

A. Kassarian, B. Fritz, P. D. Afonso, A. Alcalá-Galiano, M. J. Ereño,
A. Grainger, E. Llopis, E. McNally, C. Schueller-Weidekamm, R. Sutter

Guidelines for MR Imaging of the Hip Region

Abbreviations and clarifications • Pelvis • Standard Hip • Hip MR Arthrogram • Groin Pain • Hamstrings • Hamstrings – proximal injuries • Hamstrings – distal injuries

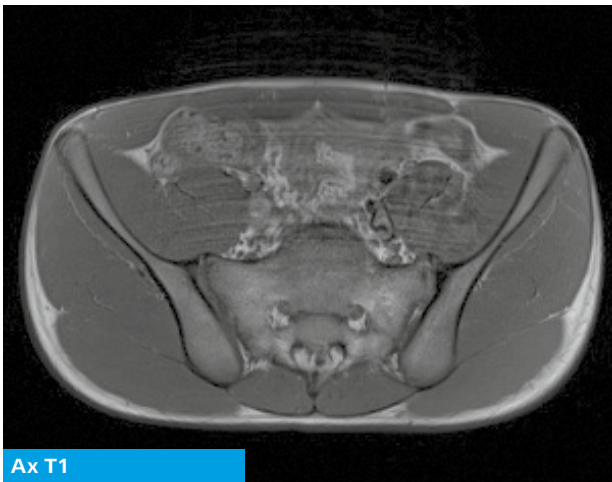
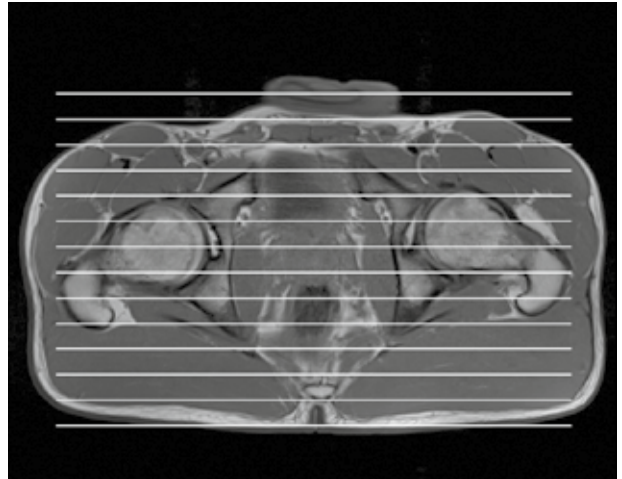
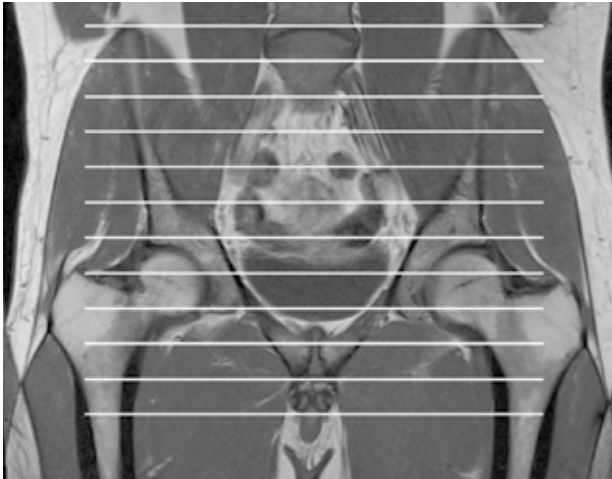
Abbreviations and clarifications

- Ax axial
- Cor coronal
- Sag sagittal
- FOV field-of-view
- PD proton density
- TE time to echo
- FS fat-suppressed
- Int intermediate
- Int FS this is a fat-suppressed sequence with a long TR and a TE between that of a traditional PD (e. g. TE=10–20) and a traditional T2 (e. g. TE=80–100). The advantage of this sequence is that the TE is short enough to maintain sufficient signal for visualization of the anatomy (like a PD) yet long enough to be more fluid sensitive (like a T2)
- For STIR sequence, TI (inversion time) should be 140–150 at 1.5T

