degenerative Deformities

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The term ‘kyphosis’ is used to describe both the normal (the gentle rounding of the dorsal spine) and the abnormal (generalized excessive dorsal curvature). Some people prefer the term hyperkyphosis for the abnormal one.

A normal thoracic spine extends from the 1st to the 12th vertebra and should have a slight kyphotic angle, ranging from 20° to 45°.

A kyphos (or gibbus) is a sharp posterior angulation due to localized collapse or wedging of one or more vertebrae. This may be the result of a congenital defect, a fracture (sometimes pathological) or spinal tuberculosis.
**Postural kyphosis** is common (‘round back’ or ‘drooping shoulders’) and may be associated with other postural defects such as flat-feet. Complete reduction with hyperextension (bending backward)

**Structural kyphosis** is fixed and associated with changes in the shape of the vertebrae. It may occur in osteoporosis of the spine (the common round back of elderly people), in ankylosing spondylitis and in Scheuermann’s disease (adolescent kyphosis).

**Gibbus deformity** is a form of structural kyphosis typically found in the upper lumbar and lower thoracic vertebrae

**in the cervical and lumbar vertebrae there is normally an anterior curvature (lordosis), any reversal of this constitutes cervical or lumbar kyphosis**
Causes:

1. Tuberculosis of the spinal column
2. Wedge compression fracture of vertebral body
3. Ankylosing spondylitis
4. Scheuermann’s disease (adolescent kyphosis)
5. Osteoporosis (most common in postmenopausal women)
6. Destructive tumors (especially metastatic carcinoma)
7. Disc degeneration
8. Unhealthy posture
Scheuermann’s disease:

This is a ‘developmental’ disorder of the growing spine in which there is irregular ossification, and possibly some fragmentation of the vertebral body epiphyses – somewhat similar to other types of ‘osteocondrosis’ in young adolescents.

(\textit{the vertebrae grow unevenly with respect to the sagittal plane})

This results in irregularity of the mature vertebral end-plates, sometimes associated with small central herniations of disc material into the vertebral body (Schmorl’s nodes).

-With increasing growth and muscular activity, affected vertebrae in the thoracic spine (which is normally mildly kyphotic) may give way slightly and become wedge shaped. If this happens, the normal kyphosis is exaggerated.

**In the lumbar spine, the compressive forces are more evenly distributed and deformity does not occur.**
Thoracic Scheuermann’s disease:

*The usual form of Scheuermann’s disease appears in the mid-thoracic vertebrae
*The condition starts at or shortly after puberty and is more common in boys than in girls
*well-marked thoracic kyphosis (hyperkyphosis) which does not improve with changes in posture

**X-ray features are typical on the lateral views:**
1. patchiness or irregularity of the vertebral end-plates
2. in some cases, Schmorl’s nodes at several intervertebral levels.
3. Later, the vertebral bodies become noticeably wedge shaped.

**Patient may complain of back pain or fatigue**
Treatment:

depends on the severity of the clinical and x-ray changes.

- In some cases, the early features are so mild that they go unremarked, and it is only when, as an adult, the person is x-rayed for some unrelated reason that the features of an ‘old Scheuermann’s are recognized.

- If there is concern about back pain and/or deformity, an extension brace worn for a year or 18 months will often allow a return to normal vertebral growth.

- If this fails, or if the deformity is already marked when the patient is first seen, operative correction and fusion may be needed.
Thoracolumbar Scheuermann’s disease

- Thoracolumbar changes may appear together with thoracic kyphosis or may occur on their own.
- Compared to thoracic Scheuermann’s, this condition is:
  1. less common
  2. tends to occur in late adolescence or early adulthood
  3. does not give rise to local deformity
  4. usually presents as low back pain.

- X-ray changes are similar to those seen in the thoracic spine, but with little or no vertebral wedging.
- Patients with low back pain may respond to back strengthening exercises.
- Operative treatment is not indicated unless there are associated features of discogenic disease.
(c,d) In lumbar Scheuermann’s there is less wedging than in the thoracic region. End-plate fragmentation can be mistaken for a fracture of the vertebral body. Arrows show typical Schmorl’s nodes
scoliosis

- It is defined as Lateral curvature of the spine that is seen from the back

- The deformity may be *postural and correctable*, or *structural and fixed*. 
Types of scoliosis:

1. Infantile scoliosis
2. Idiopathic structural scoliosis
3. Secondary structural scoliosis
4. Compensatory scoliosis
5. Sciatic scoliosis
idiopathic structural scoliosis

- It is the commonest and the most important type
- It usually presents before puberty (10-12 years) and progresses until skeletal growth ceases
- The exact cause is unknown
- It is more common in girls than boys
- The curvature may occur anywhere in the thoracic or lumbar spine
- It sometimes leads to severe and ugly deformities especially if the thoracic region is the part affected

Pathology:
- The lateral curvature is constantly accompanied by a rotation of the vertebrae on vertebral axis (body rotates toward the convexity and the spinous process away from convexity)
- In thoracic curves the ribs on the convex side are also carried around posteriorly and stand out as a prominent Hump
Clinical features:

- Deformity is the only symptom in the children, pain is occasionally a feature of adult with long standing deformity, particularly in the lumbar region.
- The severity depends largely on which part of the spine is involved (high curves are noticed early, whereas lumbar curves may pass virtually unnoticed).
- Whatever the deformity when the patient stands upright, it always looks worse on flexion; this is in sharp contrast to a postural curve, which disappears on flexion.
- The shoulder is elevated on the side of the convexity and the hip sticks out on the side of the concavity.
- With thoracic scoliosis the breasts are asymmetrical and the rib angles protrude.
- The younger the child and the higher the curve, the worse the prognosis.
Treatment:

- A period of preliminary observation may be needed before deciding between conservative and operative treatment. **At 4-monthly intervals** the patient is examined, photographed and x-rayed so that the curves can be measured and checked for progression.

