Discitis

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Discitis is not an uncommon condition and can be potentially life threatening if diagnosed late. This article reviews recent publications and discusses the clinical presentation, pathoaetiology, diagnosis, treatment and pitfalls.

Discitis is inflammation of the intervertebral disc space that is frequently associated with infection. The endplates are often involved giving rise to vertebral osteomyelitis, which has a very similar clinical presentation and treatment to discitis. Infective discitis is therefore synonymous with infective spondylodiscitis and vertebral osteomyelitis.

There has been a definite change in the natural history of infective discitis. At the turn of the 20th century the disease was most often seen in younger people, associated with a high incidence of abscess formation and high mortality rate. Over the last few decades, there has been a significant improvement in the prognosis owing to major advances in radiology and surgery. This has allowed for its earlier detection and treatment resulting in lowered morbidity and mortality. Nonetheless, morbidity remains relatively high since diagnosis and treatment is often delayed because of its insidious onset and common association with immunocompromised states.

This article is based on recent publications as well as the authors' experience in running an acute spinal service. It outlines the clinical presentation, pathoaetiology, methods of diagnostic imaging, treatment modalities, prognosis and medical pitfalls relating to discitis.

INCIDENCE AND PREVALENCE

In Western societies such as the United States and Europe the incidence of discitis ranges from 1 in 250 000 to 1 in 50 000 inhabitants per year (Krogsgaard et al, 1998; Beronius et al, 2001). There may be an increased incidence related to the ageing population and increased spinal procedures. However, in less developed nations such as Africa, a prevalence of up to 11% has been reported in patients reviewed for back pain (Bileckot et al, 1994).

There is an increased prevalence in people with lowered immune states, e.g. diabetes, chronic alcoholism, malignancy, collagen vascular disease, hepatic cirrhosis, end-stage renal failure, steroid use, human immunodeficiency virus and injection drug abusers. In fact, 45–79% of cases will have at least one of these associated co-morbidities, with diabetics predominating in 11–31% of cases (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002).

AGE, SEX AND GEOGRAPHY

There is a bimodal distribution for age, rising at around 5 years, falling in middle age, with a second peak in the sixth decade (Sapico and Montgomerie, 1979; Fernandez et al, 2000; McHenry et al, 2002). Childhood discitis has been disputed by some physicians to have a different pathoaetiology and therefore should be considered separately. There is a slight male predominance in children and definite male predominance of 2 males to 1 female in adults. There is no specific predilection for any given race.

SYMPTOMS AND SIGNS

Clinical presentation

Diagnosis is often delayed by months because adult discitis has a slow insidious onset (Sapico and Montgomerie, 1979; McHenry et al, 2002). Not infrequently non-specific symptoms of systemic infection, including fever, chills and weight loss, may be present. The lumbar spine is most commonly affected in approximately 60% of cases, followed by thoracic and lastly cervical spine (Sapico and Montgomerie, 1979; McHenry et al, 2002). Initial symptoms commonly consist of neck or back pain, with localized tenderness that intensifies with movement. Simple measures such as bed rest and analgesics are ineffective. Chronically ill patients, particularly diabetics, have an increased incidence of epidural extension often resulting in paraparesis or paraplegia.

Postoperative patients present within days to weeks of surgery with symptoms and signs similar to spontaneous discitis (Rawlings et al, 1983). These include pain with restricted movements, localized tenderness and normal neurological findings. Few cases show superficial signs of infection and neurological deficits are rare because of early diagnosis.

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Children run a more acute onset of the illness (Fernandez et al, 2000). They present commonly with rapid onset of back pain, irritability and refusal to walk. Fever is often present, accompanied by local tenderness and limited back motion.

Clinical findings

Frequent findings include localized tenderness with overlying paraspinal muscle spasm. Limited motion occurs in the involved mobile cervical or lumbar segments secondary to pain and muscle spasm. Neurological compromise consisting of radiculopathy or myelopathy occurs in up to 30% of cases (McHenry et al, 2002; Nolla et al, 2002), with the highest frequency of motor dysfunction occurring in the cervical, followed by thoracic and lastly lumbar spine (McHenry et al, 2002).