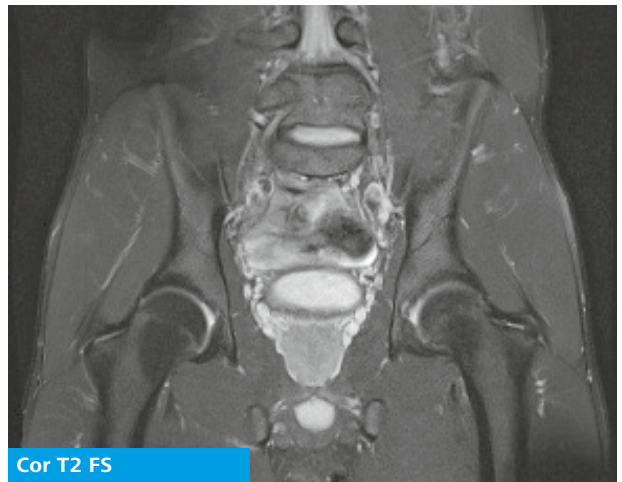
Pelvis

- Patient in supine position as straight as possible. Tape toes to get mild internal rotation of the hips
- Start with axials – include volume from just above the iliac crests to just below the lesser trochanters (coronal localizer)
- Coronals include volume from skin to skin (axial localizer)

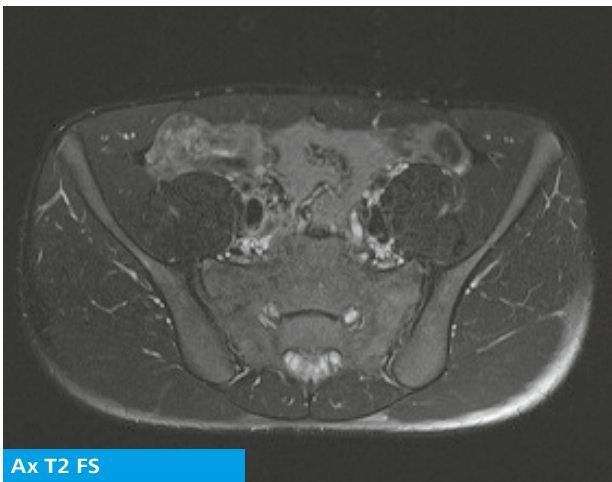
	FOV	Slice	TE	Matrix (min)
Cor T1	30, as small as possible	5 mm	min	320x240
Cor T2 FS	30, as small as possible	5 mm	80	320x240
Ax T1	30, as small as possible	5 mm	min	384x268
Ax T2 FS	30, as small as possible	5 mm	80	320x244



