Vertebral osteomyelitis is rare in children. The lumbar spine is the most commonly involved region. Vertebral osteomyelitis occurs more frequently in the vertebral body, and involvement of posterior element is rare. Vertebral osteomyelitis results from hematogenous seeding, spread from contiguous infections, and direct inoculation from spinal surgery. Initial symptoms include low back pain, difficulty standing, limping gait, and fever. Blood cultures should be obtained for children with vertebral osteomyelitis because it is the definite guide for providing accurate treatment. Computed tomography-guided abscess aspiration should be considered for patients with negative blood cultures. *Staphylococcus aureus* is the most common microorganism in vertebral osteomyelitis, and the incidence of methicillin-resistant *S. aureus* has increased in recent years. Plain radiographs, bone scintigraphy, and magnetic resonance imaging are useful for making the diagnosis. Antimicrobial therapy for 6 weeks is usually successful, and an early transition to oral form does not increase the risk of treatment failure. Debridement with implant removal is required, especially for late-onset infections associated with previous spinal surgery. Vertebral osteomyelitis can cause motor weakness and paralysis. Because of the involvement of spinal development, spinal deformities, including scoliosis and loss of normal lumbar lordosis, should be a concern in pediatric patients. Early diagnosis and adequate treatment for vertebral osteomyelitis are important to prevent severe complications and lifelong disabilities.

This article describes the case of a 14-year-old boy with spontaneous lumbar vertebral osteomyelitis who initially presented with low back pain and was successfully treated nonoperatively.

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Vertebral osteomyelitis, which involves inflammation of the vertebral bones and bone marrow, is unusual in children and adolescents. The incidence rate is approximately 0.3 per 100,000 patients younger than 20 years.\(^1\) Vertebral osteomyelitis can be categorized as acute (lasting a few days or weeks) or subacute and chronic (lasting weeks or months before antimicrobial therapy is initiated), and it can result from hematogenous seeding, spread from contiguous infections, and direct inoculation from spinal surgery.\(^2,3\) The precise diagnosis and effective treatment of spinal infections requires various laboratory, imaging, nonoperative, and operative modalities.\(^4\) Delayed diagnosis may lead to motor weakness and paralysis.\(^3\) Because postvertebral osteomyelitis scoliosis and loss of normal lumbar lordosis have been reported in children\(^5\) and due to the disease’s involvement in spinal development, accurate diagnosis and adequate treatment are crucial for pediatric patients.

This article describes a 14-year-old boy with lumbar vertebral osteomyelitis who initially presented with low back soreness and low-grade fever, which was successfully treated nonoperatively.

### Case Report

A previously healthy 14-year-old boy presented with a 3-week history of low back soreness. He reported no history of tooth extraction, spinal surgery, or trauma. His teacher reported that intolerable pain made him unable to sit on his chair in the classroom and that the low back soreness diminished when he was lying down. The patient also reported a mild fever up to 37.8°C, sore throat, poor appetite, and weight loss from 51 to 47 kg within the previous 3 weeks.

Three days before admission, clinical examination showed tenderness across the lower back, knocking pain over the left costovertebral angle, paraspinal muscle spasm, and normal bilateral lower-limb muscle power. The soreness was exacerbated by trunk forward flexion and radiated to no other regions. Lumbar radiographs showed an anterior wedge deformity from a compression fracture of the L2 vertebral body and a narrowing of the L1-L2 intervertebral disk space (Figure 1). Laboratory tests revealed leukocytosis (16800/µL) with neutrophil predominant (segment, 79.5%) and elevated C-reactive protein (CRP) (7.65 mg/dL) and erythrocyte sedimentation rate (ESR) (53 mm/hr). Oral analgesics were prescribed and a lumbar orthosis was applied, and the patient was admitted. T1-weighted gadolinium-enhanced lumbar magnetic resonance imaging (MRI) showed high-signal intensity of the L1-L2 vertebral body, which involved the left pedicle with associated paraspinal inflammation and a left psoas muscle abscess (Figure 2). Whole body gallium-67 scan revealed a gallium-avid lesion at L1-L2, and the differential diagnoses included infection, inflammatory process, and tumor (Figure 3).

Because *Staphylococcus aureus* is the most common pathogen among patients with vertebral osteomyelitis, 2000 mg of intravenous oxacillin was administered every 4 hours. Because tuberculosis could not be excluded and is highly prevalent in the authors’ country, rifampicin was used for *Mycobacterium tuberculosis* control. Computed tomography (CT)—guided biopsy of the L2 vertebral body was performed, and cultures revealed a growth of *Staphylococcus aureus*. The patient made a full recovery and was discharged after 3 weeks of antibiotic therapy.

### Figure 1
Lateral lumbar radiograph showing an anterior wedge deformity from a compression fracture of the L2 vertebral body (arrow) and narrowing of the L1-L2 intervertebral disk space.

### Figure 2
Gadolinium-enhanced sagittal T1-weighted magnetic resonance image showing enhancement of the L1-L2 vertebral body and a compression fracture of the L2 vertebral body (arrow) (A). Axial T1-weighted magnetic resonance image showing the L2 vertebral body and endplate inflammation (arrow) (B). Coronal T1-weighted magnetic resonance image showing left psoas muscle inflammation (arrow) (C).
performed through the left posterior approach, and approximately 3 mL of yellow abscess were aspirated (Figure 4). Direct gram stain of the abscess showed gram-positive cocci in groups.