INVESTIGATIONS

Haematological investigations

Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are consistently raised in over 90% of cases (Sapico and Montgomerie, 1979; Chelsom and Solberg, 1998). The mean ESR is frequently raised to 85–95 mm/hour. Leucocytosis is raised in less than 50% of cases, especially when the primary infected focus has been treated (Sapico and Montgomerie, 1979; Nolla et al, 2002).

Although blood cultures return positive in up to 72% of cases (McHenry et al, 2002; Nolla et al, 2002), they must be obtained frequently because appropriate antibiotic therapy may be introduced obviating the need for invasive tests. The positive yield increases to 85% in those with a temperature above 38°C (Nolla et al, 2002). Routine sputum and urine samples are also taken to exclude the respiratory or genitourinary tract as the primary focus of infection.

Imaging

Plain X-rays: Radiographic abnormalities typically become visible several weeks after the onset of infection and remain very useful as the first line of investigation for its diagnosis (Varma et al, 2001). Early common findings include loss of intervertebral disc space with subsequent endplate irregularities, destruction and annular calcification of the affected segment (*Figure 1*). With disease progression, the endplates become osteopaenic, there is loss of the normal vertebra trabeculation and possible deformity as a late finding (*Figure 2*) (Ozuna and Delamarter, 1996).

Computed tomography: Computed tomography (CT) can be combined with intravenous contrast or myelography and allows for the earlier detection of discitis by revealing hypodensity of the intervertebral disc, adjacent endplates, vertebral body destruction and increased adjoining soft tissue swelling with paraspinal involvement (Varma et al, 2001). Occasionally CT can better visualize gas-producing bacteria and complement magnetic resonance imaging (MRI), because of its greater ability to differentiate between bone and soft tissue than MRI.

Figure 1. A 44-year-old healthy man with a 3-month history of worsening low back pain, lethargy and night sweats. Loss of the L3/4 intervertebral disc space is seen with endplate irregularities, destruction and anterior annular calcification of the affected segment.

Figure 2. A 55-year-old healthy woman with a 4-month history of worsening mid-thoracic back pain, increasing mid dorsal kyphosis and loss of lower limb sensation and proprioception. There is a 58° focal kyphotic deformity at T6–10 secondary to complete collapse of T7 and partial collapse of T8.

Magnetic resonance imaging: MRI remains the preferred method of investigation because of its ability to differentiate between infectious discitis, neoplasia and tuberculosis (Varma et al, 2001). MRI has been reported to have a 96% sensitivity and 94% accuracy for the diagnosis of discitis (Modic et al, 1985). T1-weighted images reveal a narrowed disc space with adjacent low signal endplate changes secondary to bone marrow oedema, while T2-weighted and short tau inversion recovery (STIR) images reveal increased signals in both the disc space and endplates (*Figures 3a–c*) (Varma et al, 2001). Disc space involvement implicates an infective aetiology since involvement in tuberculosis occurs late and metastasis rarely. Intravenous contrast enhancement, e.g. with gadolinium, allows further detection of paraspinal and epidural abscesses, while excessive paraspinal involvement and/or a psoas abscess is often characteristic of spinal tuberculosis or Pott's disease.