Ax T1



Cor T2 FS



Ax T2 FS

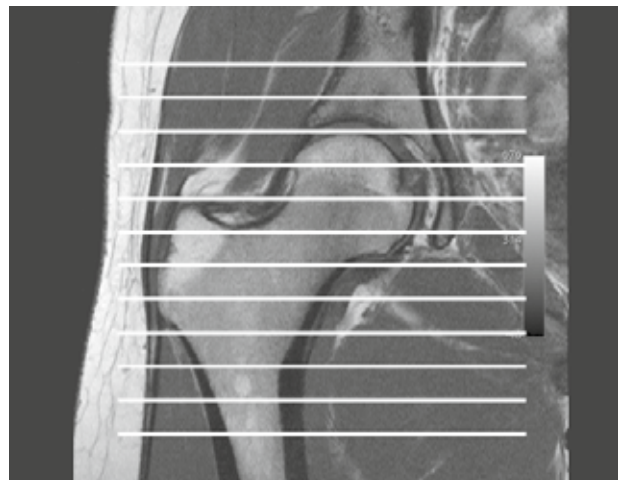
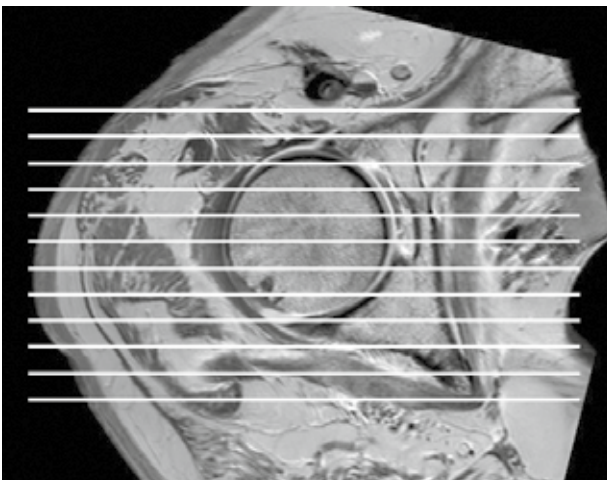


