Scoliosis

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Structural scoliosis

1-Idiopathic

- **–Infantile (0-3 years)**
- **–Juvenile (4-9 years)**
- **–Adolescent (10+ years)**
- **–Adult**

2- Congenital

- **–Failure of formation**
- **–Failure of segmentation**
- **–Mixed**

3-Neuromuscular

- Myopathic
  - AMC
  - M dystrophy
- Neuropathic
  - UMNL
  - LMNL
  - Dysautonomia (Riley-Day Synd.)

4-Others

- Neurofibromatosis
- Mesenchymal (Marfan's, Ehlers-Danlos)
- Traumatic
- Tumors
- Skeletal dysplasia

Structural scoliosis

Idiopathic Scoliosis

= 80% of scoliosis

= Familial

= 3 per 1000 of the population
has >20 degree curve.

= **One in 20 children have some degree of deformity of their spine**

Types of Idiopathic Scoliosis

1- Infantile

= 0-3 years age (early onset)

= 60% Male, 90% left sided thoracic curves common

= Plagiocephaly

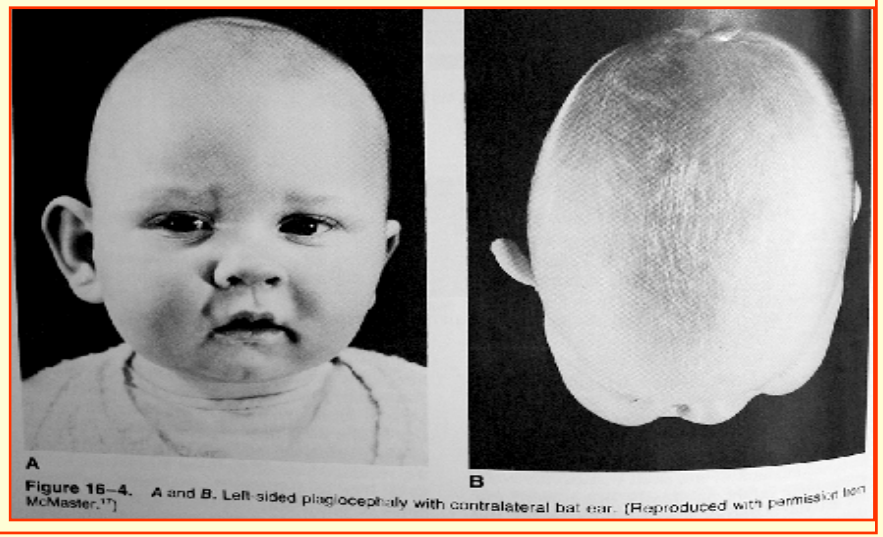
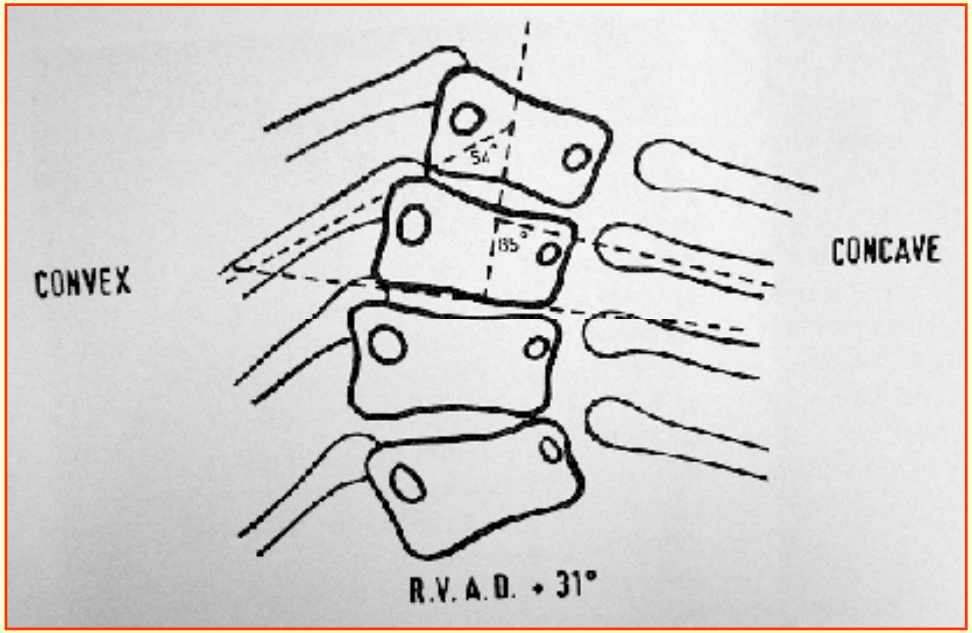


Figure 16–4. A and B. Left-sided plagiocephaly with contralateral bat ear. (Reproduced with permission from McMaster.[17])

= risk for cardio-pulmonary compromise → 10-20%

= 80-90% resolve, non-progressive.

= If rib-vertebra angle > 25 degree (Mehta)→ Progressive → Milwakee brace



2- Juvenile

- 4-9 years age
- Progressive
- !! need fusion before maturity.
- 26% cord pathology

3- Adolescent

* Commonest
* 10y - maturity (late onset)
* F > M 6:1
* Right thoracic 90%
* 50% require surgery

Progression related to

= **Female sex**
= **Younger age at diagnosis**
= **Significant rotation**
= **Single thoracic curve**
= **Large curve > 25 degree**
= **Risser 0-1**
= **Family history**
= **Growth spurt**

Other Adolescent Types

A- Thoracolumbar curves

> in females , > to the right

B- Lumbar Curves

> in females

80% to the left

no rib hump→ presented late

C- Double major curves

bad x-ray but well balanced curves

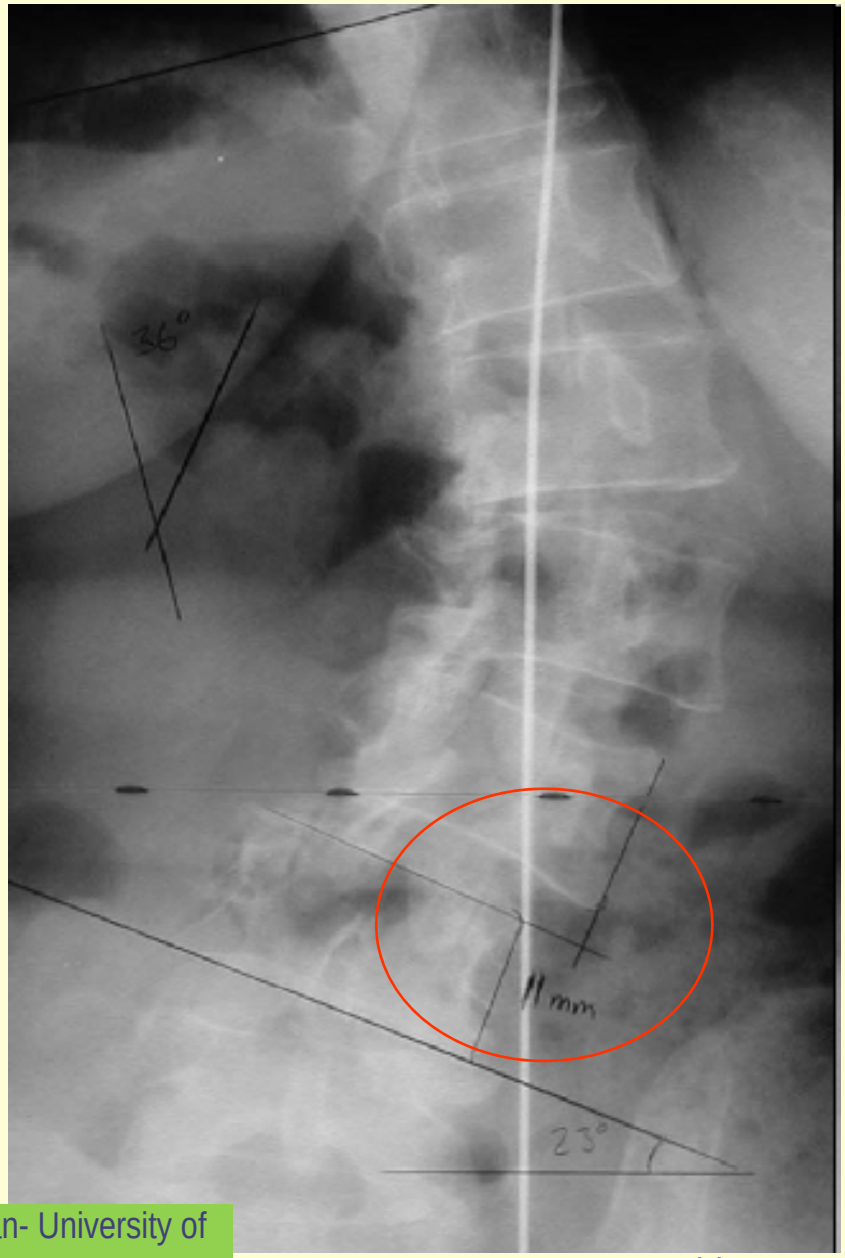
4- Adult Scoliosis

- **Prevalence:**

6-35% persons >50 years old

2.5% patients >20 years old

- **Total # patients = 64**
  - **Sex: 17 male 47 female**
  - **Age mean 62yrs (range 25-87y)**
  - **Symptoms 73 %**
  - **Back pain 69 %**
  - **Leg pain 32 %**


