

Kyphosis

Introduction/Etiology/Epidemiology

- Normal thoracic kyphosis is a normal rounding of the upper back of 20 to 45 degrees.
- *Thoracic hyperkyphosis*, clinically referred to as “kyphosis,” involves curvature greater than 50 degrees.
- Unlike scoliosis, kyphosis is not associated with rotational abnormalities.
 - Scoliosis with kyphosis is referred to as *kyphoscoliosis*.
- Kyphosis may be postural, structural, or congenital.
 - *Postural kyphosis* of the thoracic or thoracolumbar spine is a common cause of kyphosis among teens and preteens.
 - Kyphosis greater than 50 degrees
 - Usually associated with a growth spurt
 - Normal vertebral and disk anatomy without any significant wedging of vertebral body
 - Considered a normal variant or related to deconditioning
 - *Structural kyphosis* in otherwise healthy teens and preteens is most commonly caused by Scheuermann disease/kyphosis.
 - Anterior wedging of vertebral body of more than 5 degrees over 3 or more consecutive levels
 - Classically involves the thoracic spine but may also occur in the thoracolumbar or lumbar spine
 - More common in boys than girls
 - Seen in 0.4% to 10% of the population
 - *Congenital kyphosis* can occur anywhere in the spine and is associated with congenital vertebral anomalies present since birth.
 - Can be progressive: growth spurts can lead to rapid progression
 - There can be large variation in curve severity.
 - There can be sharp, angular deformities and potential for neurologic compromise.

Signs and Symptoms

- General features may include the following:
 - Rounded shoulders
 - Head leaning forward compared to body
 - Visible hump
 - Tight hamstrings (deconditioning)
 - Stiffness

- Postural kyphosis
 - Most often asymptomatic and presents as a cosmetic concern
 - May be associated with activity-related back pain or pain after prolonged sitting
 - Parents often bring in the child with reports of slouching or poor posture
- Scheuermann kyphosis
 - More frequently causes pain
 - Pain usually at apex of the deformity
 - Low back pain can result from compensation for the thoracic deformity.
 - There is often a family history of similar deformity.
 - Often present during teenaged years and can progress rapidly during skeletal growth
- Congenital kyphosis
 - Present at birth: varying degrees of severity
 - Can be asymptomatic despite severity
 - Presenting symptoms can include pain and neurologic dysfunction.

Differential Diagnosis

- Metabolic conditions leading to poor bone quality
- Neuromuscular conditions (check Gowers sign if there is concern for weakness)
- Tumor
- Postural kyphosis (roundback)
- Scheuermann kyphosis
- Congenital kyphosis

Diagnostic Considerations

- Postural kyphosis
 - Diagnosis is determined based on physical examination.
 - Kyphosis is flexible and can be consciously corrected.
 - Corrects with asking patient to stand up straight
 - Forward bending demonstrates a smooth kyphotic curvature (**Figure 12-1, A**).
 - Radiographs show kyphosis without anterior vertebral body wedging (**Figure 12-2, A**).
- Scheuermann kyphosis
 - Kyphosis cannot be consciously corrected.
 - Forward bending demonstrates a sharp, angular kyphotic curvature (**Figure 12-1, B**).
 - Diagnosis is determined based on a standing lateral radiograph of the entire spine.
 - Radiographic findings (**Figure 12-2, B**)
 - Greater than 50 degrees of kyphosis as measured by Cobb technique
 - Characteristic vertebral body wedging (> 5 degrees in at least 3 consecutive vertebrae)

