We retrospectively reviewed the records of 16 children treated for spondylodiscitis at our hospital between 2000 and 2007. The mean follow-up was 24 months (12 to 38). There was a mean delay in diagnosis in hospital of 25 days in the ten children aged less than 24 months. At presentation only five of the 16 children presented with localising signs and symptoms. Common presenting symptoms were a refusal to walk or sit in nine children, unexplained fever in six, irritability in five, and limping in four. Plain radiography showed changes in only seven children. The ESR was the most useful investigation when following the clinical course of the disease. Positive blood cultures were obtained in seven children with *Staphylococcus aureus* being isolated in five. Antibiotics were used in 14 children and spinal bracing in six. Children with spondylodiscitis often present with a confusing clinical picture leading to late diagnosis.

The early use of MRI in the investigation of children with an atypical picture may avoid unnecessary delay in starting treatment and possibly prevent long-term problems. All except one of our children had made a complete clinical recovery at final follow-up. However, all six children in the > 24-month age group showed radiological evidence of degenerative changes which might cause problems in the future.

Spondylodiscitis in children involving infection or inflammation of the intervertebral disc space or vertebral end-plate is rare. Diagnosis can be difficult and delayed because of difficulties elucidating a clear history and clinical examination for a distressed and unco-operative child, infant or toddler. In addition, the mode of presentation and failure of the child to localise the site of symptoms may lead to a delayed or incorrect diagnosis. Laboratory investigations are often unhelpful and blood cultures are usually negative. The recommended treatment is usually conservative and consists of the administration of antibiotics and/or immobilisation of varying duration.

The aim of this retrospective study was to review our experience of spondylodiscitis in children in an attempt to clarify the management of this condition.

**Patients and Methods**

A retrospective review revealed that 16 children with confirmed spondylodiscitis were admitted to our hospital between 2000 and 2007. A review of the case notes focused on the history at presentation, the clinical findings, the clinical and radiological investigations, treatment and the radiological and clinical outcome.

The age distribution of the children is summarised in Figure 1. The children were subdivided into those aged less than 24 months (< 24) and those aged 24 months or over (≥ 24) to determine if there was a difference in outcome when treating the infant and toddler compared with the child aged two years and over. There were nine girls and seven boys who had presented at a mean age of 3.3 years (6 months to 13 years). Ten were in the < 24-month group and six in the ≥ 24-month group.

The mean follow-up was 24 months (12 to 38). No diagnostic biopsies or needle aspirations had been performed on any of the children. Various imaging techniques were used. All initially had standard anteroposterior and lateral views. These were abnormal in seven. The most common finding was a decreased height of the disc space which was seen in all but two also showed erosion of adjacent vertebral end-plates.

A 99mTc bone scan was performed in five children and the diagnosis of spondylodiscitis was confirmed in four. MRI was used to confirm the diagnosis in one child in whom the bone scan had been unhelpful. MRI with gadolinium enhancement was performed in 12 of the 16 children and was diagnostic in all; all
showed pathological enhancement of the disc signal. There was no evidence in any child of vertebral osteomyelitis, hip pathology or other abnormality of the spinal cord such as intraspinal or epidural abscesses. CT was also carried out in two children, but the diagnosis was not confirmed until they had undergone MRI.

Penicillin-based antimicrobial therapy was administered to 14 children and supplemented with cephalosporin in seven. Antibiotics were given intravenously to 13 children for one to three weeks. All of these children had systemic symptoms of raised temperature and were unwell. The ESR was raised in all but not white cell count (WCC) or the level of CRP. Intravenous antibiotics were given to 12 of the 13 children for more than one week guided by the clinical recovery. The remaining child in this group was given a course of intravenous antibiotics for one week followed by an oral regime. The one child who was not given intravenous antibiotics received oral antibiotics for six months. No particular rationale for this antibiotic regime could be ascertained from the notes.

Immobilisation with spinal bracing was carried out in six children, in four combined with the administration of antibiotics. The two children who had spinal bracing alone were in the ≥ 24-month group (9 and 13 years), and presented with localised back pain. They were systemically well and had a normal WCC and negative blood cultures. MRI was used to confirm the diagnosis in both children while the duration of bracing was guided by the symptoms of back pain alone. Both made a full clinical recovery.

Of the 16 children, 15 made a full clinical recovery, with normal inflammatory markers and were reported as being free from symptoms despite abnormal radiological signs in seven. At the last follow-up one child continued to require paracetamol for persistent back pain and radiological review revealed signs of ankylosis at the affected site.

**Results**

No child had involvement of the cervical spine. The thoracic spine was affected in six children and the lumbar spine in ten. The level most commonly affected was L5-S1 (five children).

The mean duration of symptoms before attending hospital was 18 days (two days to seven weeks). The mean interval from attending hospital to establishing the correct diagnosis was 18 days (one day to six weeks). The mean delay in diagnosis in the < 24-month group was 25 days (7 to 42), but only 12 (1 to 28) in the ≥ 24-month group.

