

Review for the Generalist: Evaluation of the adolescent with back pain

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Introduction

In this age of increasingly large book bags and backpacks, backache is becoming an increasingly common complaint among adolescents. Fortunately serious back problems are uncommon. Nonetheless, most of these children will be initially referred to orthopedists. However, the pediatrician can easily do the initial evaluation in the office and determine whether orthopedic or rheumatologic referral is appropriate.

Common causes of back pain in adolescence

To properly assess these adolescents to have an awareness of the many problems that can cause back pain in a teenager (Table 1). The history is crucial (Table 2). Important considerations are whether the pain is relieved by rest or exacerbated by activities. It is important to ask whether the pain awakens the child from sleep. Does the pain radiate or is it confined to one location? Pain which comes on suddenly following an injury or fall is most likely mechanical in nature, while problems that are described primarily as stiffness that is worse in the morning or after prolonged inactivity, may well be secondary to an inflammatory disease.

Table 1

Common causes of back pain in childhood

Spondylolysis/Spondylolisthesis

Scoliosis

Scheuermann's disease

Vertebral osteomyelitis

Diskitis

Tumors—benign or malignant

Disc disease

Spondyloarthropathies

Hypermobility

Pain Augmentation

Table 1

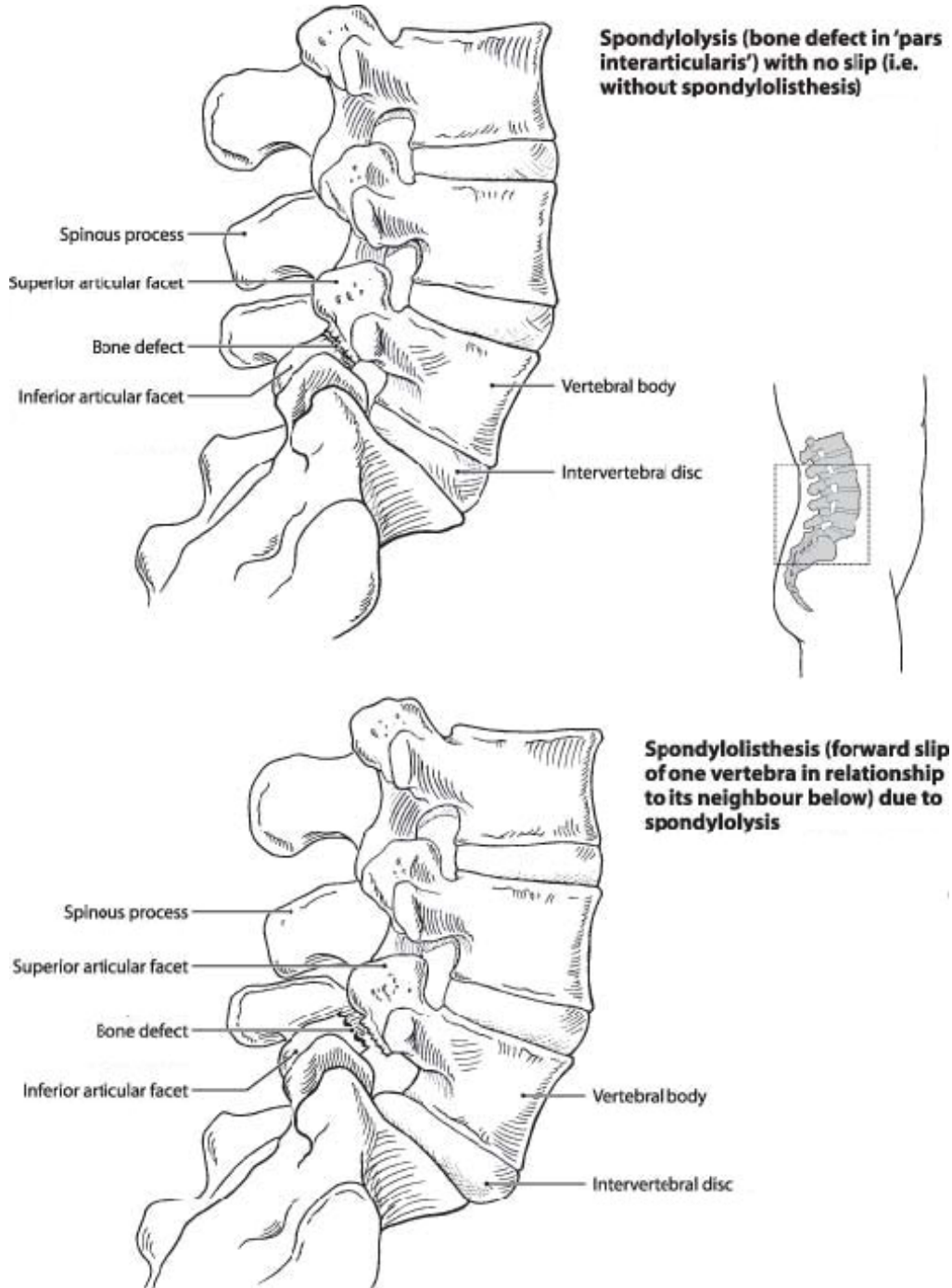
Initial historical assessment

- When did the pain begin, did it come on suddenly following an injury or fall?
 - Or slowly over a period of days without an injury?
- Does the pain wake the child up at night?
- Is the pain associated with stiffness and worse when the child first gets up in the morning?
