with conditions 1-5, (e.g., what is the likelihood that positive upright MRI findings accurately predicts favorable outcome following test-directed treatment?)

Key Question 5:
What is the evidence that upright MRI in the acute setting is more effective (diagnostic and therapeutic impact) than available diagnostic testing in the sub-acute/delayed setting in patients with conditions 1-5?