Approach to Back Pain in Children and Adolescents

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Disclosures

▸ I have nothing to disclose.
Objectives

▸ What are common etiologies of back pain in children?
▸ What are important questions to ask the patient and family during an initial clinic visit for low back pain?
▸ Why is the physical exam helpful in determining the cause of low back pain in children?
▸ What are important clinical tests that can be helpful in determining the cause of low back pain in children?
▸ What are some important imaging modalities that can be helpful in determining the cause of low back pain in children?
▸ What are “red flags” that one MUST recognize during an assessment of low back pain in children?
▸ What are “yellow flags” that also must be recognized?

Case 1

3-year-old boy complains of progressively unable to walk or sit 4 days prior to presentation. He has no obvious tenderness, but he seems more irritable while sitting. There is no history of recent trauma, or vaccinations. Review of systems was negative for fever, cough or choking. He has normal bowel movements and there is no change in his voice.

On examination, the child is awake and alert. He does not appear in pain. Cranial nerves are intact. He appears in a frog leg position with decreased tone and little spontaneous movement in both lower limbs. Deep tendon reflexes are +3 bilaterally, and the power in the upper limbs was normal. His anal tone is normal. He withdraws to tactile stimulation in all extremities. He is unable to weight bear.

The possible diagnosis is:

Case 2

13 year old boy complains of 6 weeks of stiffness in his lower back which gets better with low impact activity. He says he is also having pain in the back of his right heel and the bottom of his right foot along with some left knee pain. He denies abdominal pain, nausea, vomiting and diarrhea. He denies fever but does report that 3 days ago, he developed a painful, red eye.

On exam, he has tenderness in his right Achilles tendon and in his right plantar fascia. He has a small effusion of his left knee, injected right eye with some photophobia and tenderness at his bilateral SI joints.

The possible diagnosis is:

Case 3

A 14-month-old female child was initially evaluated for abnormal neck posture and difficulty turning her head to the right and upward. The patient was noted to perform compensatory maneuvers such as using her arms to push herself up to look around rather than simply lifting her head. Similarly, the patient was observed to make a 270° turn to the left rather than making a simple 90° turn to the right.

Physical exam was notable for leftward deviation of the head with increased bulk and tone in the right sternocleidomastoid muscle with associated right shoulder elevation. Attempts at moving the neck provoked the patient to cry.

She had good fine motor coordination for her age, but was not yet walking unassisted. No additional motor, sensory, gait, or reflex abnormalities were present.

The possible diagnosis is:
Case 4

The 15-year-old female gymnast had a 1 month history of back pain. She described her pain as a deep ache in her low back and rated it at 0/10 at best, 3/10 at the time of the evaluation, and 6/10 at worst. She also reported tightness of her hamstrings. She was unable to tolerate higher levels of gymnastic training or competition as activity made her symptoms worse. At the time of the evaluation, she was unable to practice at all.

On exam, she has generalized tenderness in her low back that radiates to her buttocks. She also complains of tight hamstrings.

The possible diagnosis is:

Case 5

16 year old boy is brought in by EMS for severe pain in his cervical spine after being injured in a car accident. He is intubated for respiratory distress and is currently not moving his upper or lower extremities. The possible diagnosis is:
Case 6

16 year old female arrives to clinic complaining of severe back pain. She says that the pain is always present. She says that she has not been able to take part in her usual activities due to pain. She also reports headaches, chest pain, abdominal pain, upper and lower extremity pain. She has missed 3 weeks of school and her parents are currently going through a divorce. She used to play soccer but did not go out for the team this year due to her pain. She says that she is having trouble falling asleep and staying asleep at night. She has not had fever, hair loss or recurrent mouth sores. She also denies rash.

On exam, she does not have any arthritis, has a normal neurologic exam and has multiple scattered tender points in her neck, upper back, upper and lower extremities.

The possible diagnosis is:

Case 7

- A 10 year old female arrives to clinic complaining of pain in her mid back that started 2 months ago and has worsened over time. She said that her pain is dull but can be sharp at times. She says that she has been unable to do her usual activities because of the pain.