 - Or does the pain come on only with activity?
- Is the pain relieved by rest?
 - Or does the child stiffen up if he or she sits for a long period? Does the child have trouble at the movies, after long car rides?
- What position or activity makes the pain better? What position or activity makes the pain worse?
- Is the pain confined to a single location or does it move up and down the back?
- Does the pain extend down into one leg or out into one shoulder?

In older children spondylolysis, a stress fracture of the pars interarticularis of the lumbar spine, is the most common structural abnormality that causes back pain. [1-2] This incidence is especially high for athletic children and is associated with sports requiring repetitive lumbar motion, including diving, gymnastics and rowing. [3] Spondylolysis may be unilateral or bilateral, occurs most commonly at L5 and is often associated with spina bifida occulta (Figure 1). It may be seen in the radiographs of asymptomatic children. However, spondylolysis is of concern because of possible progression to spondylolisthesis. Spondylolisthesis is an anterior slippage of one vertebra over another. This occurs most often at the junction of the lumbar and sacral spine (L5-S1 level). [3] Although mild degrees of spondylolisthesis may be asymptomatic, more severe involvement characteristically leads to low back pain that may radiate down the back of the thighs. These

children often complain of dull pain in the gluteal region which is made worse by standing for prolonged periods or attempting to carry a heavy load. In the early stages, spondylolisthesis is rarely associated with stiffness. Most children with this condition can be followed conservatively, but some require orthopedic intervention.

Figure 1 Representations of spondylolysis and spondylolisthesis in adolescents.