36°
11 mm
23°

SCHOOL SCREENING FOR SCOLIOSIS

1- Forward bending test

2- Scoliometer

Screening problems

1- Over referral

2-Radiation

3-Lack of parents compliance

4-Cost

Patient Evaluation

History

= Birth, development, medical history

= Any symptoms or pain

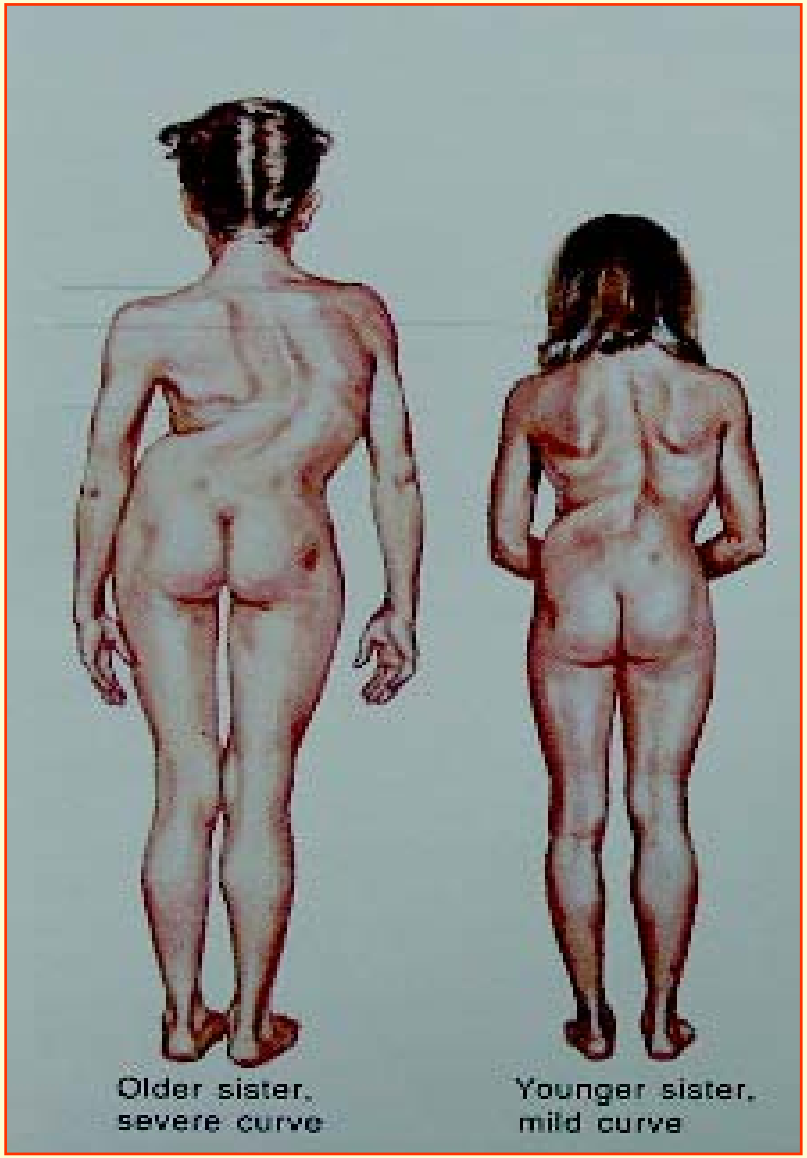
= Skeletal age.

= Female: Onset of menses

= Family history

Onset course, evolution of deformity


1/26/1999


Older sister,
severe curve
Younger sister,
mild curve

Physical Exam

Standing (back and front)

inspection

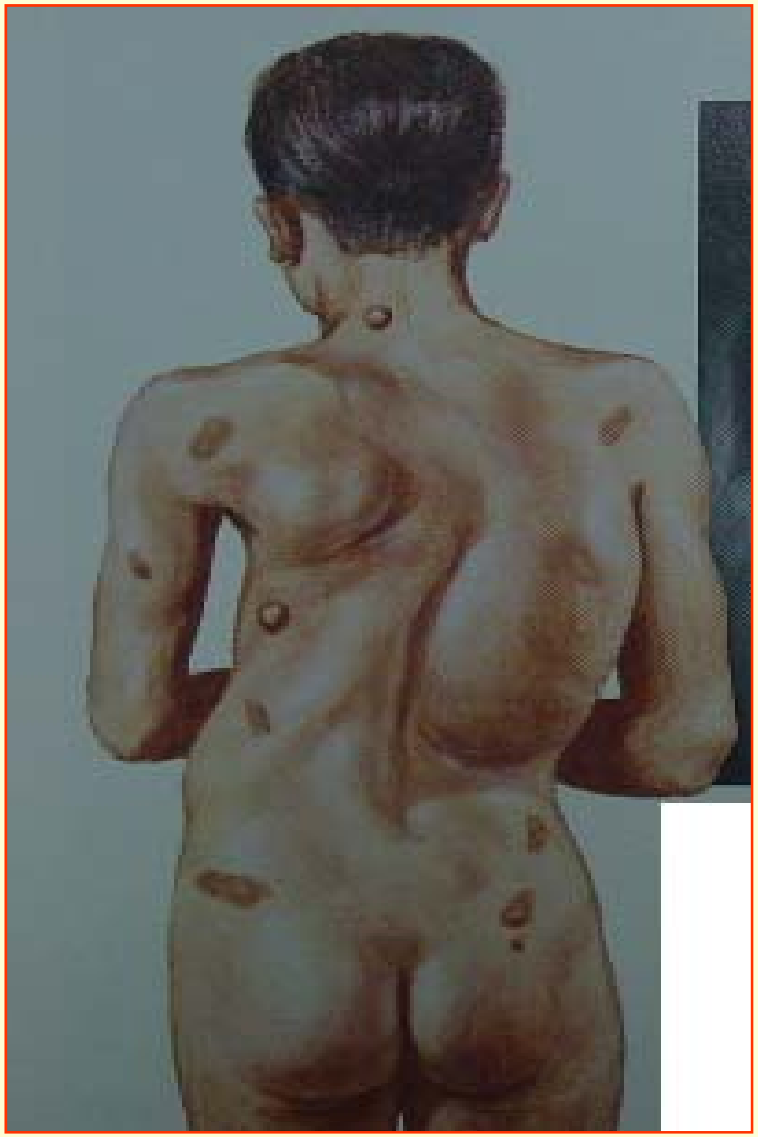
1-any curve (describe it)

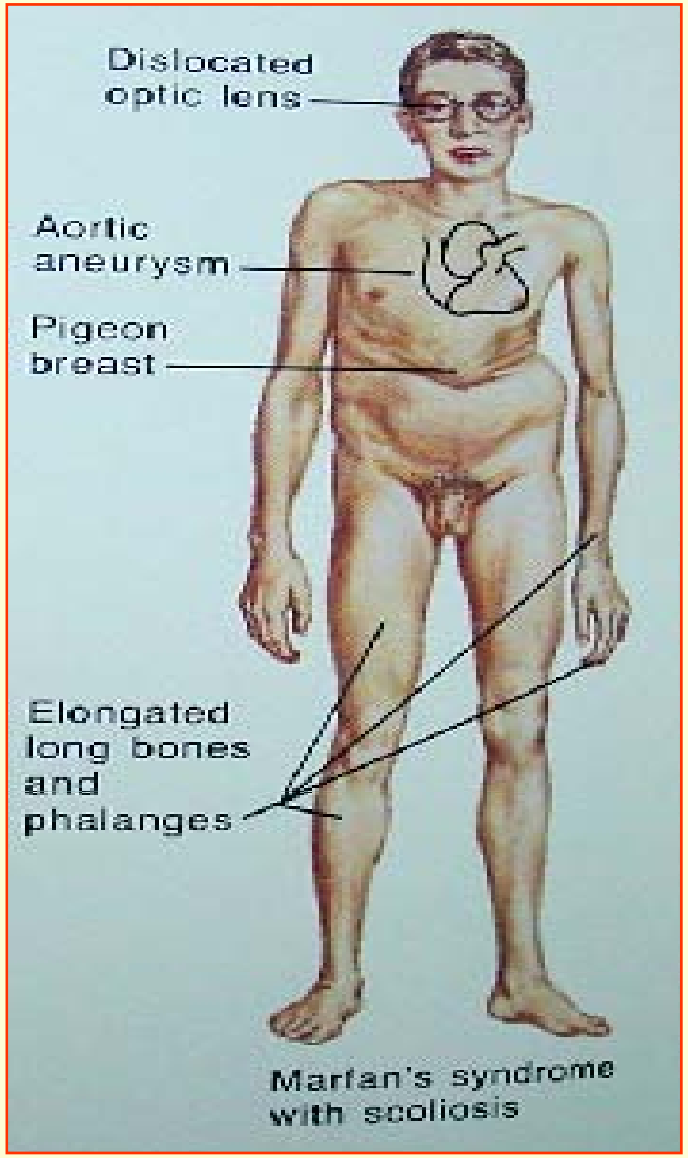
2-loins

3- Shoulder (one elevated shoulder)

