

Original Article

# Additional merit of coronal STIR imaging for MR imaging of lumbar spine

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## Abstract

**Introduction:** Back pain is a common clinical problem and is the frequent complaint for referral of lumbar spine magnetic resonance imaging (MRI). Coronal short tau inversion recovery sequence (STIR) can provide diagnostically significant information in small percentage of patients. **Materials and Methods:** MRI examinations of a total of 350 patients were retrospectively included in the study. MR sequences were evaluated in two settings. One radiologist evaluated sagittal and axial images only, while another radiologist evaluated all sequences, including coronal STIR sequence. After recording the diagnoses, we compared the MRI findings in two subsets of patients to evaluate additional merit of coronal STIR imaging. **Results:** With addition of coronal STIR imaging, significant findings were observed in 24 subjects (6.8%). Twenty-one of these subjects were considered to be normal on other sequences and in three subjects diagnosis was changed with the addition of coronal STIR. Additional diagnoses on STIR included sacroiliitis, sacroiliac joint degenerative disease, sacral stress/insufficiency fracture/Looser's zones, muscular sprain and atypical appendicitis. **Conclusion:** Coronal STIR imaging can provide additional diagnoses in a small percentage of patients presenting for lumbar spine MRI for back pain. Therefore, it should be included in the routine protocol for MR imaging of lumbar spine.

**Key words:** Back pain, MRI, spine, STIR

## INTRODUCTION

Back pain with or without radiation into lower limbs is a common problem and is one of the most common indications of requests for MRI of lumbo-sacral spine. Although some pathologies can be detected on radiographic evaluation, with increasing availability, MRI is often the first investigation of choice in these patients. Routine MRI protocols at many institutions do not include coronal imaging. Present study was aimed at evaluating the added merits of coronal STIR imaging to routine axial and

sagittal T1W and T2W MRI protocol in patients with back pain with or without sciatic radiculopathy symptoms.

## MATERIALS AND METHODS

The present study was conducted in the Radiodiagnosis department of Maharishi Markandeshwar Institute of Medical Sciences and Research, Ambala. Study was approved by the ethical committee. MRI examinations of a total of 350 patients were retrospectively included in the study from January 2014 to June 2014. Patients with previous operative history were excluded from the study.

### MRI protocol

All examinations were performed on a 16-channel 1.5 Tesla MRI scanner (Achieva, Philips Medical Systems, The Netherlands). Localizer was taken in axial and sagittal planes after making proper positioning of the patient. The MRI protocol consisted of sagittal T1W, sagittal T2W, axial

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T1W and axial T2W sequences. Coronal STIR images were acquired (TR-4000, TE-80, TI-100, FOV-220 × 332 × 75, slice thickness- 5 mm).

### MRI evaluation

MR sequences were evaluation by two experienced radiologists. One radiologist evaluated sagittal and axial images only, while another radiologist evaluated all sequences including coronal STIR sequence. After recording the diagnoses, we compared the MRI findings in both subsets of patients.

### RESULTS

There were 181 male and 169 female patients with a mean age of 38.2 years (range 12-82 years). Based on the analysis of MR sequences with or without coronal STIR images, the diagnoses are listed in Table 1 and Figure 1. Without using coronal STIR, MRI examination was considered within normal limits in 72 subjects (20.5%). Most common finding was degenerative disc disease/disc herniations, which were considered to be the cause of back pain in 138 subjects. Other causes were spondylolysis with/without spondylolisthesis (24 subjects), spinal metastasis with/without known primary tumor (36 subjects), tubercular spondylitis/spondylodiscitis (42 subjects), primary canal stenosis (8 subjects), primary spinal tumors/vascular malformations (12 subjects), congenital lesion/spinal dysraphism (6 subjects) and miscellaneous causes (12 subjects). With addition of coronal STIR imaging, diagnostically significant findings were observed in 24 subjects (6.8%) [Table 2]. Twenty-one of these subjects were considered to be normal on other sequences and in three subjects diagnosis was changed with addition of coronal STIR. Additional diagnoses on STIR included: Bilateral sacroiliitis (7 subjects), unilateral sacroiliitis (2 subjects), sacro-iliac joint degenerative (6 subjects), sacral stress/ insufficiency fracture/ Looser's zones (5 subjects), muscular sprain (3 subjects) and atypical appendicitis (1 subject).

