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# Spinal infection - an overview

Alex Goubran and James Tomlinson

**S**pine infection covers a broad spectrum of disease from simple discitis that can usually be managed in a non-specialist centre, to complex infections with epidural collection, requiring emergency surgical management in a complex spine centre. Treating spinal infection is challenging and needs close collaboration between orthopaedics, radiology, microbiology and infectious diseases. It is a diagnosis that can be easy to miss in the early stages and a high index of suspicion is critical.

## What is it?

Osteomyelitis of the spine may result from haematogenous seeding of the adjacent disc space<sup>1</sup> in a spondylodiscitis type picture; infection of the intervertebral disc and/or endplate. There may be delay in diagnosis and identification as it presents with common, often non-specific, symptoms of back and neck pain.

Though first described by Pott, specifically referencing Tuberculosis of the spine, the disease process can be caused by many pathogens. It may be isolated to the intervertebral disc space and termed spondylodiscitis<sup>2</sup> but it is when the bony structures are involved, it would be termed vertebral osteomyelitis.

## Who gets it?

Spinal infections have a bimodal distribution of incidence, with a peak below 20 years of age and another at 50-70 years of age. It is 2.5 times more common in females than males<sup>3</sup>. Certain risk factors are associated with discitis and are listed below. It is important to recognise that a large number of cases are seen in patients with no identifiable risk factors.

Common risk factors and association<sup>1</sup> include age, immunocompromise, and active intravenous drug use. Diabetes mellitus, neoplastic disease and indwelling urinary catheters. Although post-operative infection is not common, it is still important to ask about recent spinal surgery in the context of relevant symptoms.

## How common is it?

Spinal infection accounts for approximately 2-7% of all musculoskeletal infections. Its incidence is between 1:100,000 and 1:250,000 in developed countries. Its estimated mortality rate is 2-4%.

## What are the causes?

In determining the cause or origin; pertinent history and evaluation of the patient should include history of antimicrobial use, prior surgical procedures as well as urinary tract infection, bloodstream infection, skin or soft tissue infection, and intravenous drug use<sup>2</sup>.

The most common causative pathogen seen in Western societies are *Staphylococcus aureus* or *E. coli*<sup>1</sup>. Blood cultures are positive in approximately 50% of patients, and in these cases biopsy is therefore not needed. Patients with *S. aureus* bacteraemia must also undergo Echocardiographic assessment for evidence of infective endocarditis.

Discussion with microbiology and radiology colleagues is critical. Radiological guided biopsy is critical in the absence of either positive microbiology samples or positive blood cultures.

Certain regions may have endemic Tuberculosis, and/or Brucella infection and Brucella. Tuberculosis remains a major cause of spinal infection worldwide and it is important to consider in certain areas of the UK, as well as in cases of recent foreign travel to high incidence countries. Those patients who are immunocompromised or who have human immunodeficiency virus may be at higher risk of infection with mycobacteria. High rates of Brucellosis are seen in the Mediterranean, Middle East, parts of Africa and Western Asia.

Fungal disease is extremely rare<sup>1</sup>. It is usually only seen in patients with significant risk factors.

In the paediatric population<sup>2</sup>, due to vascular anastomoses in the intervertebral disc, septic

emboli do not usually cause bone infarction and bone infection in the same way as occurs in adults, but infection may be confined to the disc. In areas of endemic disease; pathogens such as Tuberculosis and Brucella should be considered.

### How is it diagnosed?

The average time to diagnosis has been reported to be between 2-4 months<sup>2</sup>. Patients may initially present with very mild symptoms, and back or neck pain. It is critical to ask patients if their pain is different from any usual background pain – both in severity and distribution. New thoracic back pain, new radicular pain and/or weakness can be key findings.

Examination should elicit any signs of instability pain (pain on sitting on standing), and a thorough neurological examination is critical. Blood tests including inflammatory markers should be sent. Gold standard imaging is MRI whole-spine with axial and sagittal sequences. Wherever possible these scans should be done with Gadolinium to look for the presence of an epidural abscess. If an abscess is present ring enhancement will be seen. MRI scans may be normal in the early stages of discitis. In these cases a second scan should be done 14 days after the initial scan. Two normal scans 14 days apart makes spinal infection extremely unlikely.