4-Skin:

- **hairy patches**
- **café au lait spots**
- **Sacral dimples**
- **Spina bifida**




Dislocated optic lens
Aortic aneurysm
Pigeon breast
Elongated long bones and phalanges
Marfan's syndrome with scoliosis

5-Pelvis (rotation, one side elevated)

6-Maturity of breasts

7- Ant. chest aymmetry

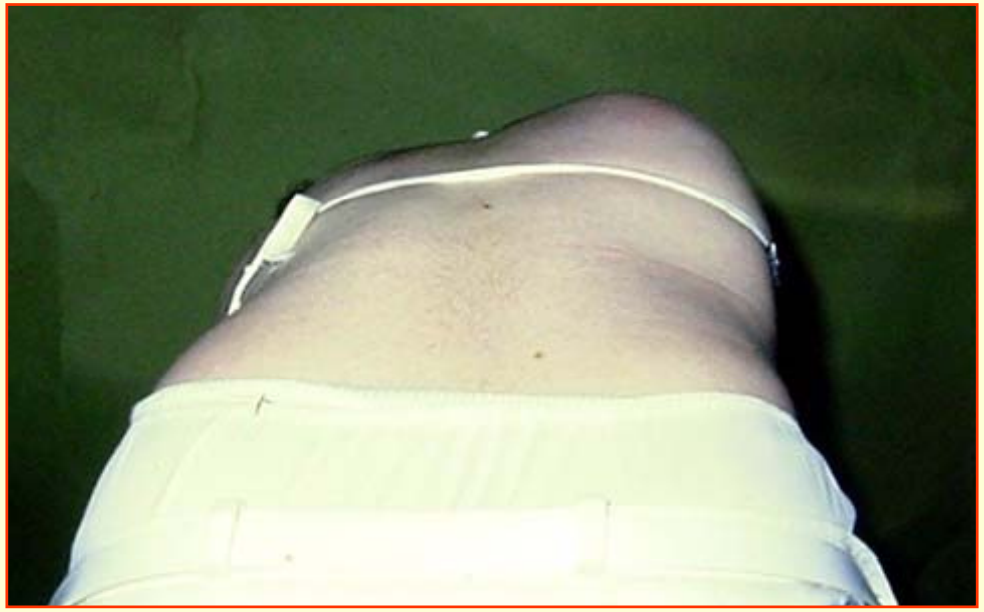
7- Axillary hair

8- Voice in male

Standing (lateral)

- **Kyphosis**
- **lordosis**

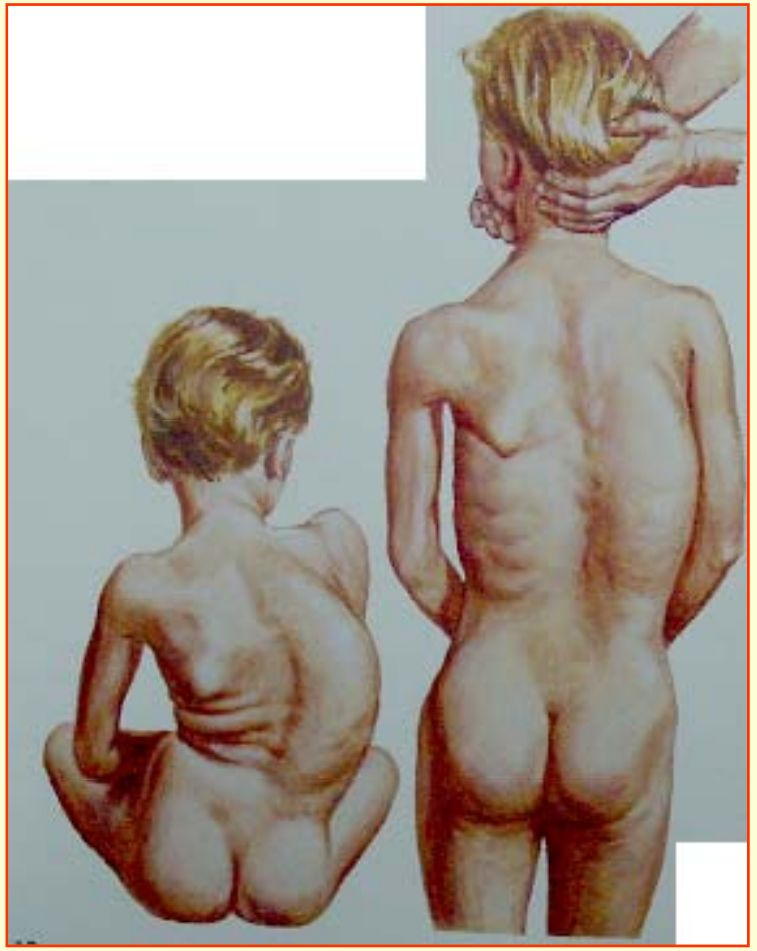
Forward bending test



Spinal mobility :

= Side bending

= Traction



Palpation

Spine

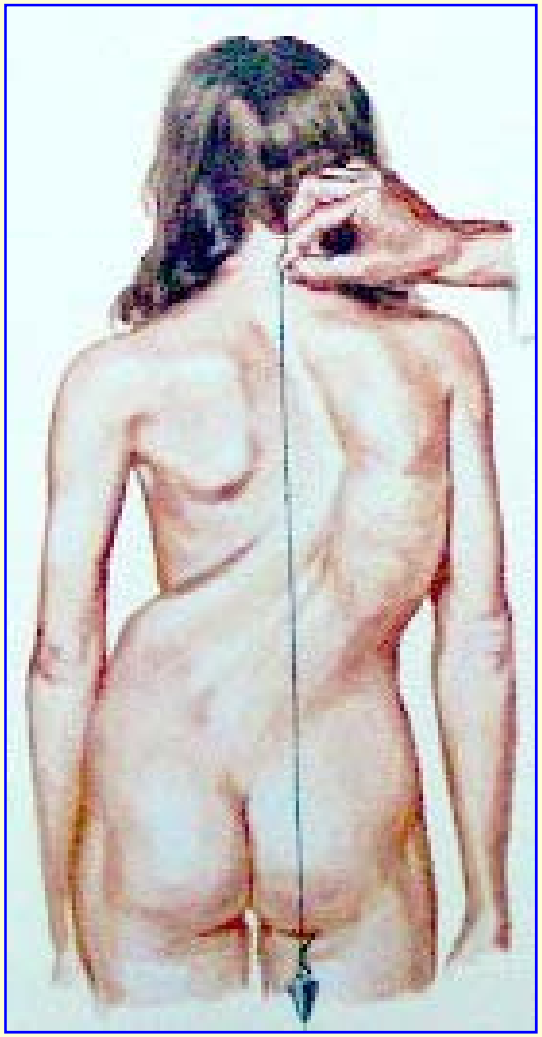
- Palpated defects
- Range of motion, Flexibility
- Rotation, Rib hump