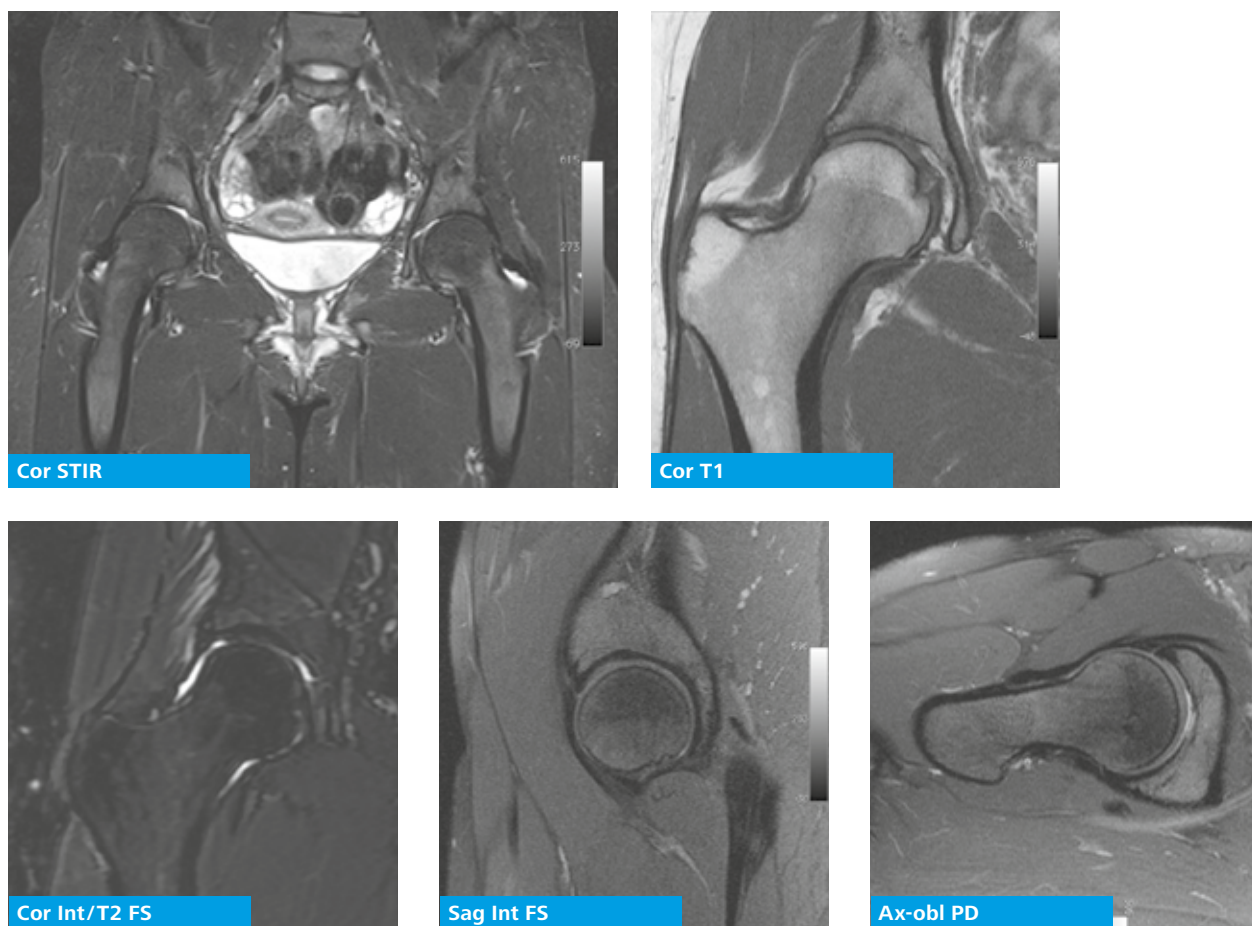
Cor T1

Standard Hip

- Patient is placed with the hips with 15° internal rotation, tape toes to maintain position
- Standard hip MRI should start with a coronal large FOV 30–40 cm of the pelvis from the sacroiliac joints to the pubic symphysis (see routing pelvis protocol)
- This is be followed with lower FOV 18–20 cm of the symptomatic hip
- Coronal plane: anterior to posterior acetabular columns
- Axial plane: anterior inferior iliac spine through lesser trochanter
- Sagittal plane: medial acetabular wall through greater trochanter
- Axial-oblique plane: parallel to the femoral neck, superior acetabular rim to inferior acetabular rim

	FOV (max)	Slice (max)	TE	Matrix (min)
entire pelvis Cor STIR	38–40 cm	6 mm	40–60	256x256
Cor T1	16 cm	3.5 mm	min	256x256
Cor Int/T2 FS	16 cm	3.5 mm	40–100	256x256
Sag Int FS	16 cm	3.5 mm	40–60	256x256
Ax-oblique Int FS	16 cm	3.5 mm	40–60	256x256





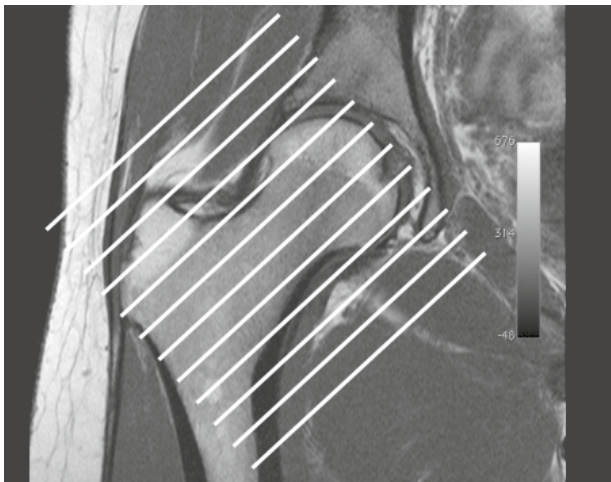
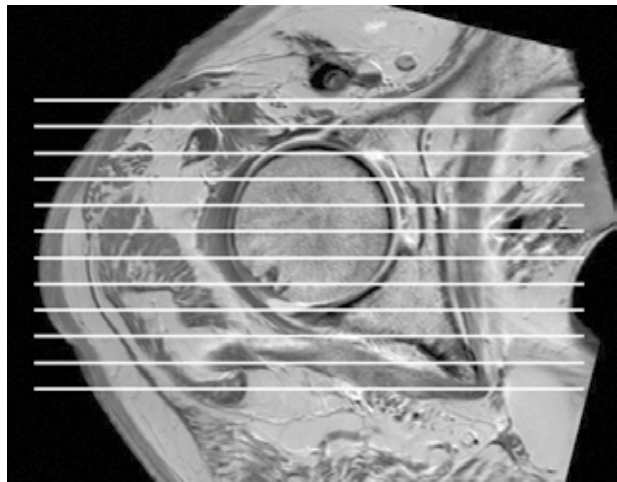
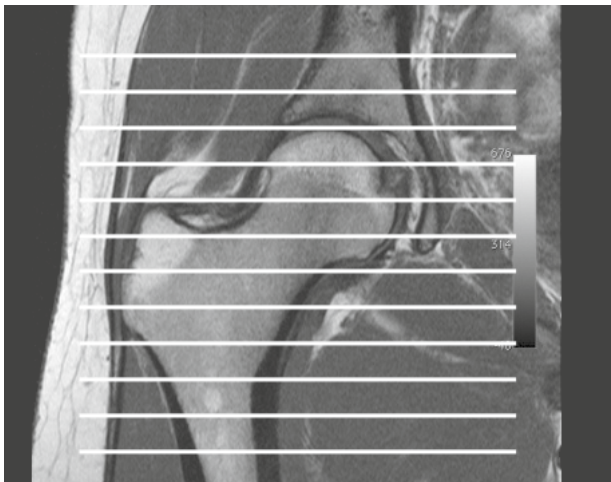
Hip MR Arthrogram