- Of note, she has a past medical history for a hospitalization 6 months ago for severe right ankle pain. She was noted to have an elevated ESR but only slightly elevated WBC. No fever. MRI showed osteomyelitis of her distal right tibia. During the hospitalization, she underwent a bone biopsy which was normal. She had blood cultures that were also normal. She received a week of inpatient IV antibiotics followed by a prolonged course of oral antibiotics for presumed osteomyelitis.

- The possible diagnosis is:
Case 8

15 year old female with Systemic Lupus Erythematosus arrives to clinic complaining of pain in her mid-back for the past 2 weeks. She says the pain is worse with deep inspiration and with lying down. She denies fever but does report increasing joint pain in her fingers. She also reports a worsening malar rash.

On exam, she has arthritis in several of the PIP joints of her fingers. She has a malar rash and has decreased breath sounds at her lung bases.

The possible diagnosis is:

About 80 percent of adults experience low back pain at some point in their lifetimes. It is the most common cause of job-related disability and a leading contributor to missed work days. ... Most low back pain is acute, or short term, and lasts a few days to a few weeks.
Epidemiology

- Back pain in children is a common occurrence
  - Scandinavian survey
    - >5000 children and young adults found that 7% of 12 year-olds had experienced at least one episode of low back pain
    - cumulative incidence increasing to 50% by age 18 years for girls and 20 years for boys

- Back pain associations
  - Female gender
  - Increased screen time
  - Negative scores on affect scales
  - Family history of back pain
Etiology of Back Pain

- One half of episodes of back pain are caused by trauma
- Other etiologies includes: UTI, viral illness, idiopathic, sickle cell pain crisis
- School backpacks have not been confirmed as a cause but studies are ongoing
- Back pain that persists or worsens deserves careful attention
  - In one series, 32/61 children who presented to an orthopedic clinic with back pain had serious underlying pathology
History and Physical Exam

Rule out symptoms that suggest the presence of a more serious underlying condition

“Red Flags” - Warning signs of potentially serious causes of back pain in children and adolescents:

- Young age (< 4 yo)
- Fever
- Weight Loss
- Type of pain
  - Severe or constant
  - Occurs at night
  - Progressive
  - Interferes with activity
  - Radiates below the buttocks
- History of malignancy or tuberculosis
- Acute or repetitive trauma
- Abnormal neurologic signs: asymmetric reflexes, Babinski, low rectal tone, bowel or bladder symptoms
History and Physical

“Yellow Flags”

Psychosocial Issues

➢ Family history of low back pain
➢ Smoking
➢ Recent Psychosocial Stress
➢ Problems at school
➢ Family’s response to child’s pain should be evaluated
➢ Counseling should be provided

Location?

➢ When did symptoms begin and were there any other associated activities or symptoms that started when symptoms started?
➢ When does it hurt?
➢ What makes it better or worse?
➢ Is there stiffness after rest?
➢ Does the pain interfere with activity?
➢ Sports participation? How aggressive is training? Is pain present during or after activity?
Pain Characterization

- **Simple sprain** – nonspecific pain in lower back, may radiate to buttocks
- **Nerve root pain** – brief, sharp, worsened by cough or straining, standing or sitting
- **Peripheral nerve pain** - burning, pins and needles, numbness, usually worse when patient is lying down
- **Inflammatory pain** – stiffness in the morning that improves with low impact activity
- **Anatomic derangement** – better in the morning and worse with activity
- **Sciatica** – pain radiating from lower back down the leg in a dermatomal distribution, aching pain in buttock and paresthesia radiating into the posterior thigh and calf and into the posterior lateral thigh and lateral shin
- **Fibromyalgia/pain amplification syndrome** - Widespread pain, missing school, loss of social interests
- **Radiculopathy** – pain, weakness, numbness or difficulty controlling specific muscles
- **Infectious/Discitis** – unable to bear weight
- **Pyelonephritis** – burning with urination

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**Differential Diagnosis of Back Pain in Children and Adolescents**

