Pedicin Pediatric Back Pain: When to Sit Up and Take Note
by Tenner Guillaume, M.D.

Back pain is uncommon among children who are under 10 years old, but the incidence of back pain increases for adolescents. A 2011 study of 7542 European teenagers states, “A total of 1180 (20.5%) teenagers reported one or more episodes of low back pain (LBP), of whom 900 (76.3%) had consulted a health provider.” Not surprisingly, adolescents have a higher incidence of back pain than noncallables.

For primary care providers, the key questions are—when is back pain the result of overuse or muscle strain? When is the pain symptomatic of more serious pathology, such as a herniated disc, spondylolisthesis, spondyloarthropathy? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

Start With the Basics – A Thorough History

The answers to the following questions will provide nearly all of the information needed to differentiate a benign issue requiring conservative management from a more serious condition. The answers will also help you determine whether to simply treat the symptoms or whether a complete radiographic study is necessary.

1. Characterize the back pain.
   - Is the pain acute, subacute or chronic? Is the pain diffuse, radiating or radicular? The more focal the pain, the easier it will be to potentially diagnose a specific problem.
   - Put your finger on it because it hurts everywhere) is less likely to result in the discovery of a specific abnormality.
   - Is the pain localized or does it involve multiple body parts?
   - Is the pain tent or activity-related, generalized or focal.

2. Determine the location of the pain.
   - Does the pain occur at rest or after activity?
   - Does the pain persist at night?
   - Does the pain occur with fevers, chills or malaise?

3. Consider the patient’s age and check neurological signs.
   - For the patient 10 or younger: The younger the patient, the more worrisome the back pain, because a pediatric abnormality is more likely to be the cause. Ask about transient paraparesis, paraplegia, numbness or paresthesias, and determine if bowel or bladder function is affected. Neurological impairment signals a more complex condition.
   - For the patient 10 or older: The older the patient, the less worrisome—neurological abnormalities are much more likely.

4. Listen for these reassuring signs.
   - Ask if the patient has missed school or sports because of the pain, whether the pain has improved over time, and if the pain responds to nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen. Additionally, discuss whether the pain is intermittent or activity-related, generalized or focal.

Back pain is surprisingly common among adolescents and young athletes, but cases require further investigation to identify causes and treatment recommendations.

1. A thorough history and a comprehensive physical exam are critical steps in the treatment of back pain. Additional tests are needed for a differential diagnosis.

2. For initial screening, begin with AP, lateral or oblique view radiographs. An MRI is needed only if there is evidence of a serious condition or if the patient has not improved after six weeks.

3. To see the guide on P. 2 for more details about which imaging studies are requested.

4. Younger patients (ages 10 and under) who complain of back pain are more worrisome—neurological abnormalities are much more likely.

For more information, visit www.gillettechildrens.org/pediatricperspective for videos and presentations.

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Refer Red Flag Issues Immediately
Refer patients suspected of having leukaemia to a pediatric oncologist. If patients have any of these conditions, refer them immediately to the appropriate service.

- Vertebral fractures
- Appendicular ring fracture
- Appendicular evisceration
- Visceral osteolysis
- Osteoid osteoma
- Erythrolymphoid hyperplasia

Special tests – Include these additional exams, if you suspect:
- Spinal cord injury – check extension in single leg stance and polyradiculopathy
- If the patient has pain while standing on the right leg and extending the right leg, the back pain has pain when standing on the left leg and extending the left leg, the presume a unilateral pain score/spine fracture on right only if the patient is bilaterally, presume that the pain score/fracture/spine is bilateral.
- Herniated nucleous pulposus or appendicular ring avulsion straight leg raise

Consider the test positive if any degree of passive elevation reproduces pain or if the patient ‡10° of the affected side.
The straight leg raise specifically tests nerve roots that contribute to the sciatic nerve, and is the test of choice in suspected foraminal stenosis (L, L, L, L, P), performing a straight stretch test, because these structures are in the foraminal nerve.
- Cervical radiculopathy – Spinal-tap test.

Turning the patient’s head in the direction of the suspected cervical radiculopathy while tilting and extending the neck in the same direction will cause torticollis compression. That compression by turning the cervical radiculopathy and radiating down the affected upper extremity.