- Patient is placed with the hips with 15° internal rotation, tape toes to maintain position
- Hip MR arthrogram should start with a coronal large FOV 30–40cm of the pelvis from the sacroiliac joints to the pubic symphysis (see routing pelvis protocol)
- This is followed with lower FOV 18–20cm of the symptomatic hip
- Axial plane: anterior inferior iliac spine to lesser trochanter
- Coronal plane: anterior to posterior acetabular columns
- Axial-oblique plane: parallel to the femoral neck
- Sagittal plane: medial acetabular wall to greater trochanter

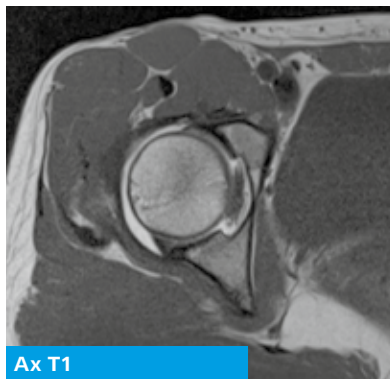
The slice thickness could be reduced according to the possibilities (including reasonable acquisition time) afforded by the used MR device, especially for MR Arthrography.

- T1 and fat-saturated T1 and PD could be reduced to 2.5 mm.
- 3D acquisitions (using fat-saturated PD sequences, DESS or others) with 0.6 to 0.8 mm thick slices could be added for the diagnosis of subtle cartilage lesions.

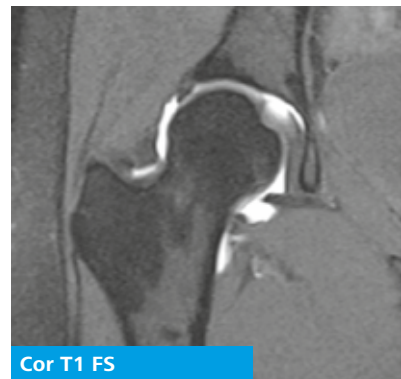
	FOV (max)	Slice (max)	TE	Matrix (min)
entire pelvis Cor STIR	38–40 cm	6 mm	40–60	256 x 256
Ax T1	16 cm	3.5 mm	min	256 x 256
Cor T1 FS	16 cm	3.5 mm	min	256 x 256
Oblique T1 FS	16 cm	3.5 mm	min	256 x 256
Sag T1 FS	16 cm	3.5 mm	min	256 x 256
Sag or oblique Int FS	16 cm	3.5 mm	40–60	256 x 256
Radial T1 +/- FS (optional)	16 cm	3.5 mm	min	256 x 256



