Pediatric spine

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• In our vertebrae, we have two naturally occurring curves:
  1. Lordosis (in cervical and lumbar regions)
  2. Kyphosis (in upper thoracic and sacral regions)

Any exaggeration of the normal curvature can be defined as an abnormality.
Scoliosis

• Definition: lateral curvature of spine with vertebral rotation.
• More common in females
Signs and symptoms

- **Symptoms of scoliosis:**
  - Pain in back, shoulders, and neck and buttock pain
  - Respiratory and/or cardiac problems in severe cases
  - Constipation due to curvature causing "tightening" of stomach, intestines.
  - Painful menstruation
  - Limited mobility secondary to pain

- **Signs of scoliosis:**
  - Uneven musculature on one side of the spine
  - Rib prominence or a prominent shoulder blade
  - Uneven hips, arms or leg lengths
  - Slow nerve action
  - Heart and lung problems in severe cases
Scoliosis

It could be either:
1- Postural
2- Structural
Postural scoliosis (temporary)

- only involves a lateral curvature of the spine (no spinal rotation)
- The deformity is secondary or compensatory to some condition outside the spine
  - short leg.
  - a pelvic tilt due to contracture of the hip.
  - Local muscle spasm associated with a prolapsed lumbar disc (sciatic scoliosis)
- When the patient sits or bend (thereby cancelling leg length asymmetry) the curve disappears.
- On x-ray: no rotation of pedicles, transverse processes or spinous processes
Postural scoliosis

(a) This young girl presented with thoracolumbar ‘curvature’. When she bends forwards, the deformity disappears; this is typical of a postural or mobile scoliosis.

(b) Short-leg scoliosis disappears when the patient sits.

(c) Sciatic scoliosis disappears when the prolapsed disc settles down or is removed.
Structural scoliosis

- It is a non-correctable deformity
- It involves spinal rotation in addition to the lateral curvature of the spine
- Secondary (compensatory) curves nearly always develop to counterbalance the primary deformity
- On X-ray: Rotation of the spinous processes, pedicles and the transverse processes
Adam's Forward Bending Test

functional vs structural

• Ask the patient to bend forward with the feet together and arms hanging down
• Stand at the back of the patient
• Look along the horizontal plane of the spine searching for abnormalities of the spinal curve in addition to a prominent rib hump and asymmetry of the trunk.
Adam’s Forward Bend Test

Functional

Structural
Causes of structural scoliosis

- Congenital
- Neuromuscular
- Idiopathic (70-80%)
Congenital scoliosis

- **Failure Formation**
  - Semisegmented
  - Fully segmented
  - Wedge Vertebrae
  - Hemivertebrae

- **Failure of Segmentation**
  - Block Vertebrae
  - Unsegmented Bar

- **Mixed**
  - Unsegmented bar with Hemivertebrae

Treatment is surgical
Neuromuscular Scoliosis

- Also known as secondary scoliosis.
- Occurs due to imbalance between sides of the spine as result of muscle spasticity.
- Probably caused by Poliomyelitis, cerebral palsy, neurofibromatosis.
- Treatment is surgical.
Idiopathic scoliosis

- According to age group
  - Infantile (0-3 years)
    - some cases resolve spontaneously but others progress to severe deformity
    - More in males
  - Juvenile (3-9 years).
  - Adolescent (10-18 years, most common type).

- Early onset <10 years
- Late onset >10 years → MC
Adolescent idiopathic scoliosis

- The most common type
- age of presentation (10-18 years)
- Deformity is the presenting symptom
- it's Painless
- appearance of hump on examination
- By history and physical exam exclude the congenital and neuromuscular types.
Common Types of Curves

- thoracic curve
- thoracolumbar curve
- lumbar curve
- double major curve
Physical examination

- Asymmetry of shoulders, chest wall or breast in addition to a hump.
- Unequal gaps between trunk and arm.
- Leg length discrepancy.
- Do neurological exam.
Imaging

- **Cobb’s angle (angle of curvature)**
- PA and lateral x-rays of the spine and iliac crests
  - The angle between intersecting lines drawn perpendicular to the top of the top vertebrae and the bottom of the bottom vertebrae
  - **Mild** → 10 – 30°
  - **Moderate** → 30 – 45°
  - **Severe** → >45°
    - >60° → respiratory complications
    - 50-90 → needs surgery to prevent progression
    - <50 → conservative
**Imaging**