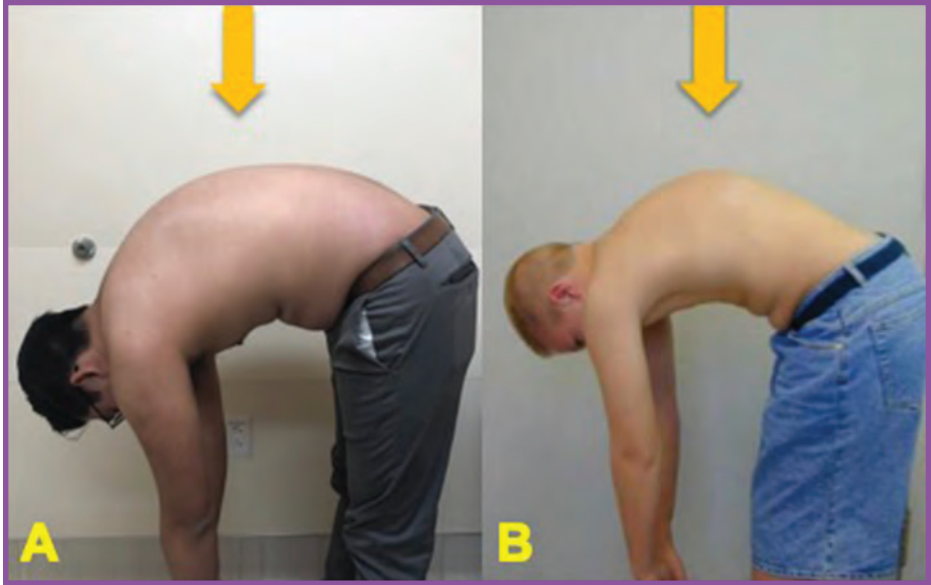


Figure 12-1. Adams forward bend test. Although when a patient is standing, postural kyphosis and Scheuermann kyphosis may appear similar, when asked to bend forward and viewed from the side a patient with postural kyphosis will have a normal smooth contour (arrow) (A) while a patient with Scheuermann kyphosis will have a sharp, angular appearance (arrow) (B).

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- End plate abnormalities
- Schmorl nodes may be present.
- Congenital kyphosis
 - Physical examination findings are variable based on severity of deformity.
 - Normal to sharp angular rigid curve (**Figure 12-3**)
 - Diagnosis is determined based on a standing thoracolumbar lateral radiograph of the entire spine (**Figure 12-4**).
 - Often, other congenital vertebral anomalies are present.
 - Kyphosis can be extremely rigid.
 - Requires magnetic resonance imaging of the spine to rule out neural axis abnormalities
 - Can be present in 20% to 40% of patients with suspected congenital kyphosis
 - Associated systemic anomalies are seen in up to 61% of patients with congenital kyphosis.
 - Genitourinary abnormalities, which are present in 20% of patients, should prompt screening renal ultrasonography.
 - Cardiac abnormality, which is present in 25% of patients, should prompt formal cardiac evaluation or echocardiography.