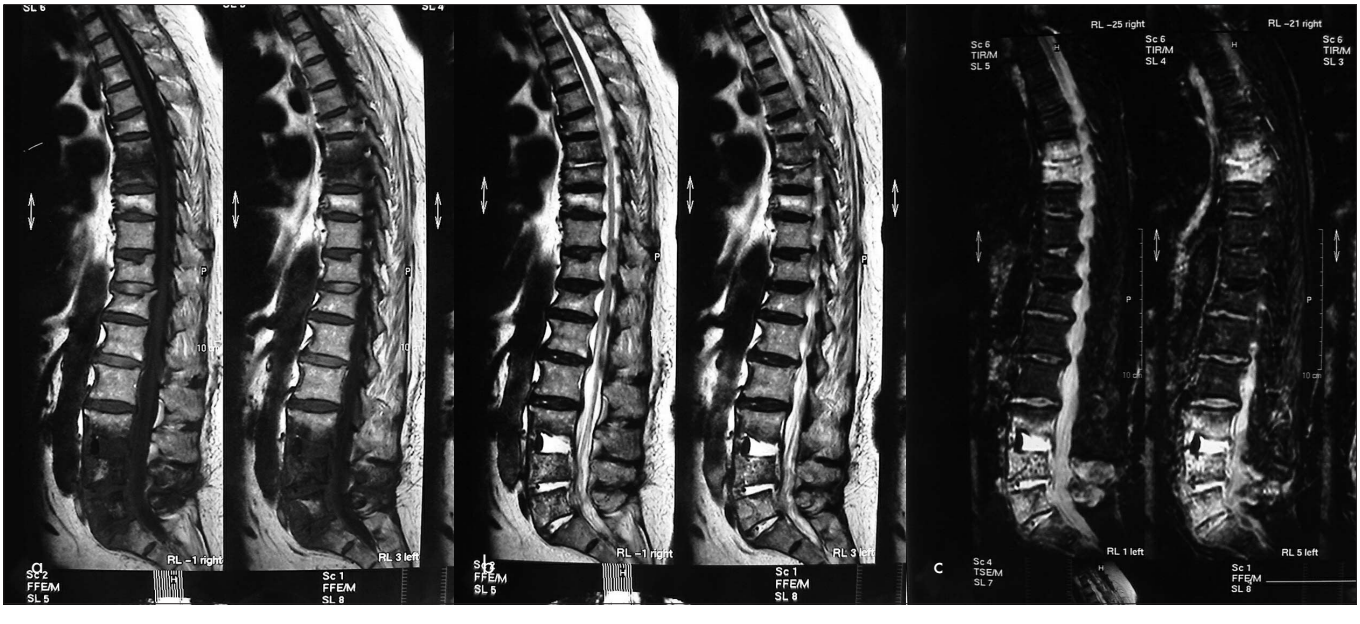
Nuclear medicine: Postoperative bone scans and indium-111 scintigraphy have limited use because of their low specificity for infection over inflammation. Both gallium-67 and technetium-99m are popular because of their increased and similar sensitivity of 94% for the detection of discitis, particularly early in the disease (Modic et al, 1985). Typically, there is a diffuse initial uptake that is followed by more localized uptake on delayed views. Technetium-99m is most advantageous because of the reduced cost and radiation dose (Varma et al, 2001).

Other tests: Routine use of echocardiography is recommended since discitis and widespread embolic infection not infrequently occur in bacterial endocarditis (Sexton and Spelman, 2002).

PATHOLOGY

The pathoaetiology of infective discitis can be understood through the appreciation of the local vascular anatomy. Spinal arteries from two lateral anastomotic chains and one median chain travel along the posterior surface of the vertebral bodies, which then give rise to periosteal and metaphyseal arteries that supply the anterior column (Ratcliffe, 1985; Smith and Blaser, 1991). In children, anastomoses occur between the metaphyseal arteries via the intermetaphyseal arteries. By the age of 15 years, these intermetaphyseal arteries become end-arteries and bacterial emboli enter this end-arterial system, resulting in a large area of localized vertebral endplate septic necrosis. Subsequent spread of infection occurs throughout the vertebral body, with later involvement of the adjacent poorly vascularized disc space, resulting in an infective vertebral spondylodiscitis. Further uncontained infection can spread into the epidural space or paraspinal soft tissues with potential abscess formation.

Figures 3. A 78-year-old non-insulin-dependent diabetic woman, who also uses steroid for her asthma, was treated 4 weeks earlier for a urinary tract-related Escherichia coli *septicaemia. She presented with a 3-day history of severe low back pain and right-sided leg weakness. a. Sagittal T1-weighted image reveals extensive adjacent low signal endplate changes secondary to bone marrow oedema involving the L3, 4 and 5 vertebral bodies. b and c. Sagittal T2-weighted and short tau inversion recovery (STIR) images reveal extensive increased signals in the L3/4, L4/5 and L5/S1 disc spaces and adjacent endplates as a result of marked inflammatory changes. There is fluid within the L3/4 disc space and pus collection in the anterior epidural space immediately posterior to the L4 vertebral body that is mildly displacing the thecal sac posteriorly. Multifocal involvement of the T7/8 disc space can also be observed in all three images.*



There is also an extensive anastomotic venous system in the epidural space known as the Batson plexus (Sapico and Montgomerie, 1979). Tributaries form around each vertebral level and continue into the pelvic plexuses, such that retrograde flow during periods of increased intra-abdominal pressures has been proposed to be the pathophysiology of sepsis spread from the pelvic organs. This hypothesis can be substantiated from the increased incidence of discitis in patients where there is an infective focus in the pelvis.