- **SKELETAL MATURITY – RISSER’S SIGN**
  - Indirect measure of skeletal maturity, whereby the ossification stage of iliac apophysis is used to judge the ossification of spinal vertebra.
  - On a scale of 5, it gives a measure of progression of ossification
    - 5 means that skeletal maturity is reached.
  - The iliac apophyses normally ossify progressively from lateral to medial; when fusion is complete, we know that spinal maturity has been reached and further increase in the angle of curvature is negligible.
  - The iliac apophysis start ossifying shortly after puberty
Imaging

- **CT and MRI**
  - may be necessary to define a vertebral abnormality or cord compression
Prognosis

- CVS /RS compromise in severe cases in pts <5 yrs
- The risk of progression depends on the following parameters:
  - Growth potential of the patient
    - In adults: Once growth has stopped, risk of progression is minimal
  - Magnitude of curve
  - Type of curve
  - Sex of the patient
- Reliable predictors of progression are:
  - a very young age
  - marked curvature
  - an incomplete Risser sign at presentation
• The curve of scoliosis often progresses most during the period of rapid skeletal growth and maturation.

Serial x-rays show how this curve increased over a period of 4 years.
Reasons to treat

- Cosmetic mainly.
- Progression (>50 degree) as a rate of 0.5-1 /year.
- Cardiac and respiratory complications.
- Disc herniation.
- Degenerative changes.

- Patients with severe chest deformities should undergo pulmonary function tests.
- A marked reduction in vital capacity is associated with diminished life expectancy and carries obvious risks for surgery.
Treatment

- (Exercise – has no effect on the curve)
  A. Patients with a curve < 20 degree will not progress any more
  B. Patients with a curve > 50 degree may progress more → surgery is needed.
  C. Those between 20-50 → need follow up
    ▫ If the curve increases with time, treat as “B”, if doesn't, considered as < 20
Treatment

"The 3O's ":
(1) observation: 4-6 monthly visits.
(2) Orthotics: braces, prevents progression and does not correct deformity.
(3) Operative intervention.
Kyphosis

- is an abnormally excessive convex kyphotic curvature (flexible or fixed) of the spine as it occurs in the cervical, thoracic and sacral regions.

- A normal thoracic spine have a slight kyphotic angle (20° to 45°). When the "roundness" of the upper spine increases past 45° it is called kyphosis or "hyperkyphosis".

- Common in males
Causes of kyphosis

- degenerative diseases such as arthritis
- developmental problems - Scheuermann's disease
- osteoporosis with compression fractures of the vertebra
- multiple myeloma or trauma.
Kyphosis types

• **Postural kyphosis**
  ▫ *is common* ('round back' or 'drooping shoulders')
  ▫ may be associated with other postural defects such as flat-feet.
  ▫ If treatment is needed, this consists of postural exercises.

• **Structural kyphosis**
  ▫ Osteoporosis of the spine (the common round back of elderly people)
  ▫ Ankylosing spondylitis
  ▫ Scheuermann’s disease (adolescent kyphosis).
A kyphos (or gibbus)

- is a sharp posterior angulation due to localized collapse or wedging of one or more vertebrae.

**Causes**

- a congenital anomaly
- a fracture (sometimes pathological)
- spinal TB.
Congenital kyphosis

Type I: failure of formation
- is the commonest (and the worst) type.
- may lead to cord compression.

Type II: failure of segmentation
- The risk of neurological compression is much less.
Adolescent kyphosis (Scheuermann’s disease)

This is a ‘developmental’ disorder

Abnormal ossification (and possibly some fragmentation) of the ring epiphyses on the upper and lower surfaces of vertebral body in the growing spine.

As a consequence these cartilaginous end-plates are weaker than normal and the affected vertebrae in the thoracic spine, may become wedge shaped.

If this happens, the normal kyphosis is exaggerated.

Schmorl’s nodes : small central herniations of disc material into the vertebral body.
Thoracic Scheuermann’s disease

- usually, appears in the midthoracic vertebrae.
- starts at or shortly after puberty
- more common in males
- The patient may complain of backache and fatigue.
Thoracic Scheuermann’s disease

Diagnosis

- X-rays: AP and lateral spine.
  Findings:
  - Anterior wedging
  - Disc narrowing
  - Endplate irregularities
  - Schmorl’s nodes
  - Scoliosis
  - Compensatory hyperlordosis

- MRI: To rule out associated abnormalities of spinal curve and nerves.
Thoracic Scheuermann’s disease

Treatment

• physiotherapy

• If there is concern about back pain and/or deformity, an extension brace worn for 1 year

• If this fails operative correction and fusion may be needed
Thank You