

Early ankylosing spondylitis and its differentials

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Patient presentation

A 32yr old male was referred for plain radiographs of the lumbar spine from his GP. His symptoms were of long standing pain and restricted movement in his lower back, which was worse in the morning, and improved through the day. He worked as a plumber and was feeling that his symptoms were beginning to impact upon his work. There was a family (maternal) history of ankylosing spondylitis (AS).

Request and Justification

- The identification of treatable causes of chronic low back pain (LBP) is of great clinical relevance (Rudwaleit et al, 2004).
- Imaging of the lumbar spine for such pain, only demonstrates the underlying cause in 15% of patients (Middleton and Fish, 2009).
- The Royal College of Radiologists (RCR) suggest that plain x-rays for chronic LBP with no 'red flag' indicators (Table 1) should not be performed unless:
 - the clinician provides cogent reasons or,
 - the radiologist believes the examination represents an appropriate means of furthering patient diagnosis and management (RCR, 2012).

Red Flag Indicators for chronic low back pain
• Thoracic pain
• Fever/unexplained weight loss
• Bladder/bowel dysfunction
• History of carcinoma
• Ill health/presence of illness
• Progressive neurological deficit
• Disturbed gait/saddle anaesthesia
• Age of onset <20 years/>55 years

ASAS criteria to identify inflammatory back pain
• Onset of back discomfort <40 years
• Insidious onset
• Improvement with exercise
• No improvement with rest
• Pain at night (improves on arising)

Table 2: ASAS expert criteria; 3 criteria present suggest an inflammatory aetiology, 4 criteria confirm it (Yu and van Tubergen, 2015)

Table 1: Red flag indicators (Semanta et al, 2003)

- The National Institute for Health and Care Excellence suggest LBP with an inflammatory etiology should be clinically identified (Wheeler, 2015) and this is established using the Assessment of Spondyloarthritis International Society (ASAS) expert criteria (Table 2).
- Imaging plays a critical role in the diagnosis and assessment of spondyloarthropathy (Calin, 1998, Jacobson, 2009, Yu and van Tubergen, 2015, and Ostergaard and Lambert, 2011).
- A family history of AS is a key determinant of susceptibility (Brown, 2011 and Jurik, 2011).

The referral for x-ray is justified

Overview of AS

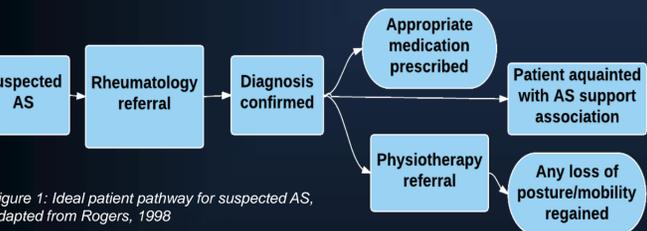


Figure 1: Ideal patient pathway for suspected AS, adapted from Rogers, 1998

- AS is a chronic, multisystem inflammatory disorder primarily affecting the sacroiliac (SI) joints / axial skeleton (Brent, 2015).
- Prototype of the seronegative spondyloarthropathies, sharing many characteristics:
 - genetic disposition (in association with HLA-B27 antigen)
 - typical sites of involvement
 - inflammatory responses (Schorn, 2015)
- 3 times more common in men (Khan, 1998)
- Peak incidence in early adulthood (Ibid, Schorn, 2015).
- Early diagnosis is paramount in initiating the ideal patient pathway (Jurik, 2011) - Figure 1.

Key radiographic findings and their differentials

1. Sacroiliitis

- Sacroiliitis represents inflammatory chondritis and subchondral osteitis at the SI joints (Olivieri et al, 2009).
- Initial erosive changes and subsequent repair leads to subchondral sclerosis and subsequent ankylosis (Diel et al, 2001)
- Radiographic / MRI manifestation of sacroiliitis (and appropriate clinical findings- Table 2) are required for the diagnosis of AS according to ASAS (Yu and van Tubergen, 2015).
- The modified New York criteria is the most widespread grading system for sacroiliitis on plain x-ray (Ibid).
- Bilateral changes corresponding to grade 2 or higher, or unilateral changes corresponding to grade 3 or higher, must be detected to diagnose sacroiliitis radiographically (Navallas et al, p 939, 2013).
- Table 3 shows Imaging findings / Table 4 shows differentials