Follow in Clinic or Refer?
The history and physical exam will help determine the severity and acuity of the patient’s back pain. If there are no red flags, we need to be sure that there is a physical warning that provides care for children and follow up with the patient’s oncologist. If red flags are present, we need to request appropriate radiographs and lab tests. See Page 2 for a guide to imaging studies. If screening radiographs point to a lesion or if the patient is at risk for a spinal cord injury, refer the patient to an orthopedic specialist who will perform the appropriate tests.

Complete a Comprehensive Exam for Back Pain
Evaluate patients while they are standing, walking bending at the waist and lying on the exam table. Include these exams:

- Standing and walking – Are the shoulders level? Does the patient limp? Does the patient have any obvious asymmetries of the spine, hips, stance? Does the patient limp?

- Appearance – Look for rash, bruising or ecchymoses, which are common manifestations of leukaemia. Check for cutaneous manifestations of dysraphism, hairy patches, dimples and deep lesions.

- Neurologic exam – Test sensation and motor responses. Check these reflexes: biceps (C7), triceps (C), brachial plexus (C7), patella (L, L), Achilles (S1). Hoffman’s test of the upper extremities, and clonus. Also look for unilateral or bilateral weakness, asymmetric abdominal reflexes, foot drop, or loss of fine motor skills in the hands.

Guide to Imaging Studies for Pediatric Back Pain

Overview – What to Request and When

- Radiography
- For trauma or a history that suggests the pain is muscular, strain, minor A/P and lateral radiographs are usually adequate.
- For a standing view (or views, if the patient cannot stand).
- For lumbosacral involvement, avoid pelvic shielding.
- For interbody fusion, perform a stiff-view for suspected spondylolisthesis.
- Flexion/extension/view for radiography for suspected scoliosis.
- MRI
- Reserve MRI for cases in which the back pain has lasted more than 1 week and is not responding to NSAIDs or therapy.
- Consider an MRI if the patient’s history and physical exam suggest back pain or radicular pain.
- Consider an MRI if there are obvious red flags during history-taking that suggest possible underlying infection or neoplasm.
- Request an MRI for high-risk (scoliosis, thickened ligaments) or clinical issues (acute stress reactions or fractures, spondylolisthesis, spinal canal stenosis, osteoporosis, stress fractures). If you are likely to refer the patient to a specialist, consider ordering a specialist MRI.
- CT Scan

**Spondylolisthesis/Scoliosis**

Because these tests are highly sensitive and nonspecific, they are used much less commonly today. They will identify areas of high metabolic activity or bone turnover. MRI are currently the preferred imaging modality in the evaluation of these conditions and results.

Interpreting Imaging Results – What to Look For

- Anterior/Posterior Radiographs
- Suspected Spondylolisthesis
- Suspected Normal Scoliosis
- Suspected Kyphosis

- Lateral Radiographs
- Suspected Scoliosis
- Suspected Scheuermann’s disease
- Suspected Kyphosis

- AP/Lateral/Oblique Radiographs
- Suspected Scoliosis
- Suspected Kyphosis
- Suspected Scheuermann’s disease

- Flexion/Extension Radiographs
- Suspected Scoliosis
- Suspected Kyphosis
- Suspected Scheuermann’s disease

- Swaying Posture
- Suspected Scoliosis
- Suspected Kyphosis
- Suspected Scheuermann’s disease

- History

- Physical Examination

- MRI

- CT scan:

- Evaluate specific anatomy of fracture.

- Radiographs – Look for bone density, cortical thickening, compression fractures.

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Refer Red Flag Issues Immediately
Refer patients suspected of having leukaemia to a pediatric oncologist. If patients have any of these conditions, refer them immediately to an orthopedic specialist:
- Vertebral fractures: Spondylolysis
- Appendicular fractures: Spondylolisthesis
- Exostoses: Osteosarcoma
- Vertebrae and paraspinal soft tissue: Lymphoma
- Pulmonary emboli
- Traumatic lesions
- Neurologic exam
- Neurosarcoidosis

Special tests – Include these additional exams, if you suspect:
- Spondylolysis – check extension in single slice and posterior to an imaginary line on the vertebra
- If the patient has pain while standing on the right leg and extending the back, the left leg and extending the spine, presume a unilateral paraspinal stress fracture/spondylolysis on the right. If the patient is bilaterally, presume that the paraspinal stress fracture/spondylolysis is bilateral.
- Herniated nucleus pulposus or appendicular sphenoid ring avulsion straight leg raise

Consider the test if any degree of pain across elevation reproduces pain pain down the affected nerve. The straight leg raise specifically tests nerves roots that contribute to the anatomic structures affected by the disc herniation. The test is considered a more accurate test if performed for involvement (L1, L2), a more perform, a more specific test, because those nerves are more specific to the femoral nerve.