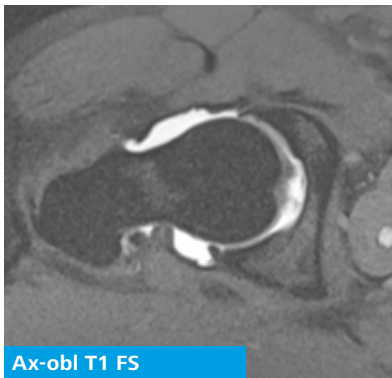
Cor STIR



Ax T1



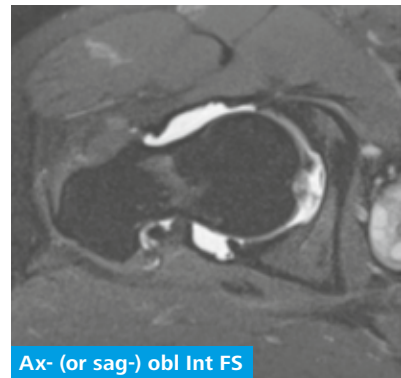
Cor T1 FS



Ax-obl T1 FS



Sag T1 FS

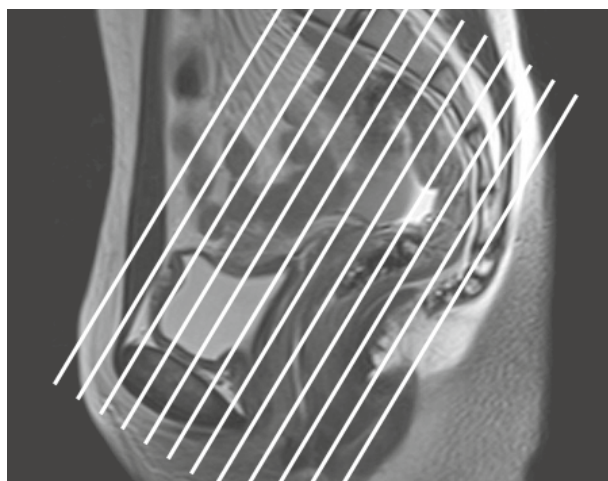
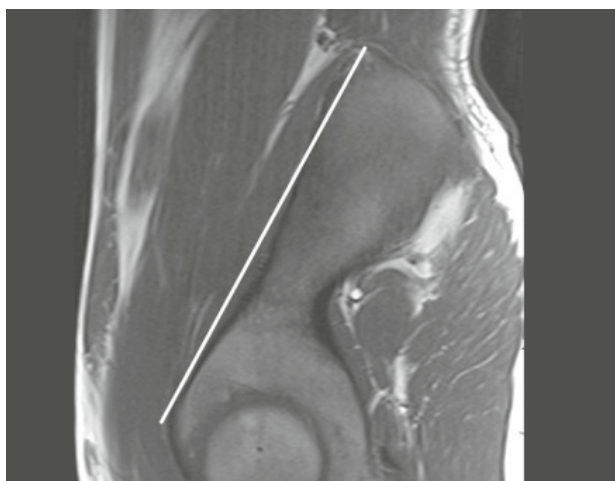
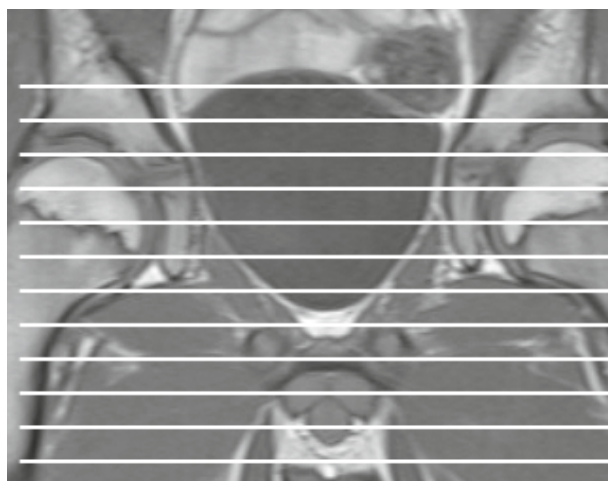
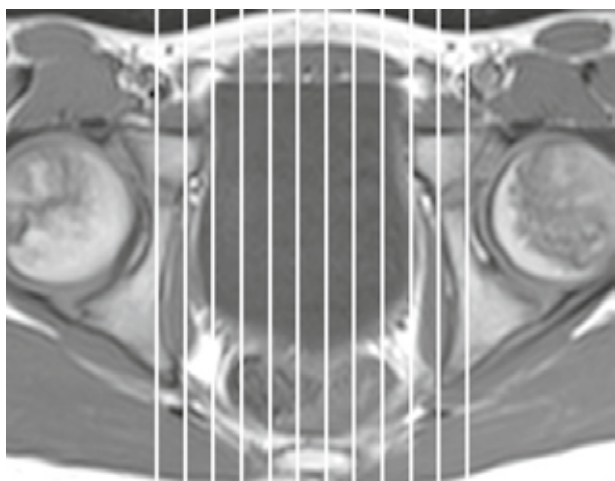