- *Exercises alone have no effect on the curve, but* they help to maintain suppleness and are a useful adjunct to operative treatment.
1. Conservative management: (braces)

*Bracing is used:*

1. For all progressive curves over 20 degrees but less than 40 degrees;
2. For well balanced double curves;
3. With younger children needing operation, to hold the curve stationary until they reach adolescence when fusion is more likely to succeed;
4. To prevent recurrence after spinal fusion.

**Two types: Milwaukee brace and Boston brace**
In the past, the **Milwaukee brace** was the one most commonly used. With an occipitocervical support proximally and a firm pelvic band distally, the spine is distracted; a mobile curve can thus be straightened to some extent. A lateral chest pad can also be used to apply pressure at the apex of the curve. The brace must be worn continuously, with a break of only 1 hour in 24
**Boston brace:**

**shorter, less repugnant *has become more* popular in recent years.

**This has the form of a thoracolumbar jacket, which is ideal for curves below T9.**
2. Operative treatment

Operative correction is indicated for curves that progress to more than 40 degrees. The principle is to expose the entire length of the curve and, by applying a distraction rod to the concave side of the curve (anchored to the laminae of the proximal and distal vertebrae of the curve), to ‘jack’ the curved segment out as straight as possible without damaging the spine or injuring the cord. The entire length of the curve is then prepared for bone-grafting in the hope that it will fuse while the back is ‘immobilized’ in a plaster jacket.
(a) X-ray of the same patient a year later, showing the Harrington distraction rod still in place.
(b) Similar correction can be obtained by the anterior approach and compression on the convex side of the curve.
Secondary structural scoliosis

- **Osteopathic scoliosis** is due to congenital vertebral anomalies. Although rare, curves may be severe and dangerously progressive.

- **Neuropathic scoliosis** is due to asymmetrical muscle weakness (e.g. in poliomyelitis or cerebral palsy).

- **Myopathic scoliosis** is sometimes seen in the rare muscular dystrophies.

- **Neurofibromatosis** may be associated with a short, and often severe, deformity; why this occurs is not known.
Postural scoliosis:

1. compensatory scoliosis:
   - Lumbar scoliosis is seen as compensatory mechanism when the pelvis is tilted laterally, as for instance when the lower limbs are unequal in length or when there is a fixed abduction or adduction deformity.

   - There is no intrinsic abnormality in the spine and the scoliosis disappears when the pelvic tilt is corrected.
2. sciatic scoliosis:

- Temporary deformity produced by the protective action of the muscles in certain painful conditions of the spine

- Most common cause is lumbar disc prolapse

- It is associated with sciatica that is aggravated by movement

- The curvature isn’t associated with rotation of the vertebrae
- When patient bends forward, the deformity disappears
- Short-leg scoliosis disappears when the patient sits
- Sciatic scoliosis disappears when the prolapsed disc settles down or is removed.
SPONDYLOLISTHESIS

- **Definition:**
  Spontaneous displacement of lumbar vertebral body upon the segment below it

- Normal laminae and facets constitute a locking mechanism which prevents each vertebra from moving forwards on the one below.
  (Forward shift (or slip) occurs only when this mechanism fails).

- The attachment of IVD isn’t strong enough to hold the vertebral bodies in alignment.

- IVD at the site of slipping is damaged and disc prolapse is occur.

- Listhesis is nearly always between L4 and L5, or between L5 and the sacrum.
Causes:

■ Dysplasia of the lumbosacral facet joints (20%).

■ Separation or stress fracture (lysis) through the neural arch, allowing the anterior part of the vertebra to slip forward (50%).

■ Osteoarthritic degeneration of the facet joints, causing them to lose their normal stability. This usually occurs at L4/5 (25%).

■ Destructive conditions such as fracture, tuberculosis and neoplasia (5%).
Clinical features:

**Dysplastic spondylolisthesis**

is seen in children. It is usually painless, but the mother may notice the unduly protruding abdomen. There may be an associated scoliosis.

**Lytic spondylolisthesis**

is the commonest variety. It occurs in adults, and intermittent back pain is the usual presenting symptom. Pain may be initiated or exacerbated by exercise or strain.

**On examination,** the buttocks look curiously flat, the sacrum appears to extend to the waist and transverse loin creases may be prominent. A ‘step’ can often be felt when the fingers are run down the spine.

**Movements are usually normal in younger patients but may be restricted in older people**
Degenerative spondylolisthesis:

usually occurs in women over 40 years with long-standing backache due to facet joint arthritis.

-Sometimes the presenting symptom is spinal ‘claudication’ due to narrowing of the spinal canal

Imaging:

**X-rays show the forward shift of the upper part of the spinal column on the stable vertebra below**

**elongation of the arch or defective facets may be seen.**

**The gap in the pars interarticularis (it lies between the lamina and pedicle) is more easily seen in oblique x-ray views,**

**The best of all in CT scans.**

![Normal Anatomy Diagram]

- Pars interarticularis
  - Part of vertebra between inferior and superior articular process of the facet joint
Treatment:

Conservative treatment:

(1) if the patient is no longer young and symptoms aren’t disabling
(2) if there is doubt as to whether the symptoms arise from the slip or from an associated disc prolapse.

It consists of bed-rest during an acute attack and a supporting corset between attacks.

Operative treatment:

(1) at any age if the symptoms are disabling
(2) in the young adult with even moderate symptoms
(3) if neurological compression is marked.

Spinal fusion is carried out to fix the unstable segment.
Thank you