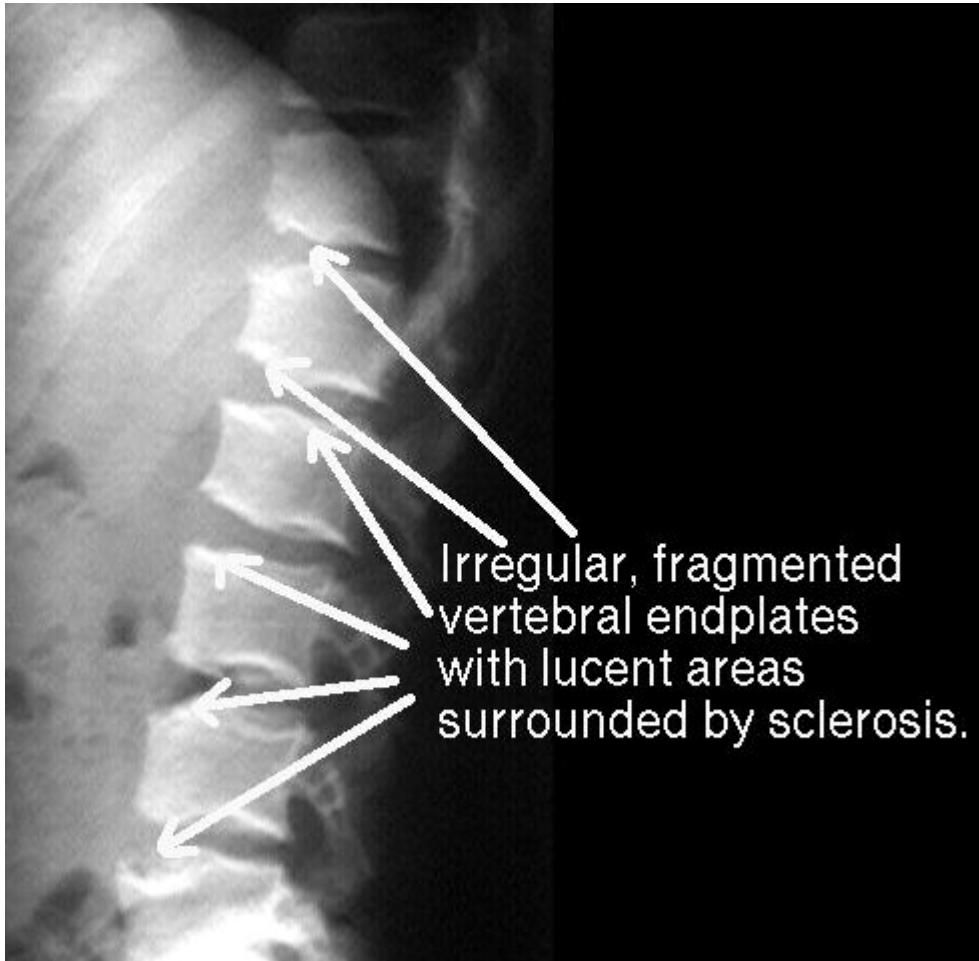
Back pain in childhood is frequently attributed to scoliosis, however, scoliosis is usually painless and only detected on examination. Pain is a common part of this condition only when mechanical damage has occurred – usually years after the onset of the disease—at which point pain tends to be moderate at most. [4-5] Every physician should be comfortable examining children for the presence of scoliosis. Children are routinely screened for scoliosis at school, but the expertise and thoroughness of the examiners varies widely. Any child whose spine appears crooked should have a careful orthopedic evaluation. Once detected, scoliosis should be carefully evaluated and followed. Many children have only mild curvatures and require no treatment, but others have progressive disease requiring bracing and, less frequently, surgery. Since the curvature occurs with growth, it is rare for scoliosis to become evident before the age of ten years. Children with back pain or abnormal curvature in the preteen years often have serious infections, tumors, or metabolic abnormalities that require immediate orthopedic evaluation.

Kyphosis is an excessive curvature of the thoracic spine in which the spine is bent forward. Looking at the child from behind, a curvature is not visible. If the child is viewed from the side when they are bending over, the upper part of the back angles forward sharply instead of the normal rounded shape. This abnormal forward curvature may be the result of abnormalities in the bone resulting from fractures, severe osteoporosis, or infections. However, most often it occurs without explanation.

Some children have postural kyphosis. This is usually a mild increase in the forward bend of the spine leading to the appearance that they are always slumping over. Typically this is asymptomatic and the children are brought to the physician with complaints of poor posture. These children often have no abnormal findings on X-ray. Importantly, children with postural kyphosis can lie face down with their back perfectly flat. Children with more significant abnormalities usually have changes in the bones. As a result, they cannot lie perfectly flat on their stomachs. Children who cannot lie flat on their stomachs need to be investigated by an orthopedist with appropriate X-rays to evaluate the reason for kyphosis. For children without significant abnormality, a program of exercises is often adequate.