### DISCUSSION

Back pain is one of the most common indications of lumbar spine MRI. Increasingly, patients are directly referred for MRI as the first diagnostic modality.<sup>[1]</sup> Addition of coronal STIR imaging to imaging protocol can depict additional important findings, most commonly related to sacrum and sacro-iliac joints.<sup>[2]</sup> Clinical findings are notoriously unreliable for pinpointing the likely site of abnormality. A recent study showed that even in patients with clinically suspected sacro-iliitis, spinal non-inflammatory disease was commonly seen.<sup>[3]</sup> Therefore relying on clinical suspicion alone and without performing coronal scanning in all patients, important diagnostic findings can be missed in small proportion of patients.

In the present study, addition of coronal STIR imaging provided diagnostically significant findings in 24 (6.8%) subjects. Importantly, 21 of these subjects were considered

**Table 1: Additional merit of coronal STIR for final MRI diagnosis**

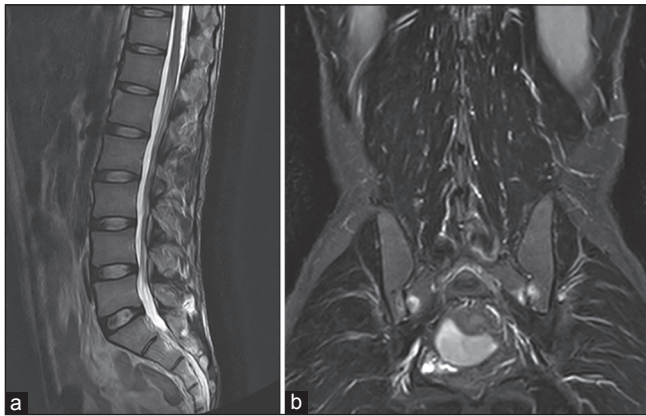
MRI diagnosis	Without coronal STIR imaging	With coronal STIR Imaging
Within normal limits	72	51
Degenerative disc disease/disc herniations	138	136
Spondylolysis with/without spondylolisthesis	24	23
Spinal metastasis with/without known primary tumor	36	36
Tubercular spondylitis/spondylodiscitis	42	42
Primary canal stenosis	8	8
Primary spinal tumors/ vascular malformations	12	12
Congenital lesions/spinal dysraphism	6	6
Miscellaneous (Synovial/ perineural cysts, Baastrup disease, facetar arthropathy)	12	12
Others	0	24

**Table 2: Showing new MR diagnoses as cause of back pain with addition on coronal STIR Imaging**

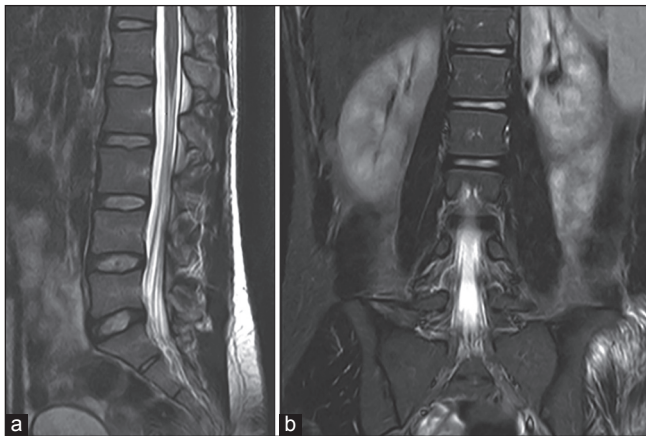
MRI diagnosis	No. of patients
Bilateral inflammatory sacro-iliitis	7
Unilateral inflammatory/ infectivesacro-iliitis	2
Sacro-iliac joint degeneration	6
Sacral stress/insufficiency fracture/ looser's zones	5
Muscular sprain	3
Atypical appendicitis	1

to be within the normal limits on routine sagittal and axial protocol. Nine of these patients belonged to a relatively young age group and showed unilateral (2) or bilateral sacroiliitis (7). Diagnosis of sacroiliitis is frequently unreliable on clinical grounds.<sup>[3]</sup> Diagnosis of established ankylosing spondylitis is easy when classical syndesmophytes and/or sacro-iliac joint ankylosis are visible on radiography. MRI is important for its early diagnosis because addition of anti-tumor necrosis factor (anti-TNF) agents can alter the disease course.<sup>[4]</sup> Early MRI findings of ankylosing spondylitis include unilateral or bilateral sacroiliitis, which can be easily visualized with coronal STIR imaging [Figure 1].