<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>POSSIBLE DIAGNOSES</th>
<th>ASSOCIATED SYMPTOMS</th>
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<tbody>
<tr>
<td>Nighttime pain</td>
<td>Tumor, infection</td>
<td>Fever, malaise, weight loss</td>
</tr>
<tr>
<td>Pain with fever or other</td>
<td>Tumor, infection</td>
<td>Nighttime pain</td>
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<tr>
<td>generalized symptoms</td>
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<tr>
<td>Acute pain</td>
<td>Herniated disk, slipped apophysis,</td>
<td>Radicular pain, positive straight</td>
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<tr>
<td></td>
<td>spondyloysis</td>
<td>leg raising test result</td>
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<tr>
<td></td>
<td>Vertebral fracture</td>
<td>Other injuries, neurologic loss</td>
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<td></td>
<td>Muscle strain</td>
<td>Muscle tenderness without</td>
</tr>
<tr>
<td></td>
<td></td>
<td>radiation</td>
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<tr>
<td>Chronic pain</td>
<td>Scheuermann's kyphosis</td>
<td>Rigid kyphosis</td>
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</tbody>
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Physical Exam

- Posture
- Shoulder height, scapular prominence, flank crease, pelvic asymmetry, leg length discrepancy
- Midline skin lesions (dimples, hemangioma, hair patches), calf atrophy
- Café au lait spots
- Muscle atrophy, fasciculations or pelvic tilt
- Abnormal gait (toe walking, spasticity, ataxia, refusal to walk)
- Involuntary knee flexion (patients with radiculopathy – flexion guards against root traction)
- Palpation
- Range of Motion
- Neurologic Exam
- Straight Leg Raise
The test is performed by having the patient lie in a supine position, placing the foot of the affected side on the opposite knee; groin pain indicates a hip problem rather than a spinal problem.

The physician then presses firmly on the flexed knee and on the opposite anterior superior iliac crest; pain in the sacroiliac area indicates a problem with sacroiliac joints.
Laboratory Evaluation

- Children with concerning history and physical
  - ESR, CRP
  - LDH, Uric Acid
  - HLA B27
- ANA, Lyme and RF are usually NOT indicated in the evaluation of children with back pain

Radiologic Evaluation

- Should be directed by clinical picture
- Children with concerning clinical findings
  - Known malignancy or abnormal neurologic exam – MRI
  - Nonbony spinal tumors, discitis, spinal cord inflammation (Transverse Myelitis), Sacroilitis, osteomyelitis, spondylolysis and spondylolisthesis – MRI
Case 1

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The possible diagnosis is:

Discitis

- Discitis is an inflammation of the intervertebral disc.
- It is rare in young children and the etiology is controversial.
- Occurs in children at around 2-5 years of age.
- They present with irritability and back pain, limp, or refusal to walk.
- On examination patients may refusal to bend forward or to sit, tenderness over the involved spine. Hip pain and stiffness and decreased power and reflexes can be seen.
- MRI spine with gadolinium is diagnostic for the disease but it can be normal initially.
- It can define the inflammation and exclude alternative diagnoses such as vertebral osteomyelitis and tumors.
- Around 60% of organisms Staphylococcus aureus.
- Empiric antibiotic therapy as an anti-staphylococcal agent and a third-generation cephalosporin are the preferable choice.
- The prognosis is usually good but anomalies of the disc space and adjacent vertebrae are common findings on long-term follow-up.
- Erythrocyte sedimentation rate is elevated in more than 90% of patients. No need to do disc biopsy to diagnose children with discitis.
- Management for discitis in children is different than adult. Antibiotics usage is associated with earlier response and fewer relapses.
- Initially patient should be started on intravenous antibiotics until the child shows clinical improvement, followed by oral antibiotics.
- Bed rest, analgesia and immobilization by casting, may help with pain control.

Case 2

13 year old boy complains of 6 weeks of stiffness in his lower back which gets better with low impact activity. He says he is also having pain in the back of his right heel and the bottom of his right foot along with some left knee pain. He denies abdominal pain, nausea, vomiting and diarrhea. He denies fever but does report that 3 days ago, he developed a painful, red eye.

On exam, he has tenderness in his right Achilles tendon and in his right plantar fascia. He has a small effusion of his left knee, injected right eye with some photophobia and tenderness at this bilateral SI joints.