Scheuermann's disease is one specific cause of back pain and kyphosis in teenagers. It is thought to result from abnormalities in vertebral development leading to the development of wedge shaped vertebral bodies. The diagnosis is easily made when the abnormal bone structure is seen on X-ray; diagnostic criteria include the presence of three adjacent wedged vertebrae, irregularity of the endplates, narrowing of the disc space and a kyphosis angle of more than 45° (Figure 2). [6] Children with Scheuermann's disease often need to wear a brace to relieve their pain and prevent worsening of their condition. Rarely, severe or worsening cases require orthopedic surgery.

Figure 2 Radiographic evidence of Scheuermann's disease



Kyphosis may also be the result of damage to the bones of the spine by infection, tumor, or poor bone formation. These conditions are all rare. Children with conditions that are known to damage the spine (such as children who have previously undergone radiation therapy) should be carefully monitored. Parents of children with poor bone formation or children on medications such as corticosteroids that predispose to osteoporosis and can damage the bones, need to be reminded that their children should be watched carefully for spine problems. Figure 3 demonstrates compression fractures due to osteoporosis that developed in a child on long-term corticosteroids. If a child has been diagnosed with an infection or a tumor in or around the spine the family should be made aware of the need for continued careful monitoring of the spine as the child grows.

Figure 3. Compression fractures due to osteoporosis after long-term corticosteroids



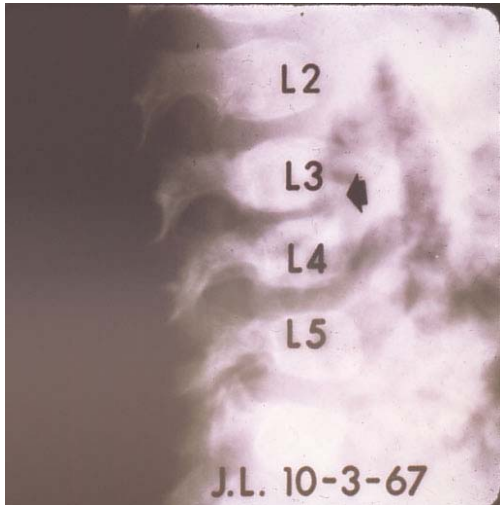
There are a variety of infections that may damage the spine. These generally present with rapidly progressing complaints of pain and may awaken the child at night. In the United States, *S. aureus* is the most common cause of vertebral osteomyelitis. [7] Tuberculosis can also affect the bones of the spine but tends to have a more insidious presentation (Figure 4). [8] Vertebral osteomyelitis most commonly affects children under the age of 10 and can be diagnosed by radiographs, bone scans or MRI.

Figure 4. Osteomyelitis of the spine due to tuberculosis (Pott's disease)



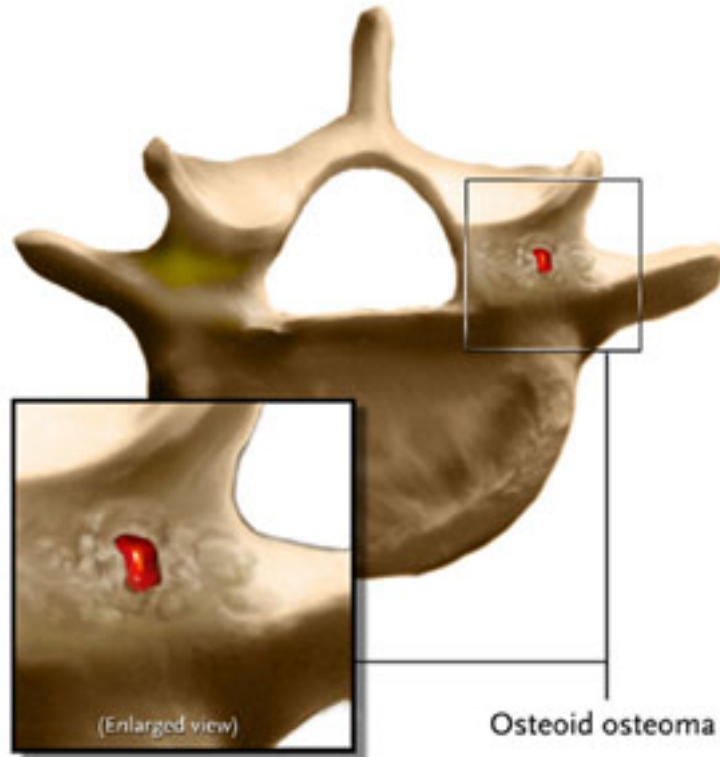
Diskitis is a confusing cause of back pain in young children. Most often it affects children under the age of five. [7] These children may have initial symptoms of a cold or flu-like illness. They then develop severe back pain, may refuse to walk and stand, or develop a limp. In some cases a bacterial infection is identified and the infection is treated with antibiotics. In many cases no causative bacteria is identified. This illness is usually diagnosed on the basis of the typical clinical picture with appropriate radiographic studies. These may include a combination of a back radiograph demonstrating narrowing of intervertebral space with destruction of the end plates (Figure 5), CT/MRI showing vertebral disk space involvement with normal appearance of the nonadjacent vertebrae, or technetium-99m bone scan with abnormal uptake in the affected area.

