



# Utility of sagittal MR imaging of the whole spine in cases of known or suspected single-level spinal infection: Overkill or good clinical practice?

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## ABSTRACT

**Objective:** Multi-sequence sagittal magnetic resonance imaging (MRI) of the entire spine is performed in patients with known single level spondylodiscitis. Our objective is to determine the frequency of multifocal infection.

**Methods:** After IRB approval, a retrospective five-year review of all patients with spondylodiscitis was performed.

**Results:** MRI identified 82 patients with single-level infection. All 82 had entire spine imaging performed within 72 h of admission, showing additional non-continuous sites of infection in 19 patients (23%). Remote levels of spondylodiscitis were present in 11 patients (13%).

**Conclusion:** Multi-sequence sagittal MRI of the entire spine may be helpful in patients with known single-level spine infection.

## 1. Introduction

Infection can affect any component of the spine; the disk, bone, soft tissues (including the spinal cord) and the potential intraspinal spaces (epidural, subdural, and subarachnoid). The most common route of infection in the spine is hematogenous, with invading organisms initially lodging in the subchondral endplates of the adult spine [1]. Irreversible neurologic impairment, one of the most feared complications of spinal infection, can cause substantial morbidity to the patient and impose large economic costs to the patient and society. Early diagnosis and treatment can avert complications and improve patient outcomes [2]. Unfortunately, the diagnosis of spinal infection can be difficult, and even delayed, as presenting symptoms can be vague. The difficulty of detecting spinal infection clinically has led physicians to rely heavily upon imaging. With a sensitivity, specificity, and accuracy above 90% and the ability to evaluate the spinal cord for impingement, MRI has been widely accepted as the imaging method of choice for spinal infection [3,4]. Less clear is the need to evaluate patients for multifocal disease once a single level of spinal infection has been identified.

Rates of multifocal spinal infection have varied from around 4% to 30% in smaller series [4–6]. Mann et al. evaluated 24 patients with spondylitis and found 21 patients (87.5%) had single level infections,

while 2 had bisegmental and 1 had multisegmental infection (8% and 4% respectively) [5]. Ledermann et al. found 7 out of 44 (16%) of patients with disk infection had involvement at several spinal levels [4]. Ziu et al. found that in 102 intravenous drug users, 71 (69.6%) had single level of infection while the remaining 31 (30.4%) had multiple levels of infection [6]. However, it is unclear if these sites were contiguous or at separate segments of the spine. The clinical ambiguity, reported rates of multifocal spinal infection and outstanding track record of MRI have left physicians feeling required to exclude multifocal infection in patients with one site of known spinal infection [7]. Accordingly, referring physicians often request MRI of the entire spine in patients with a known single site of spinal infection in search of additional levels of involvement. At the authors' institution, a regional spinal cord center, multi-sequence sagittal MRI is performed to screen the entire spine specifically for this purpose. After spondylodiscitis has been confirmed by dedicated MRI of the clinically suspected spinal region, usually lumbar, non-contrast sagittal T1-weighted, T2-weighted, STIR and fat saturated T1-weighted post-contrast images of the entire spine are performed in search of additional sites of infection. However, data is lacking on the yield of this practice and the justification for additional imaging is unclear. The purpose of our study is to determine the frequency of multifocal spondylodiscitis discovered using