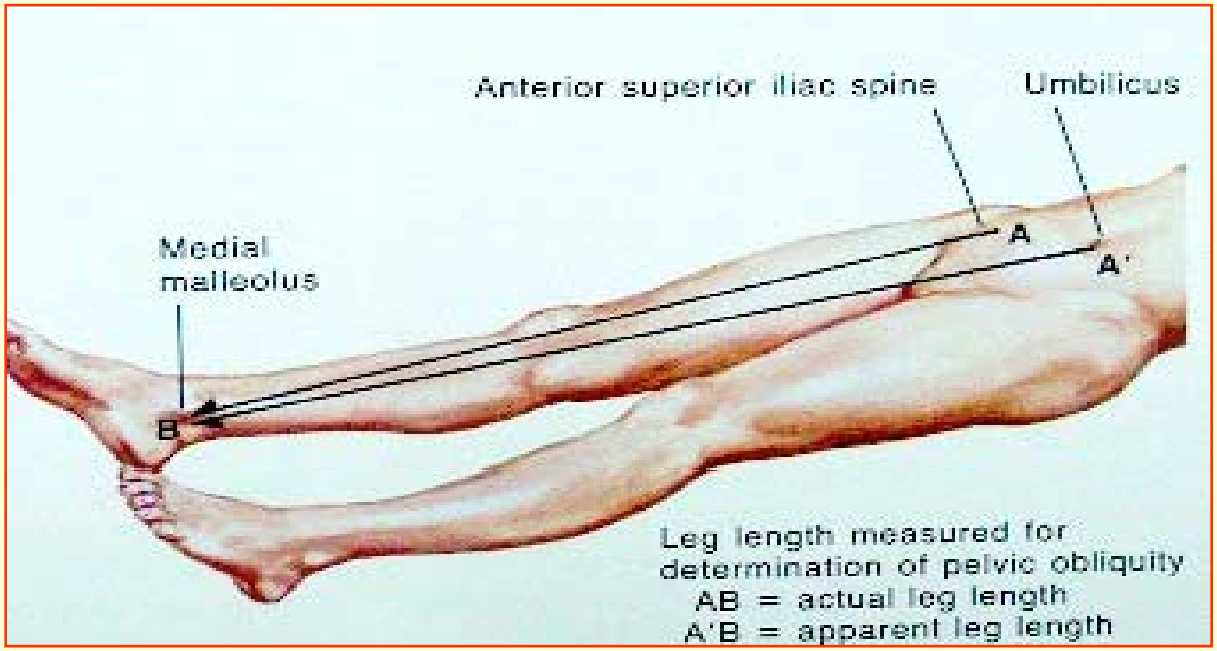
lower extremity

- Leg length, Deformity
- Pelvic obliquity

Neurologic

- Strength, Sensation, Reflexes, Clonus
- Abdominal reflexes




Anterior superior iliac spine
Umbilicus
Medial malleolus
A
A'
B
Leg length measured for determination of pelvic obliquity
AB = actual leg length
A'B = apparent leg length

Plumb line

Others

A- Ht, Wt

B- Relative proportions.

C- Mental, Psychology.

D-Signs of Syndromic or hereditary disorders

E- Cardio-pulmonary function

Special investigations

1- Renal ultrasounds

2-Cardiac assesment

3-Pulmonary function test

4-Clinical photograph

5-Muscle biopsy

6- NCS

Radiographic Studies

Plain Radiographs

* Indicated in all
* Full length standing PA and Lateral.

= Analyze

Deformity, Pathology ,Anomalies,
Defects, Bone lesions ,
Quantify scoliosis, kyphosis, lordosis.

Tanner staging to determine future growth

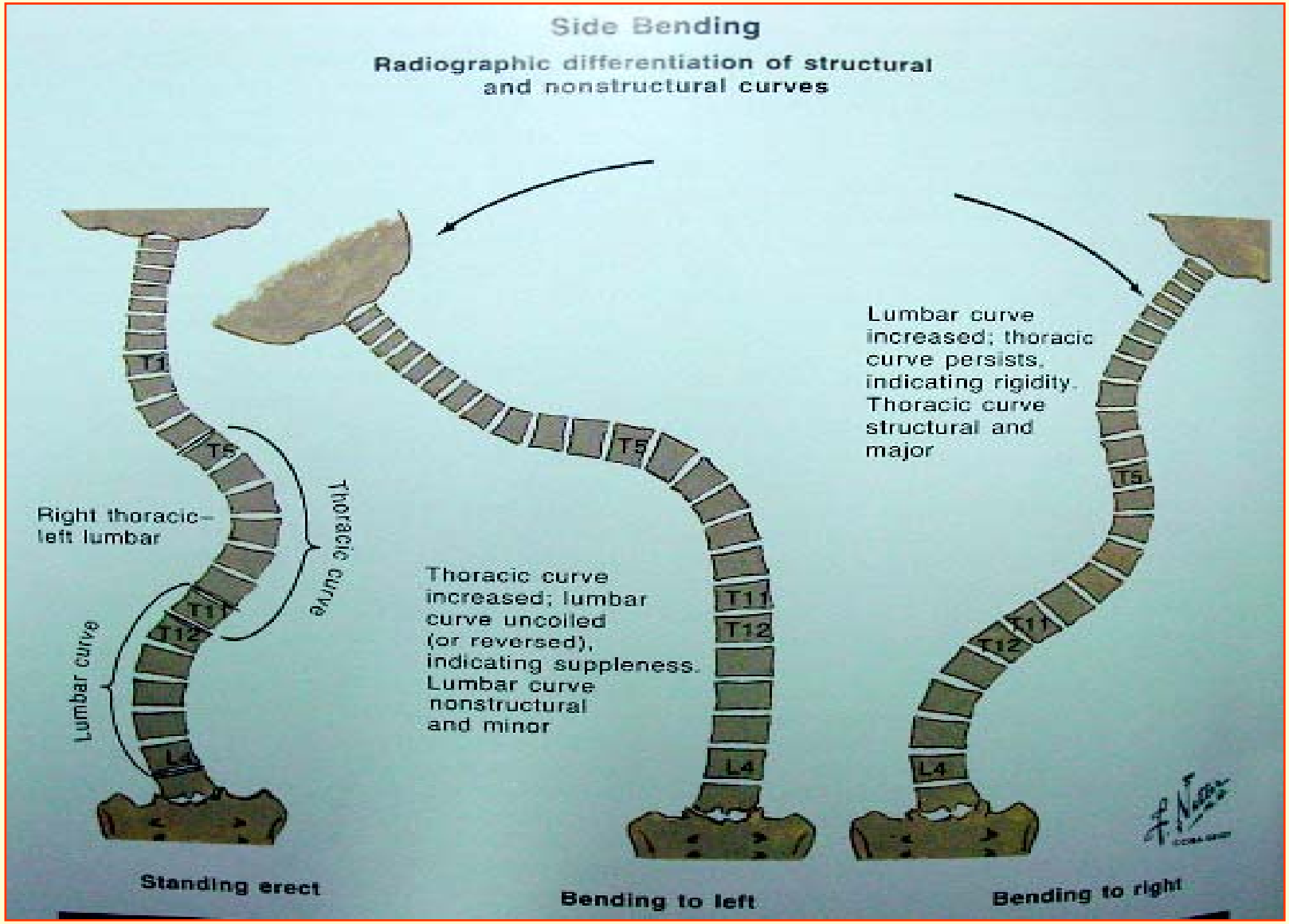
Plain Film Radiograph

- **Initial evaluation:**

  Standing PA and lateral films.

Plain Film Radiograph

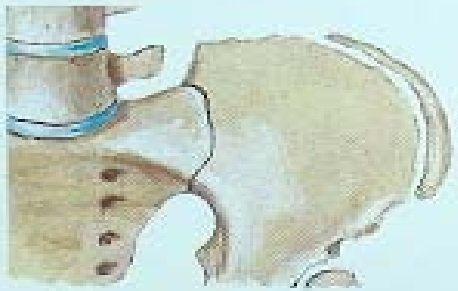
- **Flexibility of the curve is evaluated with supine side-bending films**
  (may only be needed preop.)
- **Standing PA studies are used for follow-up**


Side Bending
Radiographic differentiation of structural and nonstructural curves
T1
T5
T11
T12
L4
Right thoracic–left lumbar
Thoracic curve
Lumbar curve
Thoracic curve increased; lumbar curve uncoiled (or reversed), indicating suppleness. Lumbar curve nonstructural and minor
Lumbar curve increased; thoracic curve persists, indicating rigidity. Thoracic curve structural and major
Standing erect
Bending to left
Bending to right

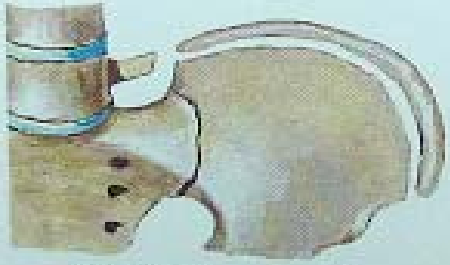
- **Lat. films beyond initial evaluation are not necessary unless Spondylolysis or Spondylolisthesis is suspected.**

- **Traction is used in patients with N.M disease with muscles Weakness /paralysis that prevents active side-bending.**