Figure 5. Radiographic changes of diskitis: narrowing of disc space with end plate destruction.



Tumors, both benign and malignant, may be a cause of chronic low-grade back pain. Leukemia and lymphoma may occasionally present as back pain during childhood with osteopenia, lytic lesions and pathologic fractures. [9] Osteoid osteomas most commonly present in the femur and tibia during the second and third decades of life, but may involve the spine. Osteoid osteomas in the spine typically come to attention because a child complains of chronic back pain that is intermittent. The pain is often worse at night and may be relieved by NSAIDs, but continues to recur. Large osteoid osteomas can be seen on X-rays; smaller ones may require bone scan. Osteoid osteomas may be confused with malignant tumors on MRI due to significant soft tissue involvement and bone marrow edema and may be more easily visualized by CT scan (Figure 6). [10]

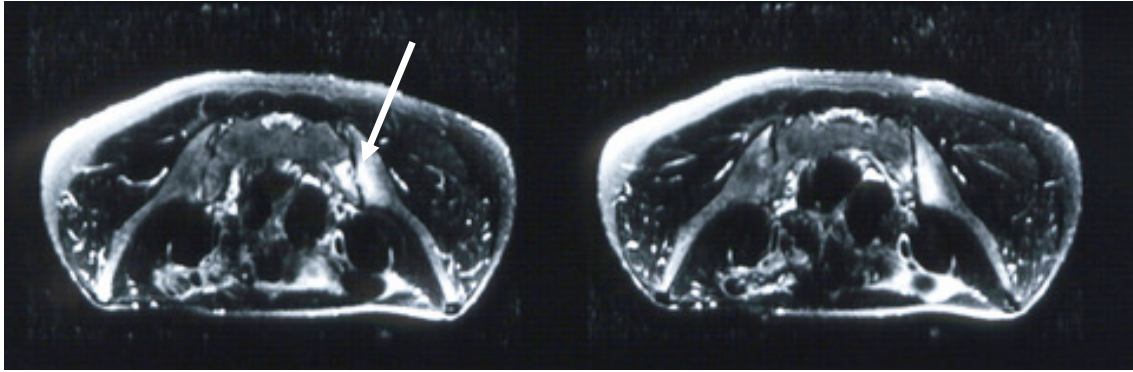
Figure 6: Representation of a osteoid osteoma of the spine.