The possible diagnosis is:

References:
Enthesitis Related Arthritis

- ERA is a type of juvenile idiopathic arthritis (JIA)
- Enthesitis – swelling and pain where tendons and ligaments attach to bone
- ERA is a disease that causes pain, swelling and stiffness in the joints of the hips, knees, ankles, feet and lower back-sacroiliitis
- More common in boys than girls
- People with ERA may also have inflammation in the eyes, skin or intestines
- Associated with HLA B27
- Responds to NSAIDS and TNF inhibitors

Case 3

A 14-month-old female child was initially evaluated for abnormal neck posture and difficulty turning her head to the right and upward. The patient was noted to perform compensatory maneuvers such as using her arms to push herself up to look around rather than simply lifting her head. Similarly, the patient was observed to make a 270° turn to the left rather than making a simple 90° turn to the right.

Physical exam was notable for leftward deviation of the head with increased bulk and tone in the right sternocleidomastoid muscle with associated right shoulder elevation. Attempts at moving the neck provoked the patient to cry.

She had good fine motor coordination for her age, but was not yet walking unassisted. No additional motor, sensory, gait, or reflex abnormalities were present.

The possible diagnosis is:
Spinal Cord Ganglioma

- A ganglioglioma is low-grade tumor of mixed cell type
- It is very rare and contains properties of both glial cells (responsible for providing the structural support of the central nervous system) and neuronal cells (the functioning component of the central nervous system)
- Ganglioglioma usually occur in the cerebrum (the part of the brain that controls motor, sensory and higher mental function), but can occur in any part of the brain or spinal cord
- In rare cases, ganglioglioma may transform into a higher grade, more malignant tumor
- Children with certain genetic syndromes, including neurofibromatosis 1 and tuberous sclerosis, are at higher risk of developing glial tumors, including gangliogliomas; however, most of these tumors develop spontaneously

Case 4

The 15-year-old female gymnast had a 1 month history of back pain. She described her pain as a deep ache in her low back and rated it at 0/10 at best, 3/10 at the time of the evaluation, and 6/10 at worst. She also reported tightness of her hamstrings. She was unable to tolerate higher levels of gymnastic training or competition as activity made her symptoms worse. At the time of the evaluation, she was unable to practice at all.

On exam, she has generalized tenderness in her low back that radiates to her buttocks. She also complains of tight hamstrings.

The possible diagnosis is:
Spondylolisthesis and Spondylolysis

- Common causes of low back pain in young athletes
- Spondylolysis is a crack or stress fracture in one of the vertebrae
- The injury most often occurs in children and adolescents who participate in sports that involve repeated stress on the lower back, such as gymnastics, football, and weight lifting.
- In some cases, the stress fracture weakens the bone so much that it is unable to maintain its proper position in the spine—and the vertebra starts to shift or slip out of place. This condition is called spondylolisthesis.
- For most patients with spondylolysis and spondylolisthesis, back pain and other symptoms will improve with conservative treatment. This always begins with a period of rest from sports and other strenuous activities.
- Patients who have persistent back pain or severe slippage of a vertebra, however, may need surgery to relieve their symptoms and allow a return to sports and activities.

Case 5

16 year old boy is brought in by EMS for severe pain in his cervical spine after being injured in a care accident.

He is intubated for respiratory distress and is currently not moving his upper or lower extremities.

The possible diagnosis is:

Data from the National Vital Statistics System-Mortality

- An average of 16,375 teenagers 12-19 years died in the United States every year from 1999 to 2006. This is less than 1 percent of all deaths that occur every year in the United States.
- The five leading causes of death among teenagers are Accidents (unintentional injuries), homicide, suicide, cancer, and heart disease. Accidents account for nearly one-half of all teenage deaths.
- As a category of accidents, motor vehicle fatality is the leading cause of death to teenagers, representing over one-third of all deaths.
- Among teenagers, non-Hispanic black males have the highest death rate (94.1 deaths per 100,000 population).
- Homicide is the leading cause of death for non-Hispanic black male teenagers. For all other groups, accident is the leading cause.
Damage to the Spinal Cord

- Damage to the spinal cord that causes temporary or permanent changes in its function
- Symptoms may include loss of muscle function, sensation, or autonomic function in the parts of the body served by the spinal cord below the level of the injury
- Injury can occur at any level of the spinal cord and can be complete injury, with a total loss of sensation and muscle function, or incomplete, meaning some nervous signals are able to travel past the injured area of the cord
- Depending on the location and severity of damage, the symptoms vary, from numbness to paralysis to incontinence. Long term outcomes also ranges widely, from full recovery to permanent quadriplegia or paraplegia. Complications can include muscle atrophy, pressure sores, infections, and breathing problems.