Three days after admission, the blood culture yielded no bacteria growth. One week after admission, the abscess culture yielded methicillin-resistant *S aureus*, and the antibiotic was switched to 400 mg of intravenous teicoplanin daily, and the rifampicin was halted. Three weeks after admission, laboratory tests revealed a normal leukocyte count (4300/µL) and improved ESR (34 mm/hr). In the fourth week of admission, laboratory tests revealed a normal ESR (14 mm/hr). A follow-up lumbar spine MRI showed a clearing of the left psoas abscess and persistent vertebral pyogenic osteomyelitis with diskitis affecting L1-L2 (Figure 5). When the antibiotic course was completed, the patient was discharged.

At 4-week follow-up, the patient reported no discomfort. The lumbar orthosis was used for 3 months after completion of the antibiotic course. At 1-year follow-up, lumbar radiographs showed no progressive lumbar deformity, and no sequelae were found (Figure 6).

**DISCUSSION**

Vertebral osteomyelitis is rare in children. The incidence rate is approximately 0.3 per 100,000 in patients younger than 20 years. The vertebral body is the most common (58%) region in which vertebral osteomyelitis occurs, followed by the thoracic (30%) and cervical (11%) spine. Vertebral osteomyelitis occurs more commonly in the vertebral body, and involvement of posterior element is unusual. The most common pathway of vertebral osteomyelitis is a hematogenous spread; pathogens may originate from urinary tract, skin, and intravascular catheter infections, endocarditis, and septic arthritis.

Contiguous spread from nearby infected tissue and direct inoculation from spinal surgery are also possible.

Back pain, limping gait, and refusal to walk are not specific to vertebral osteomyelitis. Children with vertebral osteomyelitis or diskitis have back pain, but those with vertebral osteomyelitis are more likely to also have fever and an ill-looking appearance at presentation. Furthermore, children with vertebral osteomyelitis tend to be older than those with diskitis. The current patient reported low back pain, mild fever, and general weakness for 3 weeks before definite diagnosis and treatment were made. Although the MRI showed vertebral body and disk inflammation, the current patient likely developed vertebral osteomyelitis initially, which progressed to the nearby disk (Figure 2A).

Blood cultures should be obtained for children with vertebral osteomyelitis because they are the definitive guide for providing accurate treatment. The positive blood culture rate varied from 40% to 60% of clinically defined cases. Clinicians should also consider gathering abscess cultures for patients with negative blood cultures. Computed tomography-guided spine drainage is a straightforward and accurate technique for diagnosing vertebral osteomyelitis. However, de Lucas et al reported that the positive culture rate of spinal specimens was 43%
for patients with vertebral osteomyelitis and that the unexpected results may be related to previous antibiotic treatment. *S. aureus* is the most common microorganism in vertebral osteomyelitis, and the proportion of methicillin-resistant *S. aureus* has increased in recent years.\(^{14,15}\) Gram-negative bacilli, coagulase-negative *Staphylococci*, *Streptococci*, and *M. tuberculosis* are also possible pathogens.\(^{14}\) Unkila-Kallia et al\(^ {16}\) prospectively reported that the ESR was elevated in 92% of pediatric patients with acute hematogenous osteomyelitis at admission, and the CRP was initially elevated in 98% of these patients. C-reactive protein elevated and decreased significantly faster than ESR and was considered a more sensitive predictor for disease recovery. White blood cell count was elevated in 35% of these patients and was a relatively poor indicator.\(^ {16}\) The current authors chose ESR as a follow-up laboratory index because the current patient was classified as having subacute vertebral osteomyelitis with a long treatment course, and the frequency of blood sampling could be decreased.

Although plain radiographs are usually the first image study of choice, they are not sensitive for detecting early-stage vertebral osteomyelitis. Bone scintigraphy is a more sensitive tool and is effective for looking for multiple infection sources. It shows hyperperfusion with increased uptake in all triple phases, including perfusion, blood pool activity, and bone metabolism.\(^ {19}\) Magnetic resonance imaging is the most precise imaging modality for diagnosing vertebral osteomyelitis and demonstrates disease progression over the bone and paraspinal soft tissue in detail. The most reliable findings are low-signal intensity in the vertebral bone on T1-weighted sequences, high-signal intensity over the disk on T2-weighted sequences, and high-signal intensity over the vertebral body and disk on the contrast-enhanced scan.\(^ {20}\)

Antimicrobial therapy of vertebral osteomyelitis can be shortened to 6 weeks without increasing the risk of relapse.\(^ {19}\) Early transition to oral antibiotics did not increase the risk of treatment failure.\(^ {20}\) This strategy has the advantages of lowering costs and shortening the length of hospital stay. Vertebral osteomyelitis can usually be treated successfully with antimicrobial treatment, but debridement with implant removal is needed, especially for late-onset infections associated with previous spinal surgery.\(^ {21}\)

Postvertebral osteomyelitis sequelae, including scoliosis and loss of normal lumbar lordosis, have been reported in pediatric patients.\(^ {7}\) Proper lumbar orthosis use is crucial for the prevention of anatomical deformity caused by osteomyelitis. In addition, McHenry et al\(^ {14}\) retrospectively reported that 25% of patients with vertebral osteomyelitis sustained neurologic complications, and a longer time to diagnosis and hospital acquisition were major independent risk factors for an adverse outcome. Therefore, early diagnosis and adequate treatment of vertebral osteomyelitis are important to prevent severe complications and lifelong disabilities.

**Conclusion**

Although early diagnosis of vertebral osteomyelitis is a challenge, heightened awareness with appropriate diagnostic technologies, such as MRI and CT-guided biopsy, are necessary to minimize diagnostic delay. Proper antimicrobial therapy and the application of lumbar orthosis support can achieve an optimal outcome in patients with vertebral osteomyelitis for whom no surgery is indicated.\(^ {36}\)

**References**