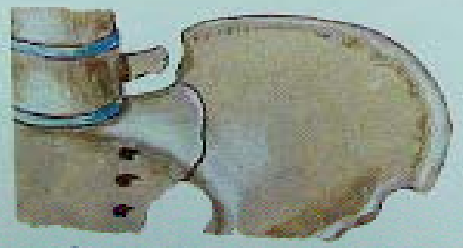
Determination of Skeletal Maturation



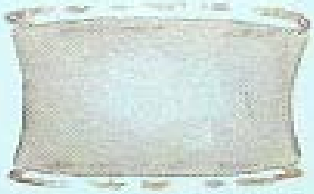
Iliac crest progresses posteromedially



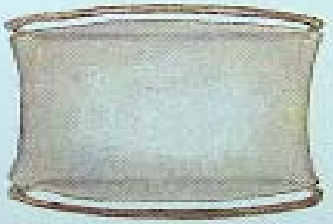
Excursion complete



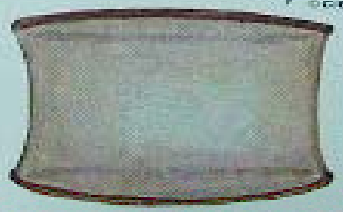
Crest fuses with ilium; maturation complete



Vertebral growth plate in formation



Growth plate complete but not united



Growth plate unites to vertebral body; maturation complete

Radiograph of left hand for comparison with Greulich and Pyle atlas
chronologic age = 14 years, 8 months
bone age = 13 years, 0 month
When epiphysis of distal radius unites, maturation complete

Approximating Skeletal Age – Risser's Sign

Ossification of the iliac apophysis – begins laterally (ASIS) and progresses postero-medially towards (PSIS) to eventually cap the entire iliac crest.

iliac crest ossification progressing posteromedially

excursion complete

"Risser 4"

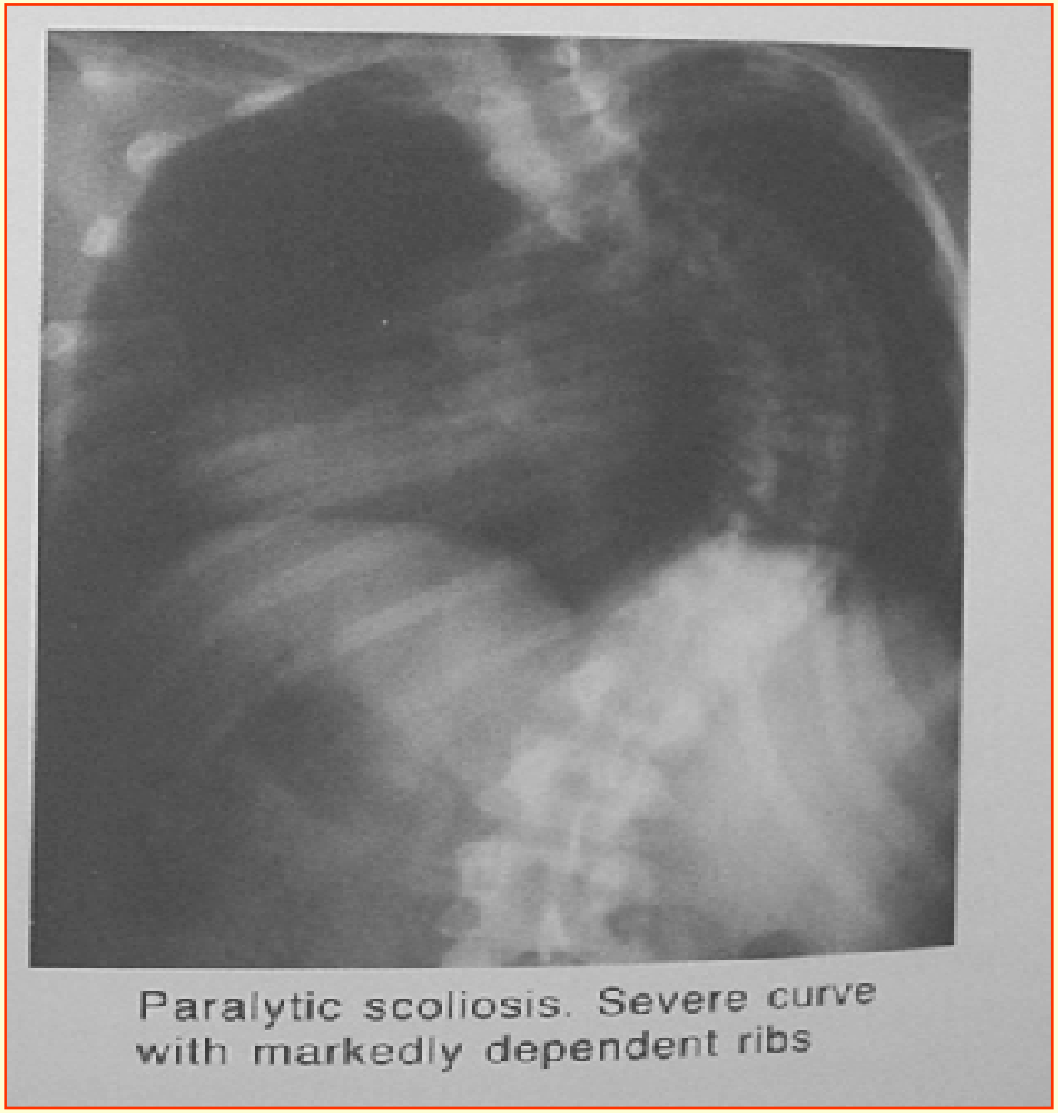
crest fused with ilium - maturation complete

"Risser 5"

Role of radiography in Scoliosis

- **Document severity**
- **Determine skeletal maturity**
- **Monitor progression**
- **Evaluate for non-Idiopathic causes of scoliosis (spinal, soft tissue, systemic pathology).**
- **Ensure adequacy of bracing / surgery**


K.H.