Differentials: Sacroiliitis	Distinguishing features : AS
reactive/psoriatic arthritis	Often unilateral (Murphy and Preston, 2003) and frequently asymmetrical (Grainger and O' Connor, 2015, Helms, 2014 and Brent, 2015).
hyperparathyroidism	Widening more dramatic, other features of hyperparathyroidism / subchondral sclerosis should be present (Jacobson, 2008, James, 2014 ¹).
infective sacroiliitis	Typically unilateral/severe, other signs of infection should be present (Yu and van Tubergen, 2015).
spinal degenerative joint disease (DJD)	Usually asymmetrical (James, 2014 ¹). Sacroiliac osteophytes are characteristic for degenerative disease in SI joints (Ibid, Helms, 2014).
inflammatory bowel disease	Grainger and O' Connor (2015) suggest an asymmetric distribution, other authors state involvement is bilaterally symmetrical-hence indistinguishable from AS (Jacobson 2008, Helms 2014).
osteitis condensans ilii	Mainly in young, multiparous women, joint margins well defined (James, 2014 ¹ and Khan,1998). No erosions (Yu and van Tubergen, 2015).
gout	Often asymmetrical, large well defined erosions (James, 2014 ¹). Tophaceous spinal deposits often present (Dheer and Rogers, 2015).

Table 4: Differential diagnoses for sacroiliitis

2. Spinal involvement

- Spinal involvement in AS is frequently observed (Grainger and O' Connor, 2015), with the syndesmophyte representing the characteristic feature (Schorn, 2015).
- Table 5 shows findings/Table 6 shows differentials

Findings:
Gracile, vertical ossifications of the annulus fibrosus (black arrows- Fig 3) representing syndesmophytes (Jurik, 2010, James, 2014 ²). Appearances on the AP image are asymmetrical (black chevrons- Fig 2.) which is more typical of reactive/psoriatic arthritis (James, 2014 ²).
Bony outgrowth L3-4 disc space (red arrow- Fig 3) which appears to bow around annulus fibrosus likely represents a spondylophyte or mixtaosteophyte (Schorn, 2015).
Vertebral body 'squaring' (blue braces- Fig 3) - osteo-proliferative change at the ventral aspect of the vertebral bodies/erosions of the superior and inferior margins of the bodies, distort normal concavity of anterior surface (Brent, 2015 and Ostergaard and Lambert, 2012).
Focal areas of osteitis at insertions of the peripheral fibres of the annulus fibrosus (red stars- Fig 3) 'Shiny corner sign' /Romanus lesion (Grainger and O' Connor, 2015, Jacobson 2008).

Table 5: Spinal findings

Differential: spinal involvement	Distinguishing features: AS
reactive/psoriatic arthritis	Paravertebral ossifications bulky/emanate from vertebral body and are unilateral or asymmetrical (Helms 2014, Khan, 1998). Romanus lesions less frequently seen than in AS (Nissman et al, 2015). Vertebral body 'squaring' occasional (Murphy and Preston, 2003) or absent (Jacobson, 2008).
DJD of the spine	Spondylophytes distinguished from syndesmophytes by horizontal orientation (Helms 2014),with vertical angulation after a few mm (Schorn, 2015). Absence of classic radiographic features of spinal DJD (Wang and Ward, 2015).
Diffuse Idiopathic Skeletal Hyperostosis	Anterior bone proliferation is flowing and undulating (Jacobson, 2008) and often >2cm thick (Coggins and Hayes ¹ , 2015). Absence of sacroiliac erosions (Ibid, Murphy and Preston, 2003) .
Ochronosis (Alkaptonuria)	Fines osseous bridges between vertebral bodies but no SI changes (Mwambingu and Hide, 2014). Disk calcification/degeneration should be present (Coggins and Hayes ² , 2015)

Table 6: Differential diagnoses for spinal changes

Findings:
Grade 3 sacroiliitis demonstrated (Fig.2) according to The modified New York Criteria.
Sacroiliac changes are typically bilateral and symmetrical with AS (Jacobson et al, 2008, Olivieri et al, 2009, Khan, 1998)
Irregular erosive contours of the caudad portion of the joint (blue arrow -Fig.2) (Schorn, 2015)
Subchondral sclerosis (small blue triangle Fig.2) more prominent on iliac side due to thinner cartilage (Navallas et al, 2013, Olivieri et al, 2009, Khan, 1998)

