

SpondyloArthritis Research Consortium of Canada (SPARCC)

Magnetic Resonance Imaging of the Sacroiliac Joints

Acquisition Protocol

Positioning the patient and coils

- Patient lies supine, as straight as possible.
- We use anterior and posterior coils (antennae) – anterior coil is more important in large patients or if there is a steep lumbosacral angle.
- Record relationship of anatomical structures to coil elements for follow-up reference.

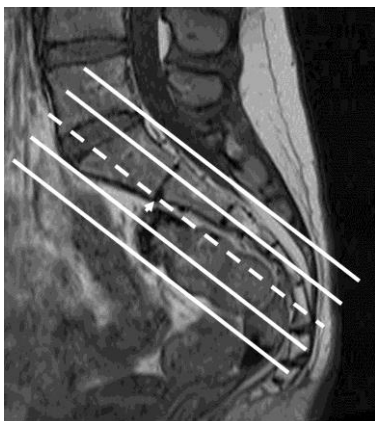
Scouts

- Scout images in 3 planes, axial scout to include hip joints. Repeat axial if necessary.
- True sagittal scout – a true sagittal scout must be performed in addition to the 3 plane scout –
 - Centre – S2 vertebral body
 - Angle 1 (rotating around the craniocaudal axis on the axial scout) – Rotate sagittal stack to select true coronal angle. If in doubt, go perpendicular to line between hip joints
 - Angle 2 (rotating around the anteroposterior axis on the coronal scout) - Rotate sagittal stack to select angle that is truly in the longitudinal axis of the sacrum (S1-S3).

REQUIRED - Sequences for Diagnosis and Scoring - location and angles

Semi-coronal or tilted coronal orientation: A coronal sequence is performed with the stack rotated so that the stack is parallel to the longitudinal axis of the sacrum between S1 & S3:

- Centering point of the stack –
 - Left/right - midline
 - Head/Foot - At the sclerotic scar formed by the vestigial disc between the S1 and S2 vertebral bodies (the caudal end of S1)
 - Anterior/Posterior - place the centre of the stack in the centre of the S1/S2 vestigial disc.
- Angling the stack –
 - Perpendicular to above “true sagittal scout”, and
 - Rotate until parallel to the posterior surface of the S2 vertebral body (anterior border of sacral spinal canal at S2). Do NOT use the L5/S1 disc to orientate the stack.



The semicoronal sequence should be planned so that the centre (dashed line) of a stack of 15 images 4 mm thick (or 20 images 3 mm thick) is positioned at the anterior border of the sclerotic line representing the junction of the 1st and 2nd sacral segments (arrowhead). Orientation of the semicoronal sequence is parallel to the dorsal cortex of the S2 vertebra (anterior border of sacral spinal canal at S2).

The semicoronal sequence must include one or two slices anterior to the SI joint and all of the cartilage compartment.

REQUIRED - Sequences for Scoring - parameters for imaging at 1.5T (may require adjustment for 3T)

T1 TSE and Short Tau Inversion Recovery (STIR) (or equivalent) should be performed.

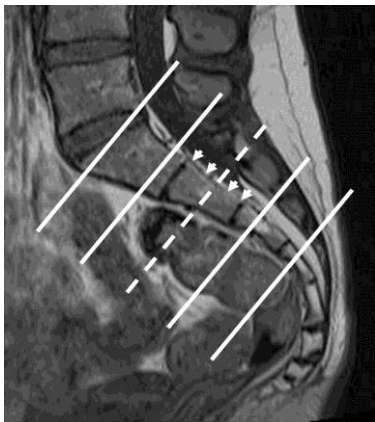
These are suggestions and can be adjusted according to magnet specifications.

- Common parameters:
 - 15 slices, 4 mm thick, 10% gap
or
 - 20 slices, 3 mm thick, 10% gap
 - FOV 280mm, square (to include iliac crests)
 - Phase encode left/right (can be anterior/posterior whichever produces less artifact)
 - NSA 1, Oversampling 100%
- T1 TSE - TR 400-500ms (2 concatenations), TE 10-15ms, ETL 3, Matrix frequency 512, phase 256.
- STIR - TR 3500+ms, TI 155-180ms, TE 50+ms, ETL 7, Matrix frequency 384, phase 256.

Sequences RECOMMENDED for Diagnosis - location and angles

Semi-axial or tilted axial orientation: An axial sequence is performed with the stack rotated so that it is perpendicular (90°) to the semi-coronal sequence:

- Centering point of stack –
 - Left/right - midline
 - Head/Foot - At the sclerotic scar formed by the vestigial disc between the S1 and S2 vertebral bodies (the caudal end of S1)
 - Anterior/Posterior - place the centre of the stack in the centre of the S1/S2 vestigial disc.
- Angling the stack –
 - Perpendicular to the “semi-coronal” sequence.



The semiaxial sequence should be planned so that the centre (dashed line) of a stack of 19 images 4 mm thick (or 25 images 3 mm thick) is positioned at the centre of the S2 vertebra. Orientation of the semiaxial sequence is perpendicular to the dorsal cortex of the S2 vertebra (anterior border of sacral spinal canal at S2) (arrowheads).

The semiaxial sequence must include all of the first three sacral vertebrae.

Sequences RECOMMENDED for Diagnosis - parameters for 1.5T (may require adjustment for 3T)

Axial Sequence – most centres perform a STIR or T2FS

For diagnostic purposes, an axial sequence is strongly recommended. This can be done in the transverse plane without angles but a semi-axial orientation is preferred, perpendicular to the semi-coronal sequences as above. This minimizes partial volume averaging, and allows image capture of the hip joints and symphysis pubis without compromising image quality or adding extra slices.

These are suggestions and can be adjusted according to magnet specifications.

- “True Axial” T2 TSE +FS (with spectral presaturation of fat) - 25 slices, 4mm thick with 10% gap, TR 3000+ms, TE 80+ms, FOV 280mm, ETL 7-13, Matrix frequency 448, phase 256.

Erosion Specific Sequence – requires high resolution

Many centres are now performing a specific sequence for evaluation of erosion and this is recommended for diagnostic purposes. The selection of an optimal sequence for erosion evaluation is complicated. The tissue interface at the edge of the bone may be comprised of: a) on the bony side, by fat, edema, sclerosis or erythropoietic tissue, and b) on the soft tissue side, by cartilage, inflammatory or granulation tissue or fluid. So the tissue contrast is highly variable. Erosions may be very small, so spatial resolution needs to be excellent. Our current recommendation is to do a high-resolution 3D gradient echo acquisition. We do not suppress fat because it provides important signal allowing higher spatial resolution and “fat sat” is neither helpful nor necessary if the right sequence is selected. We suggest the following sequence, or equivalent, which can be done on any 1.5 platform:

- 3D MEDIC (Multiple Echo Data Image Combination - a T2* weighted spoiled gradient echo sequence.)
- Semi-coronal, 40 slices, 1.5mm thick, 200mm field of view, square
- 1 average, 100% phase oversampling, 30% slice phase oversampling, Left-right phase encode
- TR 33, TE 19 (in phase), flip angle 30°
- Resolution: Frequency 448, phase, 269, slice 50%, partial Fourier 75%, no interpolation
- Bandwidth 183 Hz/Px, flow compensation on, combined echoes 3
- Acquisition time 4.28

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