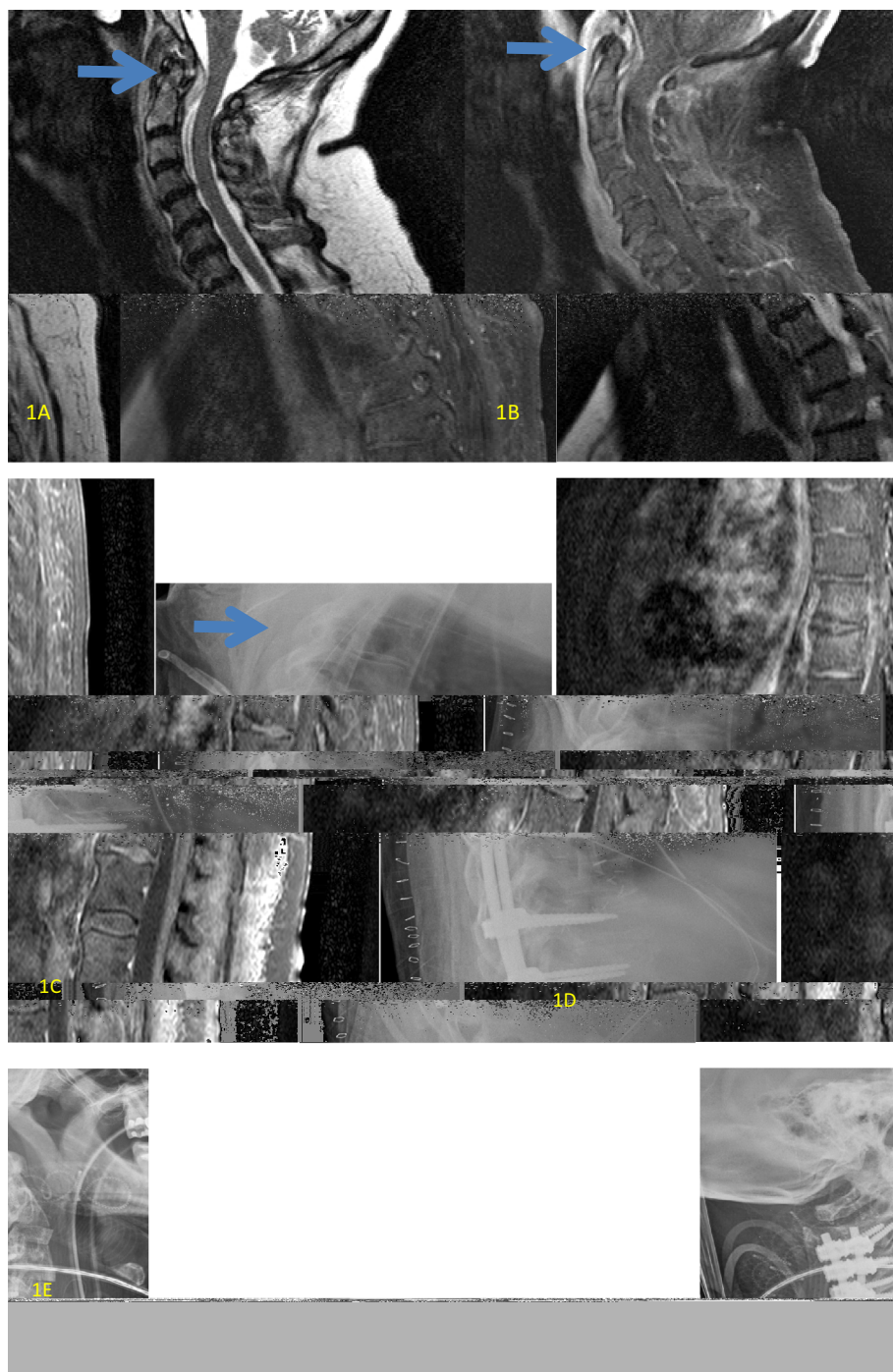
**Abbreviations:** MRI, magnetic resonance imaging; PACS, Picture Archiving and Communications System; STIR, Short Tau Inversion Recovery

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**Fig. 1.** Illustrative case 1:

A 74 year-old woman with neck pain had dedicated cervical spine MRI and subsequent screening sagittal MRI of the entire spine. Sagittal T2-weighted (A) and T1-weighted fat-suppressed post-contrast (B) MR images show a heterogeneous enhancing soft tissue mass centered at the C1–C2 articulation (blue arrow), causing mild central canal narrowing. C is a sagittal T1-weighted fat-suppressed post-contrast image of the thoracic spine, which shows additional unsuspected discitis-osteomyelitis at T8–T9 with a small epidural component (blue arrow). The patient was taken to surgery and discitis-osteomyelitis and epidural abscesses were confirmed at C1–C2 and T8–T9. D and E are intraoperative radiographs of the thoracic and cervical spine, respectively. Cultures taken during surgery grew *Staph aureus*. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

multi-sequence sagittal MRI of the entire spine in patients with a known single level of spinal infection (Fig. 1).

## 2. Materials and methods

After internal review board approval, a retrospective five-year review of the medical records and MR imaging findings of all patients with spinal infections presenting to a tertiary-care center was performed. The first inclusion criterion for the study was a diagnostic quality MRI that unequivocally identified a single level of clinically suspected spondylodiscitis. These studies were identified by PACS interrogation of all spine MRIs performed between 2009 and 2014 with reports including the terms “spinal osteomyelitis,” “discitis,” and “abscess.” Medical charts were reviewed, and patients with a history of

spinal surgery within 12 months of clinical presentation with spondylodiscitis and diagnostic MR study were excluded. The final inclusion criterion for the study was a subsequently performed multi-sequence sagittal MRI of the entire spine, which all patients included in the study had performed within 72 h of diagnostic MRI. Often, the diagnostic MRI underwent preliminary review by a neuroradiology attending, or resident on-call during off-hours, and additional sagittal sequences of the remaining spine regions were performed immediately. At our institution, sequential MR imaging of the cervical, thoracic and lumbar spine is performed in three stations with a field of view ranging from 24 to 36 cm. At each station, sagittal non-contrast T1-weighted, T2-weighted, STIR and T1-weighted fat-saturated post-contrast sequences are performed to maximize the conspicuity of spondylodiscitis. Images from each station are presented separately and collated, which simplifies

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