If blood cultures are positive then radiologically guided biopsy is not usually needed, although only 50% of cases have positive blood cultures<sup>1</sup>. Radiologically guided needle biopsy is positive in up to 73% of cases if the infected site is radiologically accessible. Open surgical biopsy can be performed if needed and has a 92% positive culture rate.

### Imaging

MRI of the spine has a sensitivity of 97%, specificity of 93% and an accuracy of 94% in diagnosis. Inability to distinguish margins between the disc space and adjacent vertebral marrow on the T1 weighted images associated with high signal intensity from disc and adjacent marrow on the T2 weighted images is considered the most salient radiological feature (Figure 1). If infection is centred on bone with spread under the anterior longitudinal ligament, TB must be suspected.

MRI can also distinguish between an infective process, degenerative disease, neoplasia or trauma. CT scanning is helpful in cases with significant bony destruction for surgical planning but is often less helpful when diagnosing early discitis with subtle changes.

Plain films should only be used to assess deformity and collapse as disease progresses

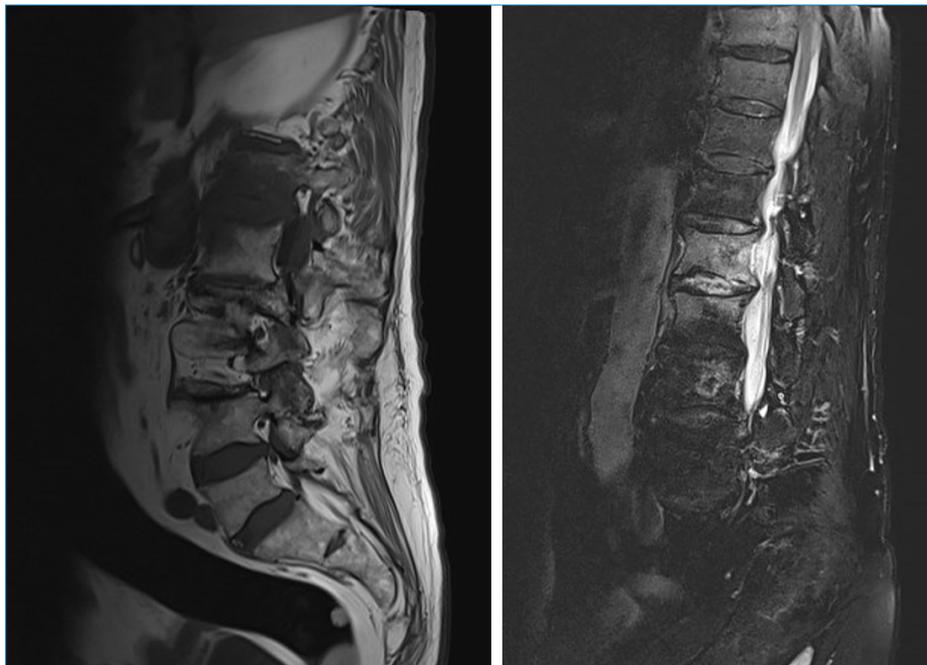


Figure 1: MRI changes.

and is treated. They do not play any useful role in diagnosing discitis in the early stages of disease.

### Medical and surgical management

Treatment should be targeted to an organism wherever possible. There are no universally agreed standards on the length of treatment. Uncomplicated discitis (not involving the epidural space) can usually be treated with two weeks of intravenous, then four weeks of oral, antibiotics. Infection with epidural involvement requires six weeks of intravenous antibiotics and a further six weeks of oral antibiotic therapy<sup>4</sup>.

The Infectious Diseases Society of America guidance suggests withholding antimicrobial therapy until an organism has been cultured. Empirical antibiotics should however, be commenced in the face of sepsis, haemodynamic instability or neurological compromise. If treatment is commenced without cultures Flucloxacillin is often the first line treatment given that *Staphylococcus aureus* the most common causative organism.