Table 3: Imaging findings for sacroiliitis

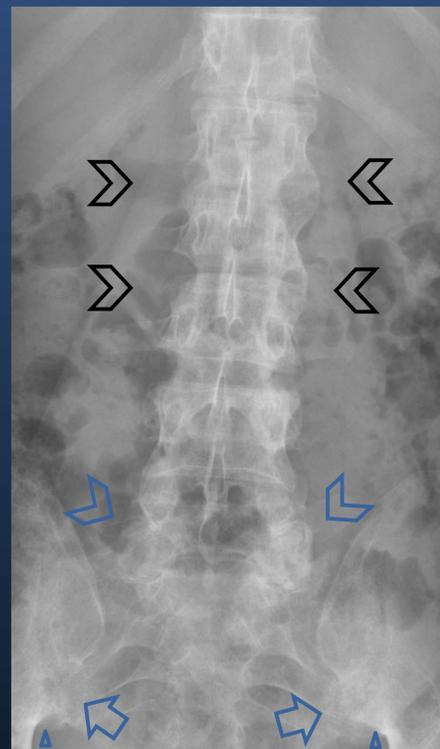


Figure 2: Cropped AP Projection

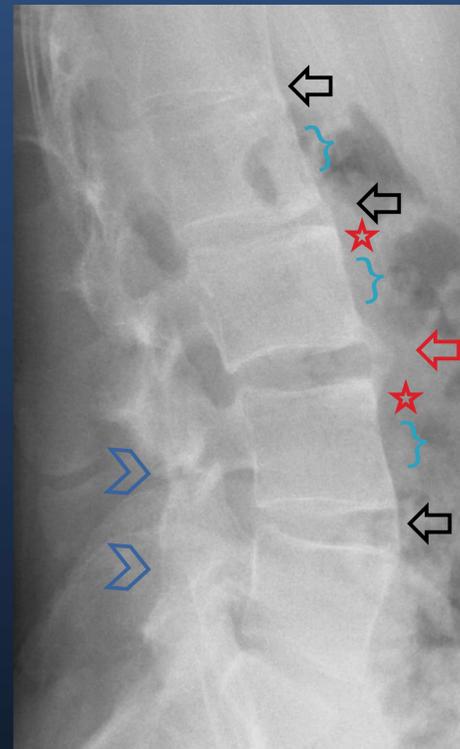


Figure 3: Cropped lateral demonstrating syndesmophytes

Practice/definitive reports

Practice

Normal lumbar curvature. The sacroiliac joints are ill-defined bilaterally suggestive of sacroiliitis. Fine flowing syndesmophytes noted to the anterior aspects of the visualised lumbar vertebrae with vertebral squaring. Note is also made of the 'shiny corner' sign at the anterior aspects of the superior endplates of L3 and L4. Findings are strongly suggestive of ankylosis spondylitis and rheumatology referral is suggested.

Definitive

Degenerative changes of the facet joint, bridging marginal osteophyte of the lumbar spine with squaring of the vertebral bodies. Erosive changes at the sacroiliac joint with sclerosis noted, findings appear to be consistent with ankylosing spondylitis.

Report comparison

- Report should provide specialist interpretation of images/relate findings to the patient's clinical presentation, in order to contribute to the understanding of their clinical condition and suggest further management (RCR, 2006).
- Practice and definitive reports were analysed according to error classification categories defined by Pinto and Brunese (2010)- Table 7.

Finding	Practice report	Definitive Report	Error analysis
sacroiliitis	✓	✓	n/a
syndesmophytes	✓	✗	Interpretive error
vertebral squaring	✓	✓	n/a
'shiny corner' sign	✓	✗	Observer error: perceptual
degenerative facet joint change	✗	✓	Observer error: satisfaction of search
conclusion : AS	✓	✓	n/a
rheumatology referral	✓	✗	Failure to suggest next appropriate action

Table 7: Analysis of practice and definitive reports with error categorisation

Practice report error:

- Failure to report degenerative facet joint changes (blue chevrons Figs. 2/3). Osteosclerosis and joint space narrowing may represent Grade 1 (mild) DJD (Parizel et al, 2015) or relate to AS, although the latter is said to be rarely visualised in early disease (Schorn, 2015).

Definitive report errors:

- Differentiation between syndesmophytes/osteophytes (Table 6).
- Failure to report 'shiny corner' sign¹.
- Failure to recommend a rheumatology referral. This advice is highly valued by GPs (Greive et al, 2010).The best outcomes for AS patients result from early Rheumatology referrals (Yu and van Tubergen, 2015).

Overall: No significant change in management but possible delay in referral.

Case summary

The patient presented with inflammatory back pain symptoms and a maternal history of AS. Plain film imaging was justified and demonstrated features consistent with seronegative spondyloarthropathy. There were small disparities between Practice and Definitive reports but with no significant impact on patient management. Whilst some of the classic radiological findings of AS were not demonstrated (such as 'bamboo', 'dagger' and 'tramline' signs described by Jacobson, 2008) and there was asymmetry (Figure 2) more typical of reactive/psoriatic arthritis, and likely coexistent DJD at L3-4, a strong radiological picture of AS is painted. However, it is important to note that ultimately the differentiation between the spondyloarthropathies is based more on accompanying clinical features than on radiographic differences alone (Khan, 1998).

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