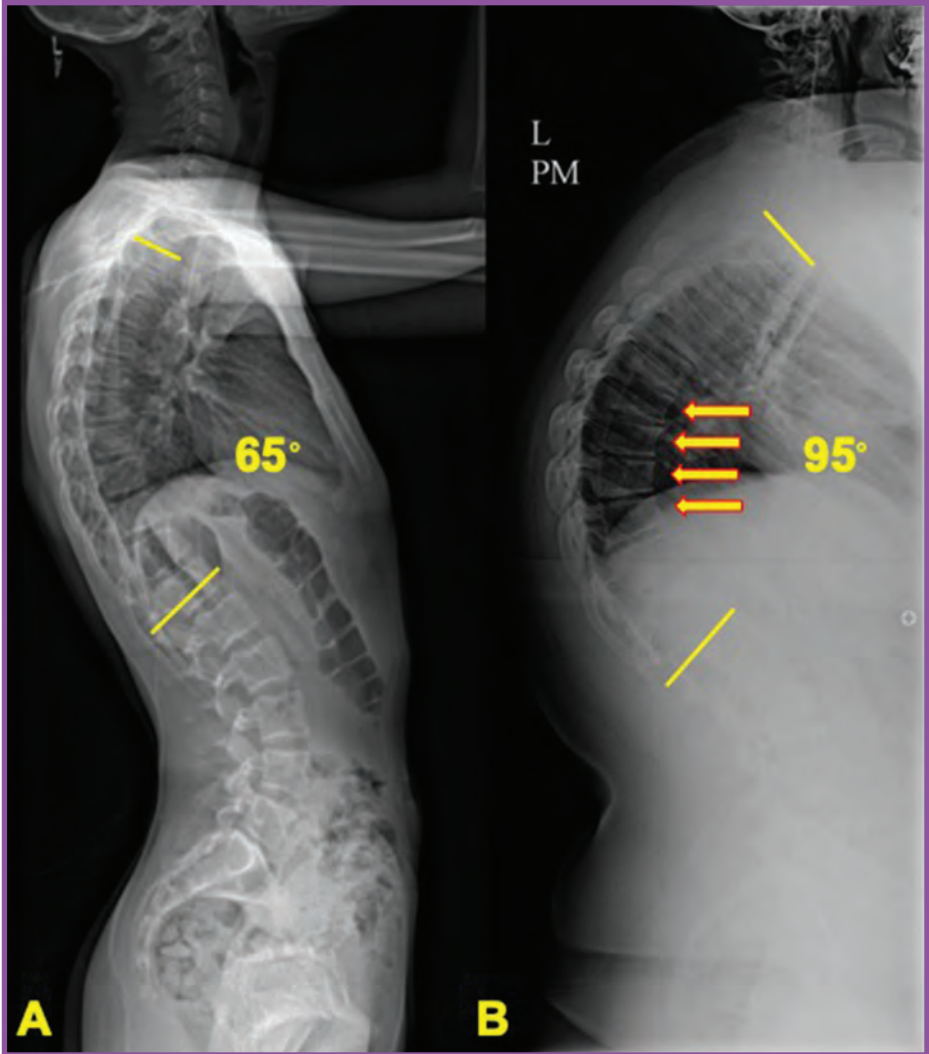


Figure 12-2. Lateral radiographs also illustrate the difference between postural kyphosis, in which the shape of the vertebral bodies is normal (A), and Scheuermann kyphosis, in which the vertebral bodies demonstrate wedging and end plate irregularities/Schmorl nodes (B). Straight lines indicate the kyphosis measured region; arrows in B indicate areas of vertebral wedging.

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Treatment

- Postural kyphosis
 - Observation, if the patient is asymptomatic
 - Physical therapy to strengthen postural muscles if back pain is present
 - Hyperextension exercises over the apex of kyphosis
 - Occasionally, a soft brace may be used.



Figure 12-3. Adams forward bend test in a patient with congenital thoracolumbar kyphosis shows a rigid sharp, angular kyphosis.

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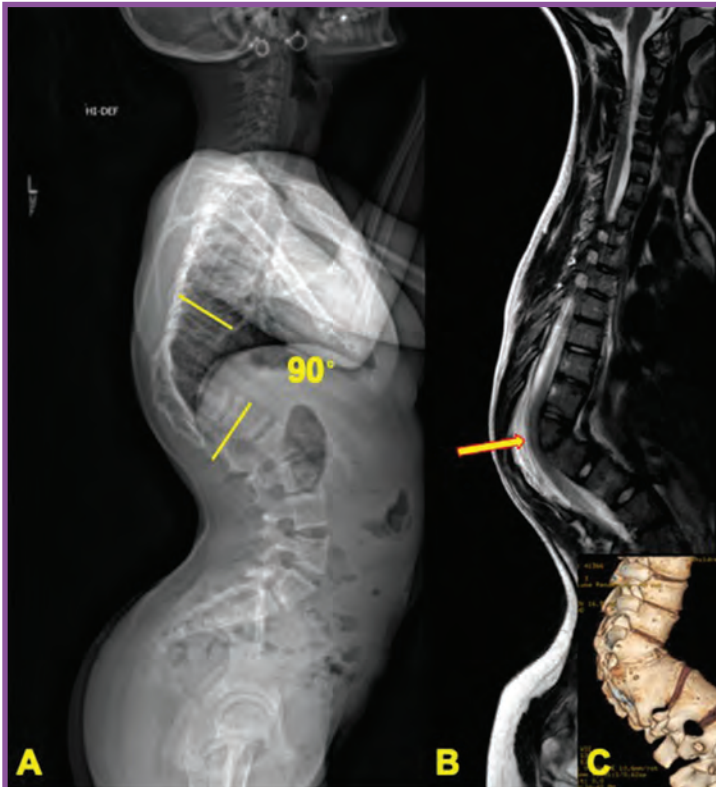


Figure 12-4. Lateral radiograph of the spine from a patient with severe thoracolumbar congenital kyphosis; straight lines indicate the kyphosis measured region (A). Sagittal T2-weighted magnetic resonance image demonstrates spinal cord compression over the apex of the deformity (arrow) (B). Three-dimensional computed tomography reconstruction shows congenital fusion at the thoracolumbar junction resulting in the severe congenital kyphosis (C).