Treatment response should be monitored with serial CRP measurements, ideally twice weekly. Repeat imaging is not routinely performed in simple discitis. Scan appearances may be abnormal for up to a year post infection, and thus repeat scans are not particularly helpful. In patients with

an epidural abscess an end of treatment scan should be performed before stopping antibiotics. This is to ensure the epidural collection has resolved<sup>5</sup>.

Simple discitis without significant bony destruction can be managed in a non-specialist centre. If significant bony destruction or epidural abscess is present patients should be managed in a specialist spine centre.

### Surgical management

Absolute indications for surgery include epidural abscess with either neurological compromise, overwhelming sepsis or both. These patients may present in extremis and life threateningly unwell and need emergent decompression and drainage. Epidural abscess at cord level (above the conus) is also an absolute indication for emergency surgery (Figure 2). Such cases need urgent transfer to a specialist spine centre.

Relative indications for surgery are deformity and instability pain. Decision making in these cases is more nuanced and must include a detailed discussion with the patient and careful management of expectations.

When surgical stabilisation is needed it may be anterior, posterior or both and is usually bespoke to each case and the indications. The approach for decompression and >>

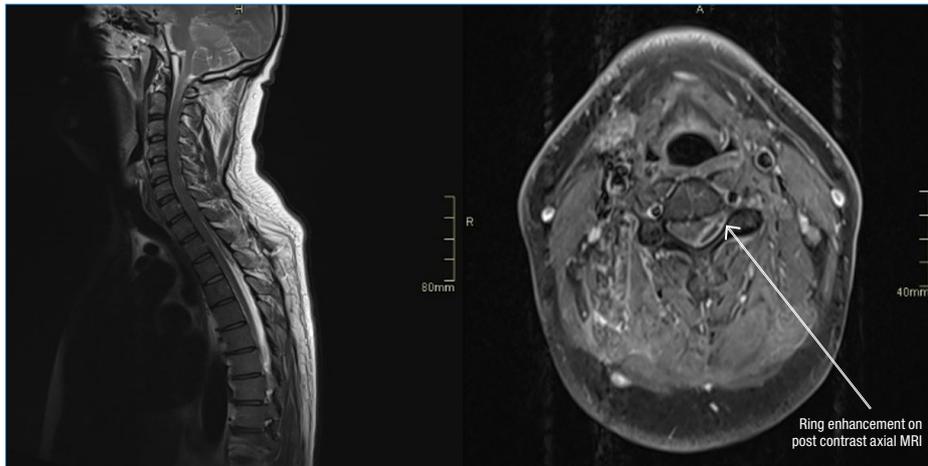


Figure 2: Epidural abscess.