Differential Diagnosis

Vertebral Fracture
- Acute single leg raise
- Another test to rule out musculoskeletal causes
- MRI – Look for increased pedicular signal intensity
- MRI with IV contrast – Determine extent of bony and non-bony injures.
- Radiograph – Look for bony debridement, cortical scalloping.

Vertebral Osteomyelitis
- Radiograph – Look for periosteal new bone formation.
- CT scan – Evaluate complete anatomy of fracture.
- If there is any question about the extent of infection, perform a bone scan.

Vertebral Hemangioma
- Bone scan – Look for increased uptake.
- MRI – Look for increased T2 signal intensity.

Vertebral Metastasis
- Bone scan – Look for increased uptake.
- MRI – Look for increased T2 signal intensity.

Disc Herniation
- MRI with IV contrast – Determine extent of bony and non-bony injures.
- CT scan – Evaluate complete anatomy of fracture.
- If there is any question about the extent of infection, perform a bone scan.

Spondylolisthesis
- MRI – Look for increased T2 signal intensity.

Neurosarcoidosis
- MRI with IV contrast – Determine extent of bony and non-bony injures.
- CT scan – Evaluate complete anatomy of fracture.
- If there is any question about the extent of infection, perform a bone scan.

Lateral Radiographs
- Anterior/posterior view
- Lateral view

MRI
- To evaluate patients with nonspecific back pain after failure of nonoperative management or for patients with symptoms suggestive of Schmorl's nodes (scalloping). MRI is the referred test of choice among orthopedic surgeons and radiologists.
- MRI – Look for increased T2 signal intensity.
- MRI with IV contrast – Determine extent of bony and non-bony injures.
- CT scan – Evaluate complete anatomy of fracture.
- If there is any question about the extent of infection, perform a bone scan.

Recommended Reading

• Radiograph – Look for osseous fragment posterior to involved vertebra.

• Radiographs – AP and lateral views.

• Radiograph – Three contiguous vertebrae with > 5 degrees of angulation.

• MRI – Look for increased T2 signal intensity.

• MRI with IV contrast – Determine extent of bony and non-bony injures.

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The patient denied any history of back pain. However, he had a history of anxiety and insomnia and takes melatonin and ramelteon for better sleep. He also reported occasional daytime somnolence and extracurricular activities because of back pain.

Physical

During the examination, he was alert, oriented in all and no acute distress. He had normal posture and gait. There was no positive shoulder imbalance. He had no evidence of shoulder laxity. His neck appeared normal with no signs of scarring or palpable pain overlying the cervical vertebrae. Skin examination of his back demonstrated no cutaneous stigmata at any level. During the Adams’ forward bend test, he had no evidence of any clear scoliotic, thoracolumbar, or lumbar prominences. He did, however, have a slight thoracic lordosis. He had no restriction of motion in the neck at any level and no palpable masses. He had no rib prominence.

The examination of his bilateral lower extremities showed that there was some tenderness at the back of each knee and no apparent limitation of motion or palpable masses. He was able to bear weight on both sides within normal limits. He was noted to have a palpable angle on the right of approximately 75° and on the left of approximately 50°. He had no apparent pain or functional limitation. His gait was normal with no positive maneuvers. There was some evidence of correction of his kyphosis, some of the kyphosis seemed structural. He had no pain with lumbar extension.

Imaging Studies

Lateral radiographs were reviewed, which showed thoracic kyphosis that measured approximately 110° to 195° (measured from T1 to T12). He also had findings consistent with Scheuermann’s disease from T7 to T12. He had anterior wedging of greater than 20° at each of these levels and more than 15° of kyphosis across these segments. There were also mild platyspondyly and asymmetric posterior vertebral body kyphosis suggestive of grade 1 Scheuermann’s disease. His CT-plumb line was noted to lie posterior to the center of gravity and was within the vertebral body, suggesting some negative sagittal balance.

Treatment

Given the patient’s tight hamstring and thoracic kyphosis, we recommended pelvic tilting exercises, stretching, and posture correction strengthening exercises, and postural exercises with a focus on strengthening the posterior chain. We also recommended physical therapy: hamstring stretching, core strengthening, and stretching for the anterior chest wall. We recommended avoiding forward bending. The patient was referred to physical therapy and occupational therapy for work hardening and postural exercises with a focus on postural exercises with a focus on core strengthening. His symptoms improved with the above intervention.