The presence of a documented prodromal illness for at least four weeks before attending hospital had been noted in eight of the 16 children, five of these had an infection of the lower respiratory tract, two a sore throat and one a facial abscess. All these prodromal illnesses had been treated in the community by a general practitioner. Six of these children were in the < 24-month group and two in the ≥ 24-month group.

Only five children presented with localising signs and symptoms which included back pain, stiffness and a reduced range of movement. Two had recalcitrant generalised malaise with no localising signs of symptoms; both were in the < 24-month group. The remaining nine children presented with various non-specific signs or symptoms (Table I). The initial diagnosis was incorrect in eight children (Table II).

The WCC was normal on presentation in 11 children with a mean of 11 100 per mm$^3$ (7000 to 16 800). The level of CRP was normal (< 10 mg/l) in eight on presentation, and ranged throughout the series from 8 mg/l to 78 mg/l. The mean ESR was 46 mm/hour (5 to 98). It was greater than 20 mm/hour in 14 children and rose above 50 mm/hour in eight.

Blood cultures taken as initial investigations were positive in seven children. *Staphylococcus aureus* was isolated from five and *Staph. epidermidis* and *Streptococcus pneumoniae* from one patient each.

Evidence of early degenerative changes defined as persistent narrowing of the intervertebral space and sclerosis with partial fusion of the vertebrae or ankylosis (complete
The mean delay in establishing a diagnosis of spondylodiscitis is often thought to be a benign and self-limiting condition. However, in our series, positive cultures were present in seven children, with *Staph. aureus* being the most common organism isolated.

We reviewed the eight children who presented with a prodomal illness requiring treatment with antibiotics as early as four weeks before presenting to hospital. All eight had received at least one course of antibiotics and six had negative blood cultures when investigated in hospital a few weeks later.

We did not perform any biopsies or needle aspirations for diagnostic purposes. This reflected our risk/benefit analysis based on the low rate of positive cultures reported in previous series. We now reserve this invasive investigation for children in whom the initial response to therapy was poor, the presence of atypical micro-organisms was suspected, or in whom a diagnosis of vertebral osteomyelitis was considered.

Appropriate imaging is important in establishing the diagnosis. In our series, initial plain radiographs were positive in only seven children. Changes such as reduced disc space and erosion of the end-plate were usually evident only when the disease had been present for at least two to four weeks.

We used 99mTc bone scanning in five children and were able to establish a diagnosis in all but one who required further imaging by MRI. A bone scan can be positive within one week of the onset of symptoms, but is less specific than MRI. We therefore reserve this investigation for the younger patient with non-specific symptoms and as a screening tool for establishing areas of inflammation or infection. We would now recommend the early use of total spinal MRI under general anaesthesia if required in children in whom the diagnosis of spondylodiscitis is suspected in order to avoid any delay in the diagnosis as supported by the findings of other studies.

In contrast to the adult form, childhood spondylodiscitis is often thought to be a benign and self-limiting condition. Because of this, some centres do not routinely prescribe antibiotics and instead recommend analgesia, rest and spinal support. However, in children in whom there is clearly a focus of infection we would recommend the use of antibiotics as a first-line treatment for this condition.

In a retrospective multicentre study, Ring et al concluded that there was a statistically significant reduction in the duration of symptoms in children who had been treated with intravenous antibiotics compared with those who had only oral or no antibiotics. Recommendations regarding
the duration of treatment, however, varied between institutions. In our series antibiotics were used in 14 of the 16 children in whom there was a clear infective focus. Intravenous antibiotics were administered if there was evidence of systemic illness. We used a combination of regular clinical assessment, radiological investigation and serial measurement of inflammatory markers as a guide to the length of treatment.

Bracing in combination with antibiotic therapy was used in four of our 16 children. In the two children treated by bracing alone, the symptoms were of localised back pain rather than of infection. Therefore, when children are symptomatic but systemically well, with a normal WCC and a negative blood culture, we would advise the use of spinal bracing on its own without antibiotics.

All except one of our 16 children made a full recovery. The remaining child continued to have mild back pain associated with premature ankylosis of the affected spine. In eight of our children, however, at a mean follow-up of 24 months (12 to 38) there was evidence of early degenerative change or ankylosis on radiological review.

A study published in 2005 with a follow-up of 23 years showed persistent radiological abnormalities in all children and symptomatic restriction of spinal movement in 20%. It also showed that even after ten years, there was a lack of regenerative capacity in the children. In our series all six children presenting at ≥ 24 months had radiological evidence of degeneration and as a result we believe that long-term follow-up is necessary for all of these children.

We recognise the limitations of our study. The review was retrospective. There were no predefined management protocols and there was a lack of useful data especially in regard to the rationale for treatment in some children. The number of children was small, although we believe it to be the largest series so far reported in the United Kingdom.

In conclusion, spondylodiscitis should be either confirmed or absolutely excluded in children who present with either unexplained spinal pain or a reluctance to sit, stand or walk in the absence of convincing alternative pathology. MRI should be used early to avoid delay in treatment. We would support the likelihood of infection as being a causal agent in this condition.

References