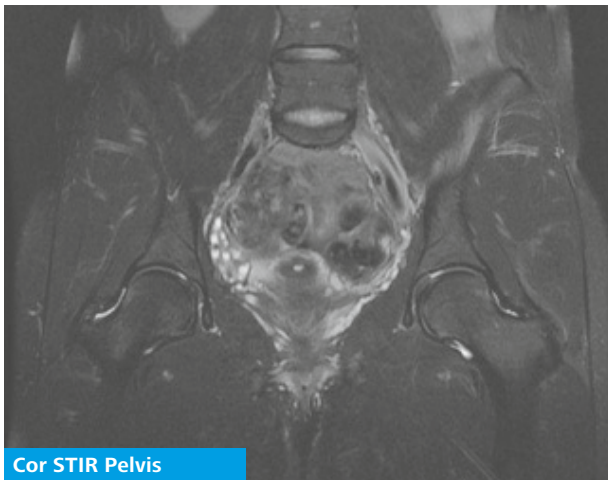
Ax- (or sag-) obl Int FS

Groin pain

- Patient in supine position and place marker at site of pain
- Use large surface / body coil
- Coronal STIR of pelvis – include volume from anterior to the symphysis pubis through the entire sacrum
- Sagittals include volume centrally from medial acetabular walls
- Axials include volume from acetabular roofs distal to inferior pubic rami
- Obliques are parallel to anterior margin of iliac bone

	FOV (max)	Slice (max)	TE	Matrix (min)
entire pelvis Cor STIR	38 cm	6 mm	40–60	256x256
Cor Int FS	16 cm	3.5 mm	40–60	256x256
Obl Int FS	16 cm	3.5 mm	40–60	256x256
Sag Int FS	16 cm	3.5 mm	40–60	256x256
Ax T1	16 cm	3.5 mm	min	256x256





Cor STIR Pelvis



Cor Int FS



Obl Int FS



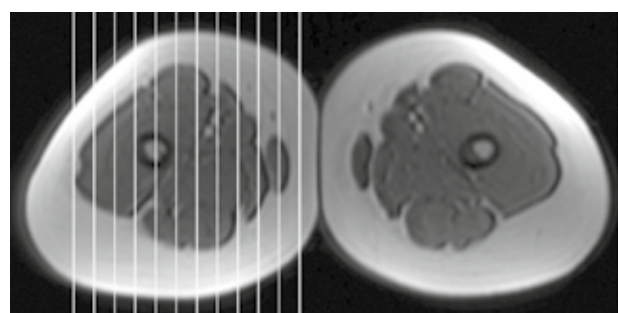
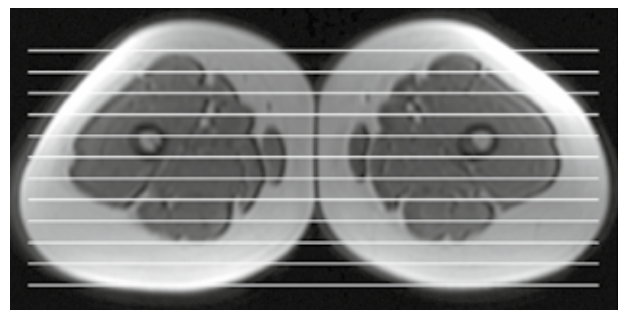
Ax T1