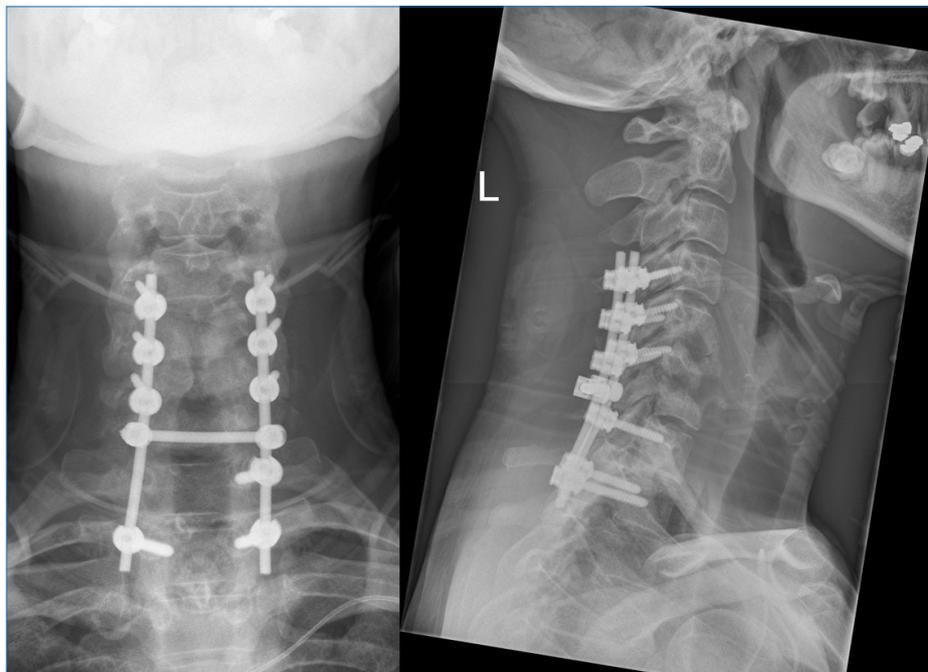


Figure 3: Posterior stabilisation of cervical spine for bony infection.

drainage of an epidural abscess is guided by the location of the abscess relative to the spinal cord - i.e. if whether an anterior or posterior approach is more suitable (Figure 3)<sup>6</sup>.

### Follow-up

It is almost impossible to give definitive guidance on which patients should or should not be followed up. Follow up may be with local orthopaedic teams, infectious diseases teams, spinal surgeons, or a combination of these.

Factors that shape follow up decisions include presence of epidural infection, treatment response (fall in CRP), causative organism (Gram negative infections may not fuse and develop chronic pain), and need for acute surgical

treatment. Patients with epidural space infection should all be followed up with an end of treatment MRI scan before stopping antibiotics. The other factors listed are all relative indications for follow up that should be considered.

### Conclusion

Spinal infection is a complex spectrum of disease ranging from simple discitis in relatively well patients to complex epidural infection that may lead to life threatening illness or severe neurological compromise. A high index of suspicion is critical as this condition is often misdiagnosed or missed altogether. Once infection has been diagnosed on cross sectional imaging multispecialty input is needed to optimise treatment. ■

### References

1. Berbari EF, Kanj SS, Kowalski TJ, et al. Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults. *Clin Infect Dis*. 2015;61(6):e26-46.
2. Duarte RM, Vaccaro AR. Spinal infection: state of the art and management algorithm. *Eur Spine J*. 2013;22(12):2787-99.
3. Baryeh K, Anazor F, Iyer S, Rajagopal T. Spondylodiscitis in adults: diagnosis and management. *Br J Hosp Med (Lond)*. 2022;83(10):1-9.
4. Bernard L, Dinh A, Ghout I, et al. Antibiotic treatment for 6 weeks versus 12 weeks in patients with pyogenic vertebral osteomyelitis: an open-label, non-inferiority, randomised, controlled trial. *Lancet*. 2015;385(9971):875-82.
5. Luzzati R, Giacomazzi D, Danzi MC, et al. Diagnosis, management and outcome of clinically- suspected spinal infection. *J Infect*. 2009;58(4):259-65.
6. Hadjipavlou AG, Mader JT, Necessary JT, Muffoletto AJ. Hematogenous pyogenic spinal infections and their surgical management. *Spine (Phila Pa 1976)*. 2000;25(13):1668-79.

### Key learning points

- Spinal infection is often diagnosed late and it is critical to maintain a high index of suspicion.
- MRI imaging is the gold standard and should be performed early.
- Antibiotics should be withheld until an organism has been cultured unless a patient is systemically unwell.
- Input from spinal surgeons, microbiologists and infectious diseases is critical to optimise management.
- Simple discitis without significant bony destruction can be managed in a non-specialist centre. If significant bony destruction or epidural abscess is present patients should be managed in a specialist spine centre.
- Treatment response should be monitored with serial CRP measurements, ideally twice weekly. Repeat imaging is not routinely performed in simple discitis as scan appearances may be abnormal for up to a year post infection.
- Patients with epidural space infection should all be followed up with an end of treatment MRI scan before stopping antibiotics. Other factors may be relative indications for follow up that should be weighed individually.