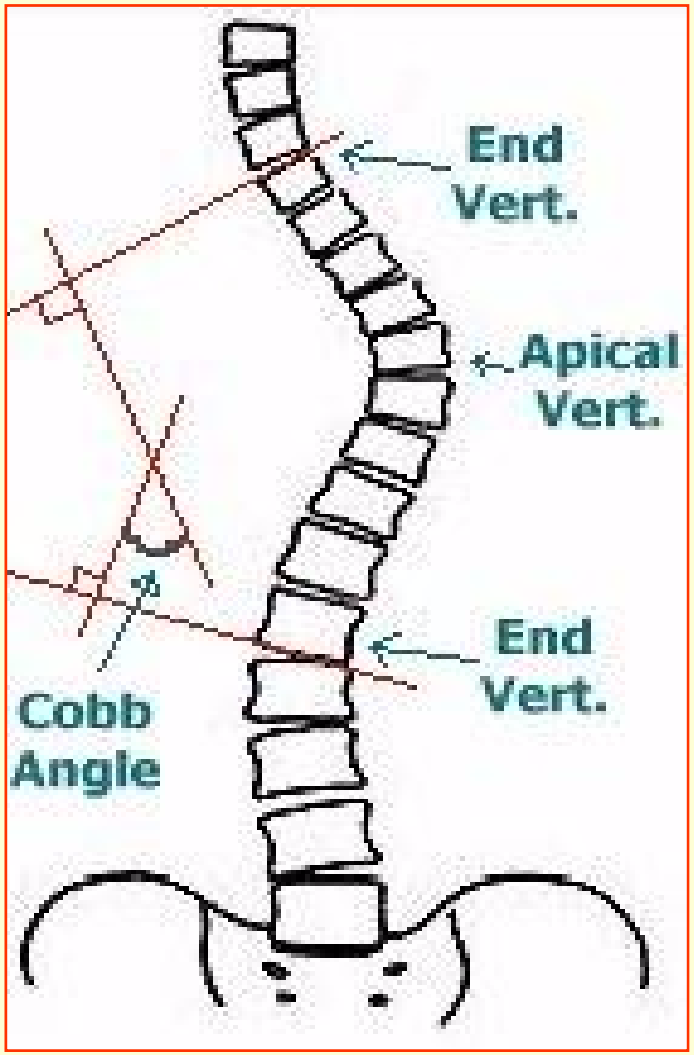


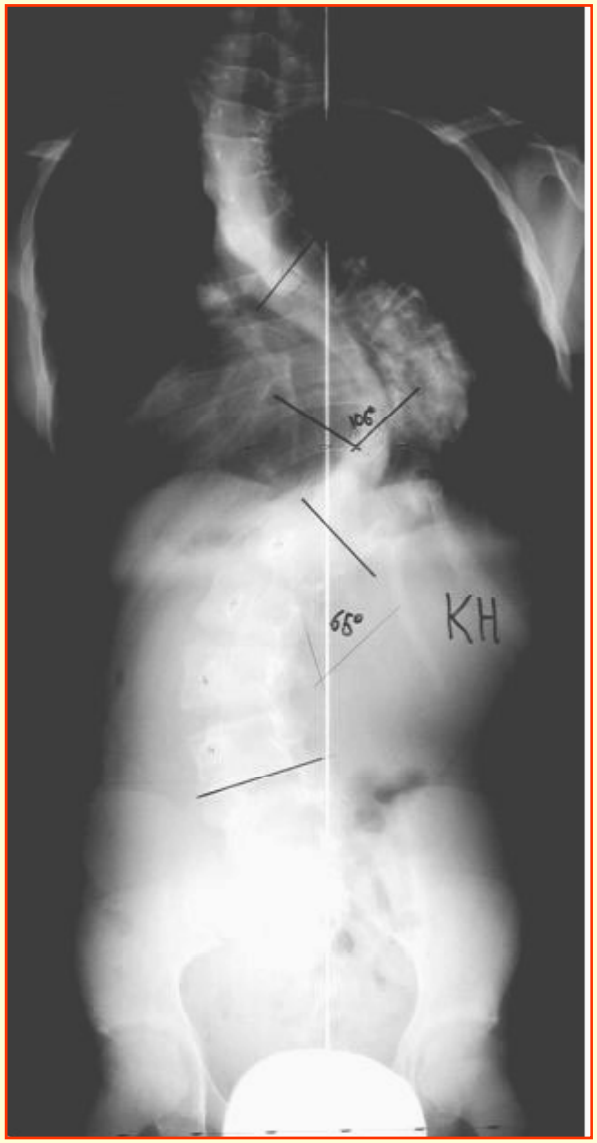
Paralytic scoliosis. Severe curve with markedly dependent ribs

Quantification of deformity

Cobb angle

End levels of curve
Greatest degree measureable
Follow up readings from same levels


End
Vert.
Apical
Vert.
End
Vert.
Cobb
Angle


KH

Cobb angle problems

1- Measure one plane deformity

2-Not accurate with large curves

Indications for MRI in Scoliosis

*Suspect local pathology

Tumor, Infection...

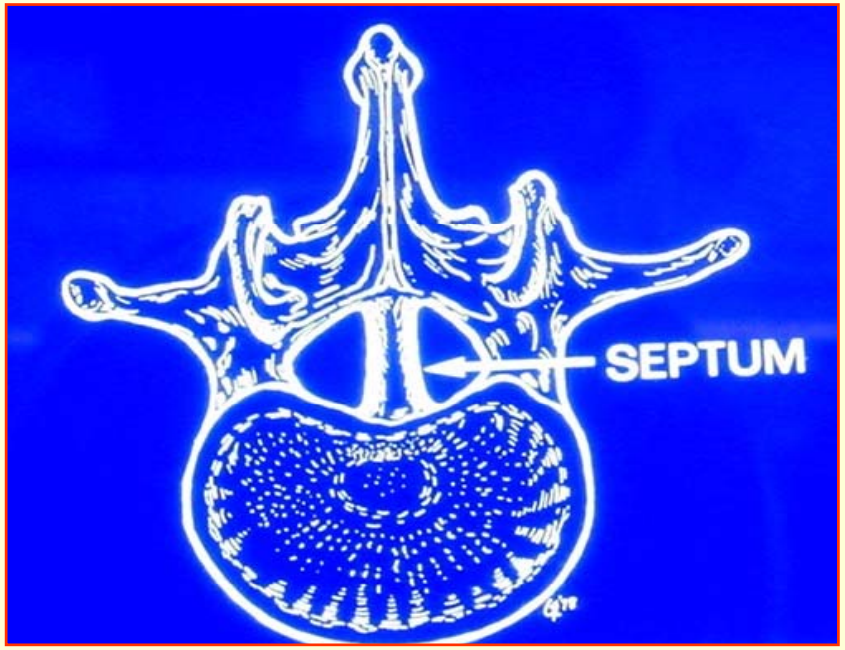
*Unusual curve patterns

Left thoracic
Sharp angulation
Unbalanced curves

*N.M type curves

R/O Chiari, Syrinx, Tethered cord,
Diastomatomyelia

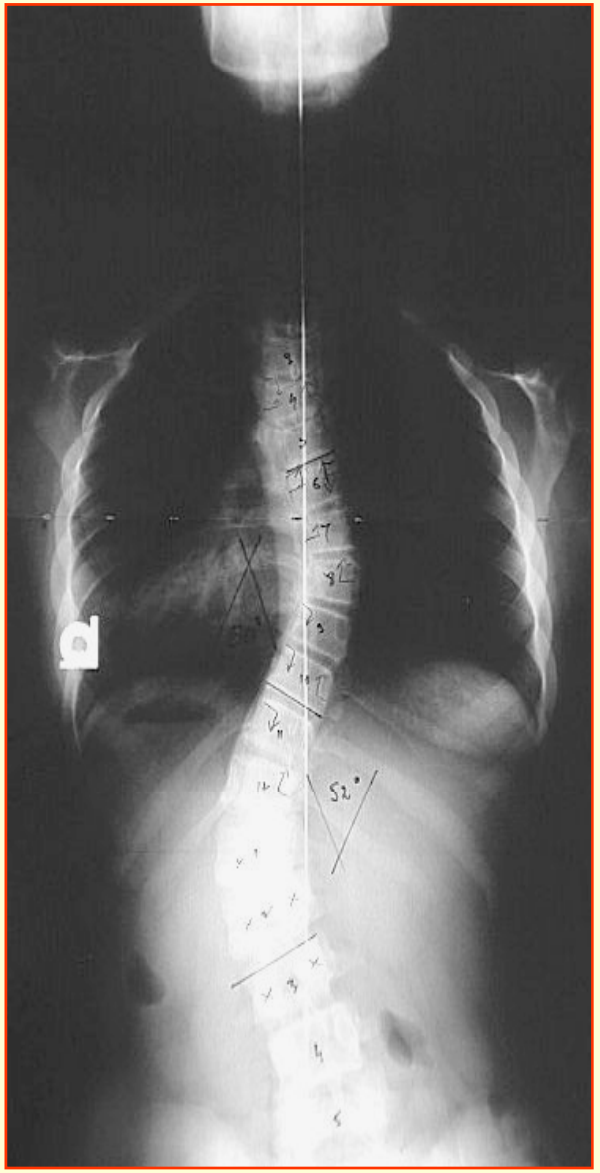

Se:1/1
Im:7/12
A
4
7


SEPTUM

Idiopathic Scoliosis

Treatment approach:

Proper curve and patient assesment



Infantile:

= **Many resolve spontaneously**

= **Observe, if progressive (10-20%)**

Brace . !!!???? early surgery

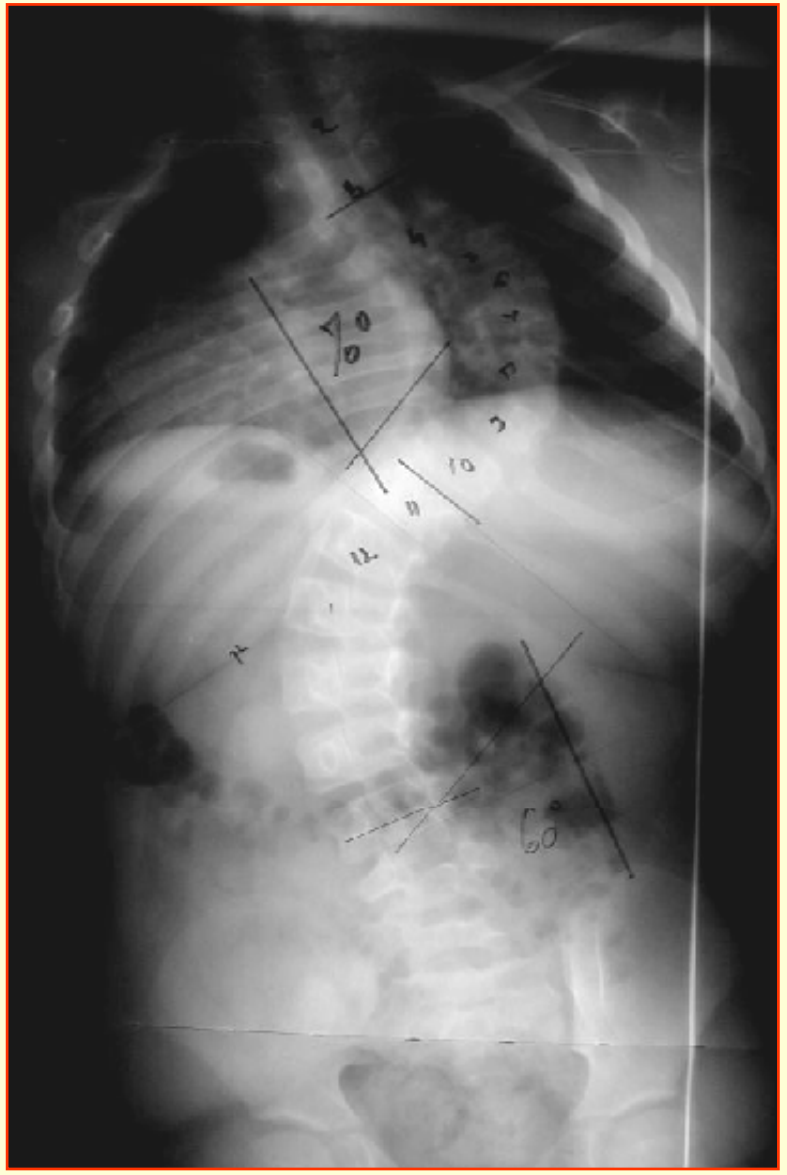
Juvenile:

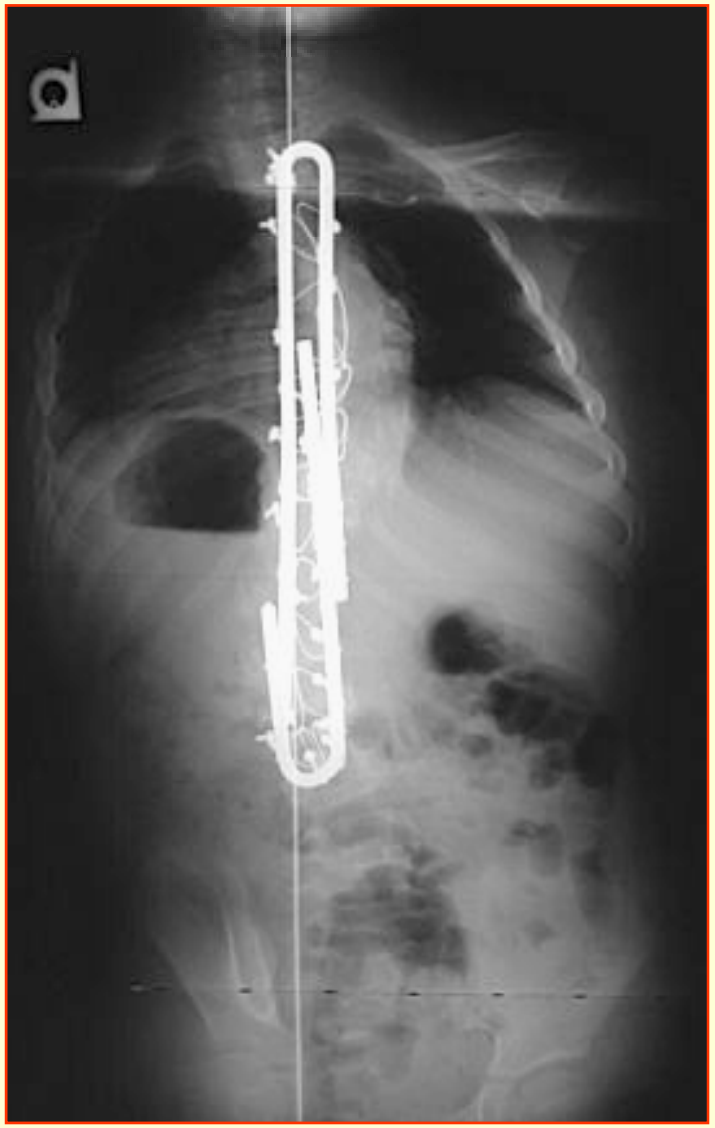
= **Mostly observe**

= **Brace if progressive or surgery**

- **Onset: 4-9 y**
- **Progresses rapidly.**
- **Always look for underlying disease**

- **Apex anterior convex epiphysiodesis**
- **Early instrumentation without fusion.**





Adolescent Idiopathic Scoliosis

Observation

Curves < 20 degrees, skeletally immature. Patient near maturity, curves < 40 degrees.

Bracing

- Immature patient > 25 degrees
- Patient with progression > 10 degrees

Surgery

- Curve ~ 45-50 degrees
- Much growth remaining, progressive, failed brace

Bracing

for bracing to be effective

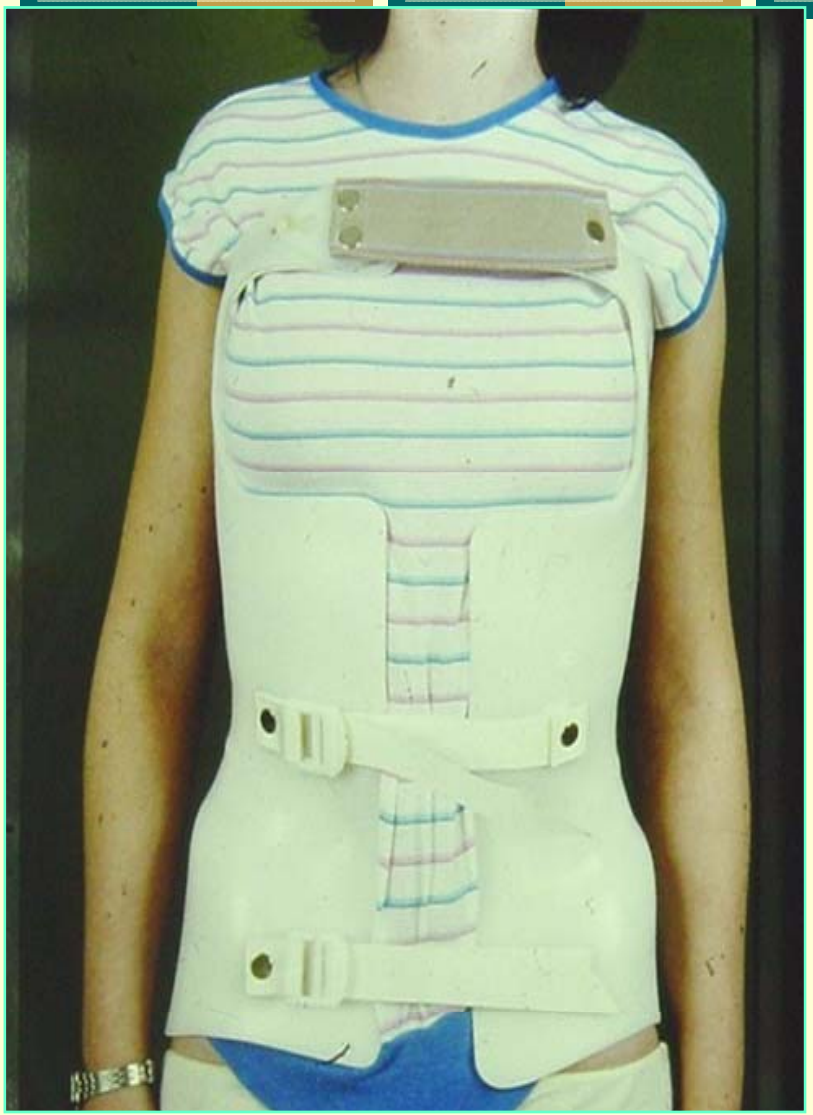
- **Remaining growth**
- **Curve < 40 degrees**
- **Proper brace, and compliance**