Scheuermann’s Disease
• Boys: 5% may seek “sage” advice from parents to avoid lumbosacral pain. A review of their pain and overall health is on file.
• If you are likely to refer the patient to a specialist, consider an MR or CT Scan.

CT Scan
• Examines bone anatomy for suspected vertebral, burst or pedicle fractures or of osseous alignment.

Refer Red Flag Issues Immediately
• Refer patients suspected of having leptomeningeal to a pediatric oncologist. If patients have any of these conditions, refer these patients to the appropriate specialist.

Special tests — Include these additional exams, if you suspect:
- Spondylodiscitis — check extension in single slab and prone with straight leg raise.
- Spondyloptosis — check flexion in single slab and prone with straight leg raise.

If the patient has pain while standing on the right leg and extending the back, the back pain may have any of the following reasons:
- The left leg is extended and the spine, presume a unilateral pars stress fracture/spondylolysis on the right. If the right side is bilateral, presume that the pars stress fracture/spondylolysis is bilateral.
- Herniated nucleus pulposus or apophyseal ring avulsion straight leg raise

Consider the test positive if any degree of passive elevation results in reproduction of pain. This depends upon the strength of the leg. The straight leg raises specifically tests nerve roots that contribute to the sciatic nerve. A patient who is treated surgically for a suspected foraminal involvement (L4, L5), perform a femoral stretch test, because those nerve roots supply the femoral nerve.

Cervical radiography — Spine’s test
Turning the patient’s head in the direction of the suspected cervical radiolucency while tipping and extending the neck in the same direction will cause foraminal compression. That compression by the surgeon should be complete or nearly complete.

Follow in Clinic or Refer?
- The history and physical exam will help determine the severity and acuity of the patient’s back pain. If there are red flag issues, send the patient to be examined by a physical therapist who provides care for children and follow up with the patient family. If the patient has no red flag issues, then request appropriate radiographs and lab tests. See Page 2 for a guide to imaging studies. If screening radiographs point toward a possible fracture, refer the patient to a pediatric orthopedic specialist who will perform an appropriate workup.


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2. Identify the type of pain.
   - Is the pain acute? The result of trauma? Unremitting or more subtle? Has it grown progressively worse? Is the pain recurrent, related to activity or worse at night? Is the pain associated with constitutional symptoms, such as unintentional weight loss, fevers, chills or malaise?
   - Is the pain in one or multiple areas? Is the pain diffuse, radiating or radicular? The more focal the pain, the easier it will be to potentially identify an underlying cause. The answers to the following questions will provide nearly all of the information needed to differentiate a benign issue requiring conservative management from a more serious condition. The answers will also help you determine whether to simply treat the symptoms or whether a complete radiographic study is necessary.
   - Ask if the patient has missed school or sports because of the pain, whether the pain is intermit-
tent or activity-related, generalized or focal.

3. Differentiate physical examination from diagnostic testing.
   - Establish whether the pain is lumbar thoracic or cervical and whether it is focal, diffuse or radiating or radicular. The more focal the pain, the easier it will be to potentially identify an underlying cause. Nonlocal, diffuse pain (“My whole back hurts” or “I can’t put my finger on it because it hurts everywhere”) is less likely to result in the discovery of a focal underlying pathology with radiographic work-up.
   - Ask if the patient has a history of back pain or related conditions. Is the pain associated with trauma, such as a herniated disc, spondylolysis, scoliosis, Scheuermann’s disease, osteomyelitis, discitis, leukemia, tumors, or ankylosing spondylitis? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

4. Listen for these reassuring signs.
   - Ask if the pain has improved over time, and if the pain responds to nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen. Additionally, discuss whether the pain is intermittent or activity-related, generalized or focal.

5. Be aware of the potential for serious underlying conditions.
   - Be aware of the potential for serious underlying conditions, such as a herniated disc, spondylolysis, scoliosis, Scheuermann’s disease, osteomyelitis, discitis, leukemia, tumors, or ankylosing spondylitis. Nonfocal, diffuse pain (“My whole back hurts” or “I can’t put my finger on it because it hurts everywhere”) is less likely to result in the discovery of a focal underlying pathology with radiographic work-up.