Sag Int FS

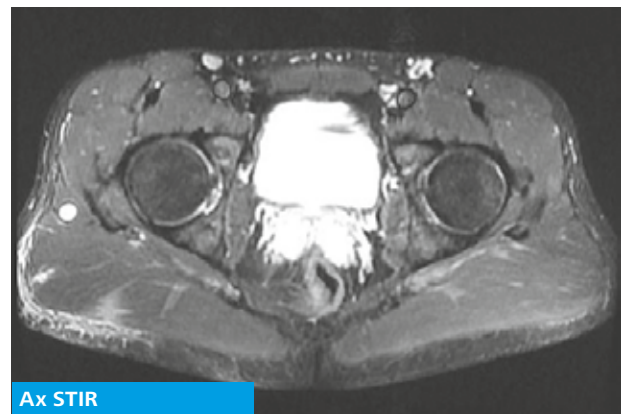
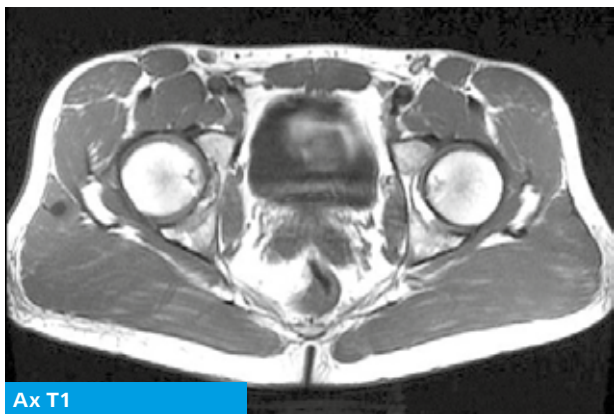
Hamstrings

- Patient feet first in supine position, phased-array surface coil over thighs
- Legs close together, marker at site of pain
- Axials of both thighs with wide margins above and below the markers
- Proximal injuries: axials and oblique coronals include bilateral hamstring origins
- Distal injuries: axials of the affected thigh and oblique coronal or sagittal images along the axis of the affected muscle. (Coronal-oblique plane for medial or lateral injuries and sagittal plane for anterior or posterior injuries)



Proximal injuries

	Sequence	FOV (max)	Slice (max)	TE	Matrix (min)
Bilateral Survey	Ax T1	38 cm	7 mm	min	256x256
	Ax STIR/FS	38 cm	7 mm	40–60	256x256
Bilateral Hamstring Origins	Ax T1	24 cm	5 mm	min	288x256
	Ax PD FS	24 cm	5 mm	35	288x256
	Cor-obl PD FS	32 cm	3 mm	35	288x256
	Sag-obl PD FS (optional)	32 cm	3 mm	35	288x256



Distal injuries

	Sequence	FOV (max)	Slice (max)	TE	Matrix (min)
Bilateral Survey	Ax T1	38 cm	7 mm	min	256x256
	Ax STIR/FS	38 cm	7 mm	40–60	256x256
Bilateral Hamstring Origins	Ax T1	24 cm	5 mm	min	288x256
	Ax PD FS	24 cm	5 mm	35	288x256
	*Cor/Sag Obl PD FS	32 cm	3 mm	35	288x256

* Coronal-oblique to the muscle in medial/lateral injuries. Sagittal-oblique to the muscle in anterior/posterior lesions.