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- Scheuermann kyphosis
 - Physical therapy and/or bracing are indicated for moderate deformities.
 - Moderate deformity: 50 to 80 degrees
 - Bracing with antikyphosis thoracolumbosacral orthosis is typically only used if patient is skeletally immature
 - ❖ Bracing is aimed at preventing deformity progression and is usually implemented until skeletal maturity.
 - ❖ Effect of bracing treatment on the natural history and progression of disease remains unknown
 - Nonsteroidal anti-inflammatory drugs may also be used to manage pain.
 - Surgery is rarely indicated for Scheuermann kyphosis.
 - When the kyphosis is *severe* (> 70 degrees) and/or symptomatic, spinal fusion may be considered (**Figure 12-5**).
- Congenital kyphosis
 - Treatment varies from observation to surgery.
 - Observation is preferred for small, nonprogressive curves.
 - Bracing is typically ineffective with congenital deformities.
 - Surgery is required for moderate to large curves that are progressive.
 - Curves that are associated with neurologic compromise require urgent or emergent intervention.

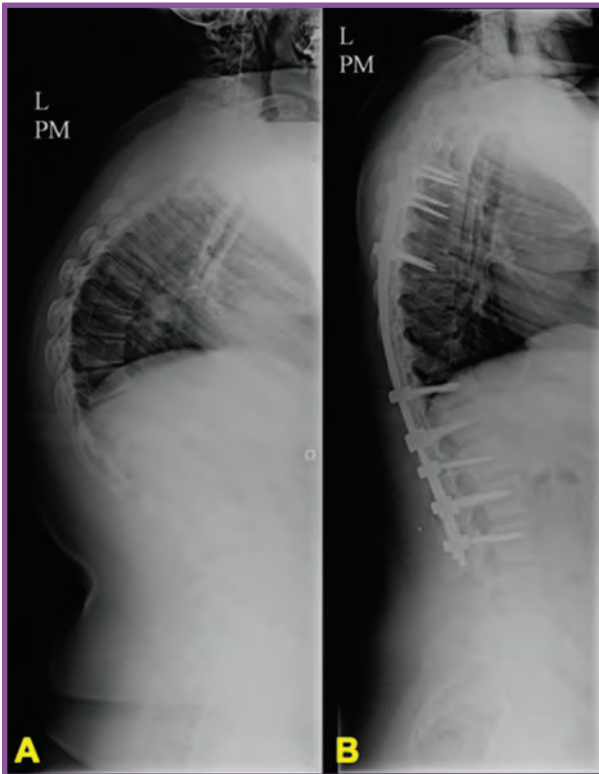


Figure 12-5. Radiographs from a 19-year-old with severe Scheuermann kyphosis of 95 degrees (A) who underwent posterior spinal fusion with instrumentation and experienced marked improvement in back pain (B).

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Expected Outcomes/Prognosis

- Postural kyphosis
 - Does not lead to permanent deformity, is not progressive, and is reversible
 - Pain, if present, typically responds to conservative treatment.
- Scheuermann kyphosis
 - Surgery is rarely indicated.
 - Pain usually responds to conservative treatment.
 - Rarely, severe curves (> 100 degrees) can lead to cardiopulmonary compromise.
- Congenital kyphosis
 - Expected outcomes and prognosis depend on the location and severity of kyphosis.
 - Outcomes range from no treatment needed to complex posterior spinal fusion and instrumentation.
 - Untreated large, progressive curves can result in neurologic deterioration if not evaluated and treated in a timely fashion.

When to Refer

- Refer to an orthopaedic surgeon for the following:
 - Symptomatic postural kyphosis
 - Scheuermann kyphosis > 50 degrees (severe)
 - All cases of congenital kyphosis.