Microscopic examination of biopsy samples will be identical to those for any pyogenic infection. There is evidence of endplate and disc necrosis, with a predominance of neutrophil infiltration in the acute stages and lymphocytes later on in the infection.

Source of infection

There remains a tentative association with direct trauma, but often there is no identifiable source of infection. The urinary tract is the commonest primary focus of infection but soft tissues, respiratory tract and pelvic organs also may be other foci for haematogenous spread of infection (Sapico and Montgomerie, 1979). Use of contaminated syringes commonly encountered in intravenous drug abusers also offers direct venous entry for an array of pathogens.

Causative organisms

Staphylococcus aureus remains the most common bacterial pathogen in up to 70% of all infective discitis (Sapico and Montgomerie, 1979; McHenry et al, 2002). Uropathogenic organisms such as *Escherichia coli* and *Proteus* species are more common in patients with genitourinary tract infections, whereas *Pseudomonas aeruginosa*, *Klebsiella* species and other gram-negative organisms can be encountered in intravenous drug abusers. Naturally, there is an increased prevalence of discitis in immune suppressed states. Similar to adults, childhood discitis often has no obvious primary focus of infection with *S. aureus* being the most common pathogen isolated.

Infective discitis rarely occurs following surgical intervention. The rate is approximately 0.25% for lumbar discectomy and 0.5% for anterior cervical discectomy (Sapico and Montgomerie, 1979). These iatrogenic cases occur as a result of direct inoculation from the operative site as opposed to haematogenous spread. Once again *S. aureus* remains the most common pathogen, but *S. epidermidis* and *Streptococcus* species should also be considered.

Differential diagnosis

The following need to be considered in the differential diagnosis: spinal malignancy (commonly metastatic disease but occasionally primary malignancy), spinal epidural abscess, osteomyelitis, pyelonephritis, rheumatoid spondylitis and other forms of seronegative spondyloarthropathies (Varma et al, 2001).

MEDICAL AND SURGICAL MANAGEMENT

Tissue biopsy

Percutaneous needle or trocar biopsy under neuroleptic sedation allows for a minimal invasive method of obtaining disc tissue specimens for microbiological and histological examination (*Figure 4*) (Varma et al, 2001). Yield and safety can be maximized with the use of CT especially if the thoracic spine is involved. Nonetheless, similar to blood cultures, culture-positive results remain modest with an organism isolated in approximately half of biopsies (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002). In these cases, repeat needle biopsy or open surgical biopsy may be warranted. Not surprisingly, open biopsy remains the most invasive technique but has the highest return for positive cultures in more than 75% of cases (Sapico and Montgomerie, 1979) thereby securing the diagnosis.

Medical treatment

Treatment must be modified according to the antibiotic sensitivities of the organism isolated and to the primary focus of infection. If no organism is identified, then broad-spectrum antibiotics must be initiated. In the acute stages of the infection, surgical debridement combined with antibiotic therapy does not appear to be advantageous over antibiotic treatment alone (Ozuna and Delamarter, 1996).

Rarely, spinal tuberculosis must be considered in light of repeated negative cultures. Tuberculosis can often be established if the

