

Abnormal spinal posture and back deformities

Mechanism: The normal balance of the spinal column in the coronal (scoliosis) or sagittal (kyphosis/lordosis) plane is disrupted by asymmetric bone, disc, muscle, or neural forces. Scoliosis is a three-dimensional deformity with lateral curvature, vertebral rotation, and rib/waist asymmetry. Degenerative scoliosis begins in the intervertebral disc, leading to asymmetric degeneration, ligament hypertrophy, and instability. Hyperkyphosis results from anterior vertebral wedging (due to growth-plate abnormalities in youth, or osteoporotic fractures and disc degeneration in older adults). Reactive deformity is caused by pain-induced asymmetric paraspinal muscle spasm.

Syndromes:

Adolescent idiopathic scoliosis (AIS) - the most common form in children; typically a painless right thoracic or left lumbar curve.

Congenital scoliosis - arises from vertebral formation/segmentation anomalies.

Neuromuscular/syndromic scoliosis - associated with cerebral palsy, muscular dystrophy, neurofibromatosis, etc

Degenerative (de novo) scoliosis - lumbar-predominant curve presenting after skeletal maturity, accompanied by axial back pain.

Scheuermann kyphosis - rigid juvenile thoracic hyperkyphosis with anterior vertebral wedging.

Osteoporotic kyphosis ("dowager's hump") - progressive thoracic kyphosis from vertebral compression fractures.

Red flags:

- Painful scoliosis, especially nocturnal pain relieved by NSAIDs (suggests osteoid osteoma or osteoblastoma).
- Atypical curve (left thoracic), rapid progression ($>1^\circ/\text{month}$), or focal neurologic deficit (mandates MRI to exclude syrinx or tumor).
- New/worsening spine pain with fever, IV drug use, or immunosuppression (suspect spondylodiscitis or epidural abscess).
- History of cancer, unexplained weight loss, or a destructive vertebral lesion (suspect metastasis).
- New or progressive neurologic deficit, myelopathy, or bowel/bladder dysfunction (requires urgent MRI).

Examination:

- 1) History - age of onset, pain presence, progression rate, and neurologic symptoms.
- 2) Physical exam - Adams forward-bend test with a scoliometer, assessment of shoulder/scapular asymmetry, leg-length discrepancy, skin exam (for café-au-lait spots or midline dimpling), and a full neurologic exam.
- 3) Radiography (first-line) - standing PA and lateral full-spine films with Cobb-angle measurement.
 - MRI - reserved for atypical features, rapid progression, neurologic deficits, or suspected intraspinal pathology/infection
 - CT - utilized for complex osseous deformity, surgical planning, and characterizing fractures or tumors.

Treatment: Directed at the cause:

- **Observation** - for AIS with Cobb angle <20–25°.
- **Bracing** - rigid TLSO for skeletally immature AIS with curves ~20–40°.
- **Surgery (spinal fusion)** - for curves ≥45–50° or progressive deformity.
- **Adult degenerative scoliosis** - first-line conservative care (analgesics, physical therapy, selective bracing); surgery reserved for intractable pain or neurologic compromise.
- **Secondary/structural deformity** - treat the underlying cause (tumor resection, antibiotics, or antiresorptive therapy).

Onset	Children	Adults
Acute / Subacute	reactive scoliosis (osteoid osteoma), infection (spondylodiscitis)	osteoporotic compression fractures, metastasis, epidural abscess, disc herniation
Chronic	adolescent idiopathic scoliosis (AIS), Scheuermann kyphosis, congenital/neuromuscular	degenerative (de novo) scoliosis, persistent AIS, osteoporotic kyphosis

Explanatory notes: AIS - adolescent idiopathic scoliosis, TLSO - thoracolumbosacral orthosis, NSAIDs - non-steroidal anti-inflammatory drugs, PA - posteroanterior. Department of Neurology, First Faculty of Medicine, Charles University and General University Hospital ©