Case 6

16 year old female arrives to clinic complaining of severe back pain. She says that the pain is always present. She says that she has not been able to take part in her usual activities due to pain. She also reports headaches, chest pain, abdominal pain, upper and lower extremity pain. She has missed 3 weeks of school and her parents are currently going through a divorce. She use to play soccer but did not go out for the team this year due to her pain. She says that she is having trouble falling asleep and staying asleep at night. She has not had fever, hair loss or recurrent mouth sores. She also denies rash.

On exam, she does not have any arthritis, has a normal neurologic exam and has multiple scattered tender points in her neck, upper back, upper and lower extremities.

The possible diagnosis is:
Case 7

A 10 year old female arrives to clinic complaining of pain in her mid back that started 2 months ago and has worsened over time. She said that her pain is dull but can be sharp at times. She says that she has been unable to do her usual activities because of the pain.

Of note, she has a past medical history for a hospitalization 6 months ago for severe right ankle pain. She was noted to have an elevated ESR but only slightly elevated WBC. No fever. MRI showed osteomyelitis of her distal right tibia. During the hospitalization, she underwent a bone biopsy which was normal. She had blood cultures that were also normal. She received a week of inpatient IV antibiotics followed by a prolonged course of oral antibiotics for presumed osteomyelitis.
Chronic Recurrent Multifocal Osteomyelitis

- Chronic recurrent multifocal osteomyelitis (CRMO) is an inflammatory bone condition.
- Signs and symptoms include recurrent episodes of pain and joint swelling, with or without fever.
- Symptoms typically begin in childhood. CRMO may occur alone or with psoriasis or inflammatory bowel disease, or as part of the syndromes, Majeed syndrome or DIRA.
- For most children, CRMO resolves after many years without lasting effects.
- CRMO can cause slow growth and permanent bone deformity.

Case 8

15 year old female with Systemic Lupus arrives to clinic complaining of pain in her mid-back for the past 2 weeks. She says the pain is worse with deep inspiration and with lying down. She denies fever but does report increasing joint pain in her fingers. She also reports a worsening malar rash.

On exam, she has arthritis in several of the PIP joints of her fingers. She has a malar rash and has decreased breath sounds at her lung bases.

The possible diagnosis is:
Pleuritis/Pleural Effusion

Pleural effusions in children most commonly are infectious (50% to 70% parapneumonic effusion); congestive heart failure is a less frequent cause (5% to 15%), and malignancy is a rare cause.

Parapneumonic effusion is defined as fluid in the pleural space in the presence of pneumonia, lung abscess, or bronchiectasis.

Staphylococcus aureus is the single most common pathogen causing empyema (29% to 35% of cases), especially among infants younger than 2 years of age. Streptococcus pneumoniae is the cause in up to 25% of cases of empyema. Haemophilus influenzae is a less frequent pathogen but still is significant in the development of parapneumonic effusion in children up to 5 years of age. Group A streptococci have re-emerged as significant agents causing empyema in later childhood. Anaerobic pulmonary infection is uncommon, and more than 90% of affected patients manifest periodontal infections, altered consciousness, and dysphagia.

Commonly seen in patients with inflammatory diseases such as systemic lupus and systemic juvenile arthritis.

Summary

▸ Back pain is common in children, more so after adolescence
▸ Need to pay attention to symptoms suggesting a serious underlying condition
▸ Low back pain in a child younger than 3 should be alarming
▸ Need comprehensive history and physical exam
▸ Laboratory and Imaging studies should be directed by clinical features
▸ Commonly, low back pain is nonspecific – conservative measures are appropriate
▸ Pay attention to back pain in athletes and consider Spondylolysis and Spondylolisthesis
▸ Consider the role of psychosocial factors
Questions?