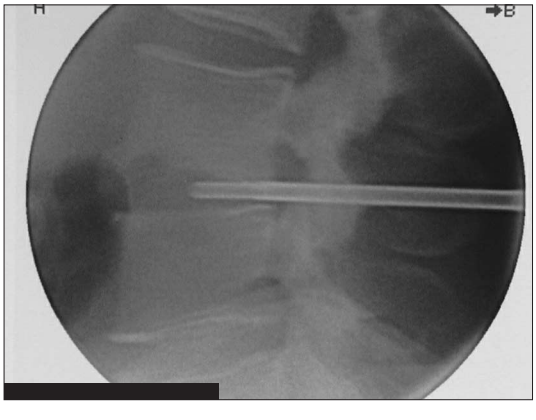


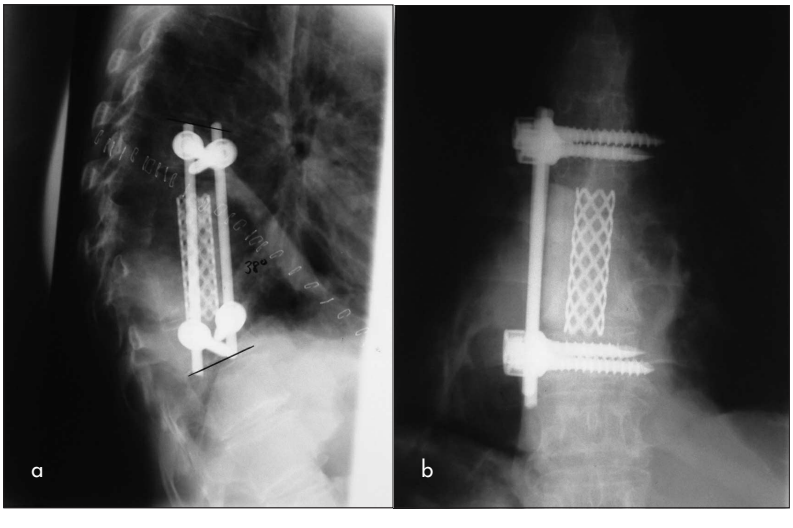
Figure 4. Same patient as Figure 1*, showing a large core needle biopsy of the L3/4 disc space, which later returned positive for* Staphylococcus aureus*. The patient was treated successfully with intravenous antibiotics.*

patient originates from the Indian subcontinent, has previously been exposed to pulmonary tuberculosis, has a history of foreign travel, symptoms of a chronic illness and typical MRI findings showing multiple contiguous level involvement, preservation of the intervertebral discs and adjoining abscess formation (Smith and Blaser, 1991).

Although the optimal duration of antibiotics is ill-defined in the literature, intravenous treatment is typically administered for 4–6 weeks (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002). Serial monitoring of ESR and CRP showing a fall by at least 50%, no pain from instability or neurological deficits, would prompt the clinician to switch over to oral antibiotics for a further 4–6 weeks. Thereafter, a repeat biopsy and continued antibiotic therapy is indicated if there are any clinical signs or rise in the infection parameters indicative of disease reactivation. Optimal patient management includes the involvement of specialist teams consisting of a combination of orthopaedic spinal surgeons, infectious diseases, clinical microbiologists and neurosurgeons. Regular neurological monitoring is mandatory, which allows for an early surgical referral in those who have significant or deteriorating neurology.

After an initial 2 weeks of bed rest and appropriate analgesia, the patient is mobilized with a brace for external immobilization (Sapico and Montgomerie, 1979; McHenry et al, 2002). This allows the affected segments to fuse in a sagittally aligned position. A further period of bed rest may be required if there is pain on mobilization. Bracing is generally used for up to 3 months following the initiation of treatment. Despite the correct use of antibiotics and bracing, some patients develop segmental vertebral collapse and a smaller group develop late kyphosis (McHenry et al, 2002). Patients must therefore be monitored closely with serial radiographs. The majority of medically treated cases typically continue to spontaneous fusion.

Figure 5. a and b. Same patient as **Figure 2.** *The thoracic sagittal profile was restored with the use of a metal cage and pedicle screw/rod device via a transthoracic surgical approach. There was immediate return to normal of lower limb sensation and proprioception following surgery and the patient was treated successfully with intravenous antibiotics.*



Antibiotic therapy

The choice of specific antibiotics is outside the scope of this review. However, intravenous narrow-spectrum antibiotics must be administered according to the sensitivities of the organism isolated. Negative cultures dictate the use of broad-spectrum antibiotics. For optimal treatment, advice on the choice of antibiotics and continued treatment must be obtained from an experienced microbiologist.

Surgical treatment

Patients who develop neurological deficits, abscess formation, pain from instability or spinal deformity, and disease progression despite correct antibiotics, or as a result of non-compliance or antibiotic toxicity, may be candidates for surgical intervention (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002). Surgery may take the lesser form of drainage of the epidural or paraspinal abscess, resulting in decompression of the neural structures, or a more extensive approach aimed at stabilizing the involved segments, thereby allowing earlier mobilization. A variety of metallic implants can be used for spinal stabilization and occasionally, extensive anterior vertebral body reconstruction using traditional biological strut grafts or modern day metal cages is necessary (*Figures 5a* and *b*). Unlike infection of large joints, the use of metallic implants has not been shown to be detrimental to the successful treatment of infective spondylodiscitis (Faraj and Webb, 2000).