6. Consider the plans for follow-up.
   - Ask if the patient has a history of back pain or related conditions. Is the pain associated with trauma, such as a herniated disc, spondylolysis, scoliosis, Scheuermann’s disease, osteomyelitis, discitis, leukemia, tumors, or ankylosing spondylitis? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

For primary care providers, the key questions are—when is back pain the result of overuse or muscle strain? When is the pain symptomatic of more serious pathology, such as a herniated disc, spondylolysis, scoliosis, Scheuermann’s disease, osteomyelitis, discitis, leukemia, tumors, or ankylosing spondylitis? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

Start With the Basics – A Thorough History
The answers to the following questions will provide nearly all of the information needed to differentiate a benign issue requiring conservative management from a more serious condition. The answers will also help you determine whether to simply treat the symptoms or whether a complete radiographic study is necessary.

2. Characterize the back pain.
   - Is the pain acute? The result of trauma? Unremitting or more subtle? Has it grown progressively worse? Is the pain recurrent, related to activity or worse at night? Is the pain associated with constitutional symptoms, such as unintentional weight loss, fevers, chills or malaise?

2. Determine the location of the pain.
   - Establish whether the pain is lumbar thoracic or cervical and whether it is focal, diffuse or radiating or radicular. The more focal the pain, the easier it will be to potentially identify an underlying cause. Nonlocal, diffuse pain (“My whole back hurts” or “I can’t put my finger on it because it hurts everywhere”) is less likely to result in the discovery of a focal underlying pathology with radiographic work-up.

3. Consider the patient’s age and check neurological signs.
   - Is the patient 10 or younger? The younger the patient, the more worrisome the back pain is, because a pathologic abnormality is more likely to be the cause. Also, ask about transient paraparesis, paraparesis, numbness or paresthesias, and determine if bowel or bladder function is affected. Neurological impairment signals a more complex condition.

4. Listen for these reassuring signs.
   - Ask if the patient has a history of back pain or related conditions. Is the pain associated with trauma, such as a herniated disc, spondylolysis, scoliosis, Scheuermann’s disease, osteomyelitis, discitis, leukemia, tumors, or ankylosing spondylitis? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

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Pediatric Back Pain: When to Sit Up and Take Note
by Tenner Guillaume, M.D.

Back pain is uncommon among children who are under 10 years old, but the incidence of back pain increases for adolescents. A 2013 study of 7,542 European teenagers states, “A total of 1,490 (20.5%) teenagers reported one or more episodes of low back pain (LBP), of whom 350 (9.8%) consulted a health provider.” Not surprisingly, athletes have a higher incidence of back pain than nonathletes.

For primary care providers, the key questions are—when is back pain the result of overuse or muscle strain? When is the pain symptomatic of more serious pathology, such as a herniated disc, spondylolisthesis, Scheuermann’s disease, osteomyelitis, osteitis, scoliosis, or other idiopathic conditions? What follows is a practical guide to evaluating pediatric back pain, with recommendations about which cases should be referred to an orthopedic specialist and which cases can be managed in the primary care setting.

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The answers to the following questions will provide nearly all of the information needed to differentiate a benign issue requiring conservative management from a more serious condition. The answers will also help you determine whether to simply treat the symptoms or whether a complete radiographic study is necessary.

1. Characterize the back pain.
2. Determine the location of the pain.
3. Consider the patient’s age and check neurological signs.
4. Listen for these reassuring signs.

1. Key Insights:
   - Ask if the patient has missed school or sports because of the pain, whether the pain is intermit- tent or activity-related, generalized or focal.
   - Discuss whether the pain is due to injury or overuse or muscle strain?
   - When is the pain symptomatic of more serious pathology, such as a herniated disc, spondylolisthesis, Scheuermann’s disease, osteomyelitis, osteitis, scoliosis, or other idiopathic conditions?

2. Determining the Location of the Pain

Establish whether the pain is lumbar, thoracic or cervical and whether it is focal, diffuse, radicular or radiculopathy. The more focal the pain, the easier it will be to potentially identify an underlying cause. Nonspecific, diffuse pain (“My whole back hurts” or “I can’t put my finger on it because it hurts everywhere”) is less likely to result in the discovery of a focal underlying pathology with radiographic work-up.

3. Consider the patient’s age and check neurological signs.

Is the patient 10 or younger? The younger the patient, the more worrisome—a pathologic abnormality is more likely.

4. Listen for these reassuring signs.

If the patient has missed school or sports because of the pain, whether the pain has improved over time, and if the pain responds to nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen. Additionally, duration whether the pain is intermittent or activity-related, generalized or focal.