Sacral stress/insufficiency fractures are an important cause of disabling pain in elderly patients and are difficult to diagnose on clinical and radiographic grounds. Both MRI and scintigraphy have nearly 100% sensitivity of their detection. On STIR, these fractures are seen as hypointense bands with associated marrow edema appearing hyperintense<sup>[5]</sup> [Figure 2]. Similarly, sometimes Looser's zones due to osteomalacia may



**Figure 1:** (a and b) Sagittal T2W image (1a) showing no significant disc degeneration/herniation. Mild vertically oriented Modic type II changes are seen at anterior corner of L1 vertebra. Coronal STIR image shows small erosions along inferior parts of bilateral sacroiliac joints with associated marrow edema. Further evaluation with HLA B-27 confirmed the diagnosis of ankylosing spondylitis

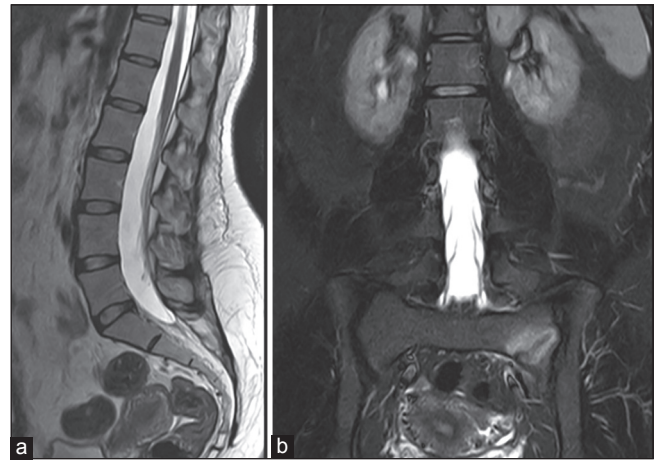


**Figure 3:** (a and b) Sagittal T2W image (2a) shows no significant abnormality except for straightening of curvature. Coronal STIR image shows hyperintense signal in left sided gluteal muscles indicative of muscular sprain

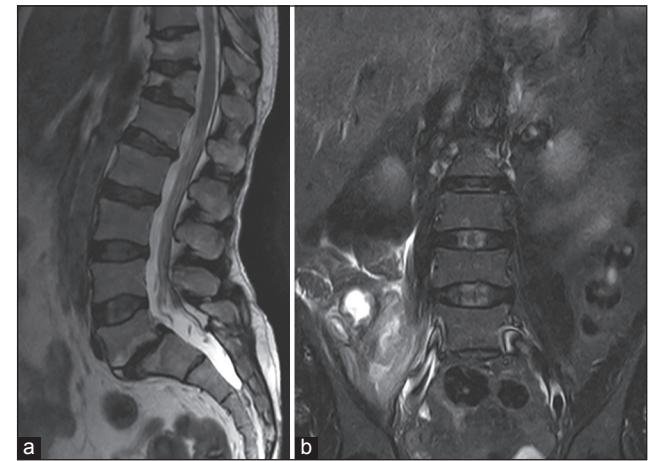
be diagnosed with coronal STIR imaging, which can direct biochemical assessment for correct diagnosis.

Sacro-iliac joint degenerative changes is another under-recognized cause of back pain, especially in females, and is frequently unrelated to the degree of degenerative changes in the lumbar spine, and it can be detected with coronal STIR imaging.<sup>[6]</sup> Another cause of back and buttock pain, which can be diagnosed with coronal STIR imaging, is muscle sprain, especially in gluteal muscles [Figure 3] although additional imaging is required for complete evaluation in such cases.

Atypical presentations of acute appendicitis are common especially in elderly patients as seen in one patient in our study who was referred for suspected radiculopathy and right anterior thigh pain. STIR showed extensive inflammation in right iliac fossa and along right ilio-psoas muscle [Figure 4]. Further evaluation showed ruptured appendicitis, which was confirmed on surgery.



**Figure 2:** (a and b) Sagittal T2W image (2a) showing no significant disc degeneration/herniation. Coronal STIR image shows obliquely oriented sacral stress fracture on left side with associated marrow edema



**Figure 4:** (a and b) Sagittal T2W image (4a) shows old compression/collapse of D11 and D12 vertebrae and mild anterior wedging of L1 vertebra. Also there is evidence of grade I anterolisthesis at L5-S1 level with compression of bilateral L5 exiting nerve roots in neural foramina (not shown). Coronal STIR image shows extensive inflammation in right iliac fossa and along right psoas muscle. Subsequent imaging and surgery confirmed the diagnosis of complicated appendicitis

In conclusion, addition of coronal STIR imaging to routine protocol of lumbar spine MR imaging can provide important information in a small number of patients, which can be useful in early diagnosis and institution of correct treatment. Therefore, coronal STIR imaging should be included in routine imaging of lumbar spine MRI.

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