PROGNOSIS AND PATIENT FOLLOW UP

Neurological deficits occur in 25% of patients, with less than 10% having a permanent deficit (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002). There is an increased prevalence in those with associated co-morbidities such as diabetes mellitus or other immune suppressed states, which often contribute to the delay in diagnosis and subsequent treatment. Mortality approached 25% in the pre-antibiotic

era and today stands between 5 and 10% (Sapico and Montgomerie, 1979; McHenry et al, 2002; Nolla et al, 2002).

Over 90% of patients respond well to a treatment combination of antibiotics alone or combined with surgery (Sapico and Montgomerie, 1979. Nonetheless, up to 14% of cases followed long term will experience a recurrence of the infection, particularly in those with suppressed immune states (McHenry et al, 2002). In a multivariate analysis, of 253 patients followed long term, recurrent bacteraemia, chronic draining sinuses and paravertebral abscesses were independently associated with relapse; while motor weakness or paralysis, a longer time to diagnosis, and hospital acquisition were independently associated with adverse outcome (McHenry et al, 2002).

Outpatient monitoring showing successive reduction in ESR and CRP values remains essential and is consistent with successful treatment. Decreasing CRP levels has generally been shown to be more sensitive than ESR. Often CRP will return to normal but ESR rarely returns to pre-infection levels (Sapico and Montgomerie, 1979).

Serial radiological examinations using either plain radiographs or CT scans are equally important to identify bony collapse or deformity. Progressive disc height loss, end plate sclerosis, followed by spontaneous segmental fusion over subsequent months, is generally consistent with a successful treatment protocol. However, careful monitoring of the acute clinical response to treatment must be used to determine successful treatment outcome rather than relying on these unpredictable radiographic features.

Patient education on the importance of antibiotic regimen compliance remains pivotal for treatment success because an incomplete protocol can lead to antibiotic resistance with horrifying results. Patients are also instructed to self-monitor for early neurological deficits and return early for medical assistance on detection of the slightest deficit.

Medicolegal pitfalls

Failure to detect an epidural abscess remains the most significant medicolegal pitfall associated with discitis. Missed epidural abscesses often progress until major neurological deterioration has occurred. Slow neurological deterioration may be a result of direct compression whereas acute deterioration is secondary to a vascular ischaemic event (Sapico and Montgomerie, 1979). In the latter cases, the prognosis for complete recovery is extremely poor once a serious deficit has occurred.

CONCLUSIONS

Nowadays infective discitis is more commonly seen in the older age groups, tends to be of a lower grade inflammatory reaction and is occasionally characterized by abscess formation. A urinary tract infection is a common primary focus of infection. The diagnosis may be difficult because of its insidious onset; particularly before the onset of destructive changes radiologically that occur after several weeks. Biopsy by either open or closed methods might be necessary to establish the diagnosis and isolate the causative organism which is usually *S. aureus*. Epidural infection resulting in neurological compromise is the most devastating complication, particularly if neglected. The duration of antibiotic treatment is determined by monitoring the clinical symptoms, haematological infection parameters, temperature curve and interval radiological changes. The prognosis is generally good and most patients will recover within 1 year. HM

Conflict of interest: none.

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KEY POINTS

- There is a bimodal distribution of discitis for age but it is mainly a condition affecting patients in the sixth decade.
- Diagnosis is delayed because of its slow insidious onset and common association with immunocompromised states.
- Magnetic resonance imaging is the preferred method of investigation.
- Urinary tract infection is the most common primary focus of infection.
- *Staphylococcus aureus* is the commonest bacterial pathogen.
- Appropriate antibiotic treatment must be administered over an 8–12-week period.
- Serial monitoring of inflammatory markers and X-rays is mandatory.
- Surgery is mainly reserved for those who develop neurological deficits, abscess formation and pain from instability or deformity.
- Failure to detect an epidural abscess leading to major neurological deficits remains the most significant medicolegal pitfall.
- The majority of patients treated with antibiotics respond well and go on to spontaneous fusion.

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