Herniated discs are a common complaint among adults and a frequent explanation for back pain which starts in adulthood. This condition is relatively rare in children because they have more flexibility and are less likely to be doing the work-related heavy lifting. Although MRI of the spine is very accurate at identifying disc problems, the finding of minor disc problems on the MRI is not a reliable explanation for back pain. Family history of disc disease, high body mass index and structural abnormalities, such as scoliosis are important prognostic factors. [11]

Low back pain and morning stiffness are commonly due to spondyloarthropathies in teenagers. However, adolescents rarely come to the doctor complaining of low back pain when they wake up in the morning. Since the onset is very gradual, most accept this stiffness as normal. The key to suspecting a spondyloarthropathy lies in carefully examining the teenager and finding evidence of arthritis or tendon insertion pain (enthesitis) elsewhere [12] A strong family history of back pain also should suggest this diagnosis. Another key indicator is that children with spondyloarthropathies almost never have the ability to bend over and touch their toes. Radiographs of the back and sacroiliac joints are usually negative though rarely abnormalities of the SI joint may be noted (Figure 7).

Figure 7. Radiographic sacroilitis typical of a spondyloarthropathy



Although the history of morning stiffness and difficulty bending over may be ascribed to mechanical problems, this is unlikely to be true in children and adolescents. Asking the series of questions in Table 1 will help the physician to suspect a rheumatic disease rather than an injury. In addition children with back pain secondary to a spondyloarthropathy often have heel pain, sacroiliac joint pain, or knee pain.

Many children have benign musculoskeletal pain, including back pain, due to hypermobility. These children have mostly afternoon pain after exercising and back pain is often one of many musculoskeletal complaints. [14] Teenagers with a pain augmentation syndrome may have back pain complaints. They often fit a predictable profile. Their back pain is severe, incapacitating, often associated with sleeping problems and fatigue, and occurs with other severe muscle and joint pains. School absences are common. The adolescent usually is in a stressful life situation. [15]

Physical Exam

A careful examination, including full neurologic examination, should be performed on any child complaining of back pain. Point tenderness is suggestive of infection or bony injury. Careful inspection may reveal unexpected masses suggestive of tumors. Scoliosis often results in one shoulder appearing higher than the other or the hips appearing uneven. A positive scoliosis screen is typically described in the literature as occurring when the ribs on one side appear higher than the other when the child bends over. Since the primary curvature is usually in the thoracic spine with a secondary compensatory curvature occurring in the lumbar spine, it is often easier to detect scoliosis by running one's hand over the lumbar spine and feeling the unevenness in height between the muscle bundles on the two sides. Spondylolysis/spondylolisthesis will usually be manifested by pain with lumbar hyperextension. Forward bending is generally painless but extension to an upright position may produce pain. Straight leg raising test should be positive in the setting of lumbar disc disease. Adolescents with a spondyloarthropathy (ankylosing spondylitis, psoriasis) may have reduced lumbosacral spine mobility and limited anterior forward flexion as demonstrated by an abnormal modified Schober test. [13] Children with hypermobility must demonstrate significant hypermobility at least 4/9 Beighton points (Figure 8) and the pain augmentation teen will have exam only multiple musculoskeletal trigger points.

Figure 8. A hypermobile child with excessive back flexibility



Laboratory testing

Laboratory testing is useful in the evaluation of children with back pain when it is necessary to exclude an infection or other serious problem. Children with osteomyelitis or discitis often have elevated erythrocyte sedimentation rates. However children with spondyloarthropathies may have entirely normal laboratory testing falsely reassuring the physician that the child could not possibly have arthritis. Because the most severe spondyloarthropathy is ankylosing spondylitis many physicians expect children with this condition to be male and HLA B27 positive. HLA B 27 positive males are over represented among children with spondyloarthropathies, but girls with the appropriate findings and HLA B27 negative individuals are common. Plain radiographs may be useful for large lesions, such as scoliosis. Further imaging studies, such as bone scan, CT scan and MRI are all useful for more subtle defects and should be used when necessary. Adolescents with hypermobility or pain augmentation syndromes may need a back radiograph and a complete blood count and sedimentation rate to exclude the more serious back problems.

Summary

As backache becomes an increasingly common complaint among adolescents, it becomes more important for the general pediatrician to be well versed in the causes of pain as well as their evaluation and treatment. Through proper questioning, the cause of most children's pain can be identified and treated in the most effective way. Proper evaluation may help determine whether orthopedic, rheumatologic, sport medicine, physical therapy, or other consultations are needed.

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