bracing can at best slow or stop progression,

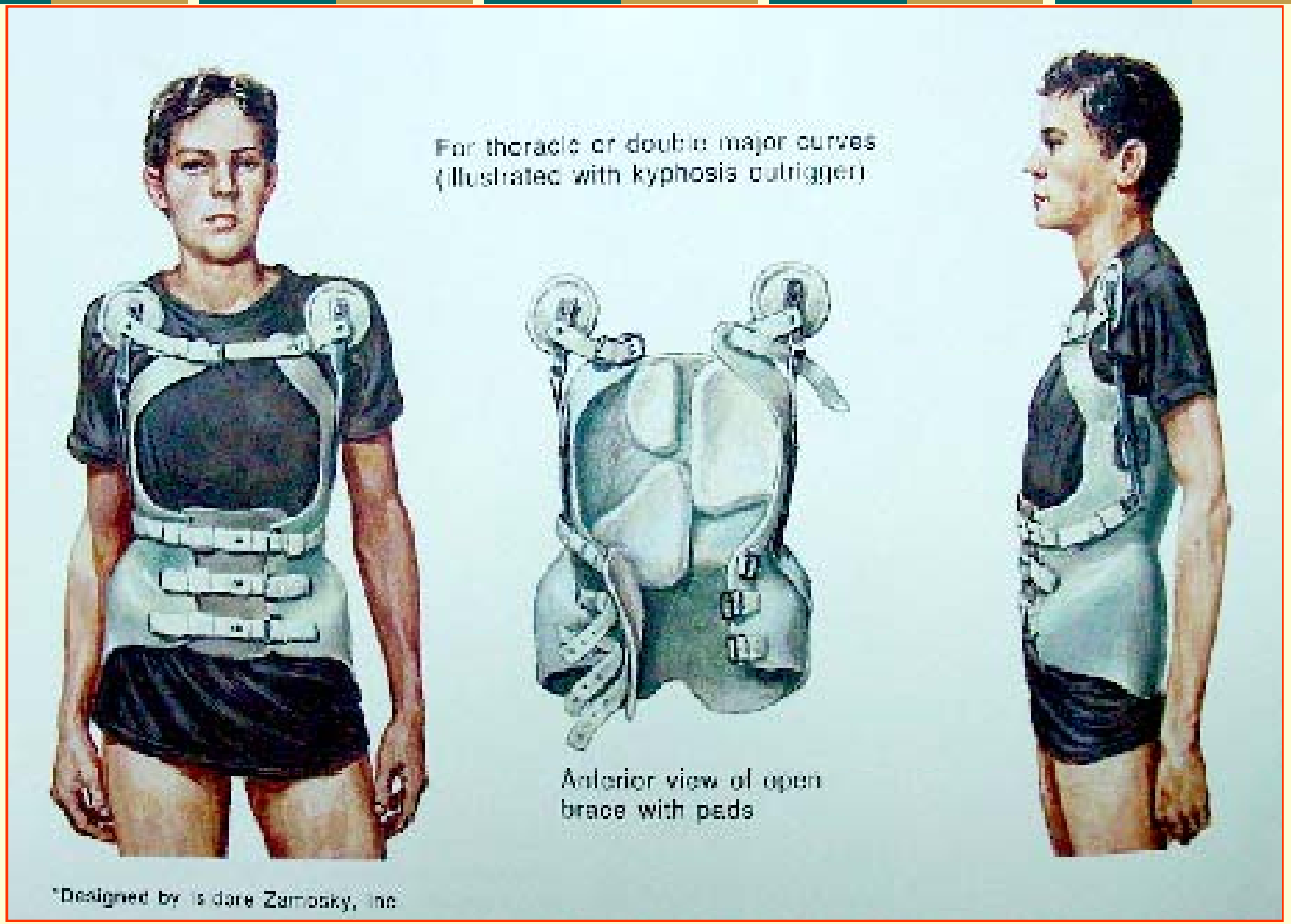
it does not correct a deformity

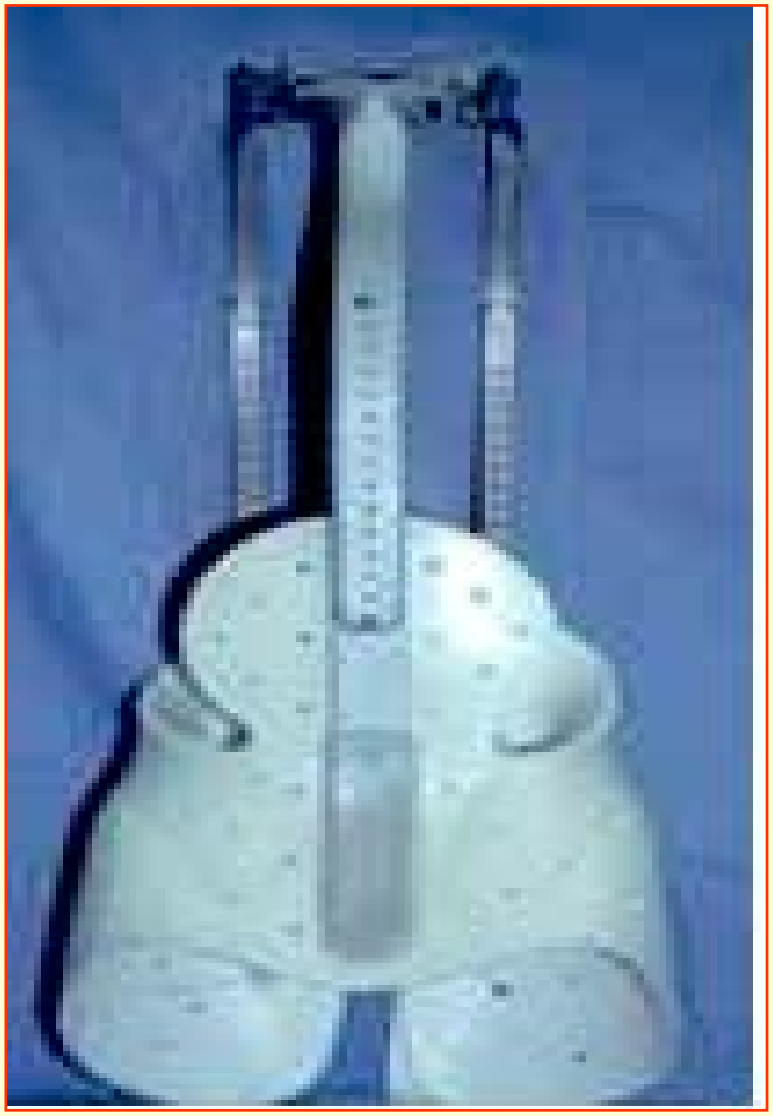
Summit brace

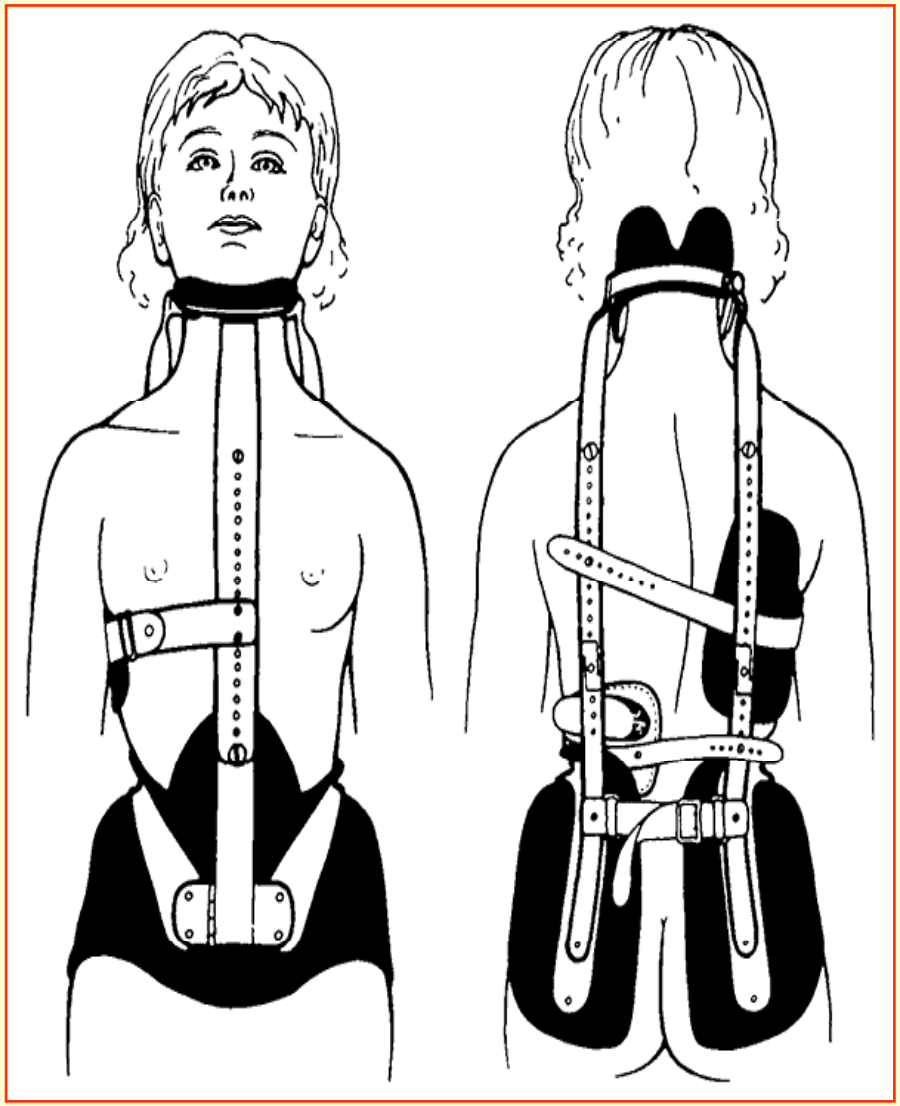
Custom TLSO

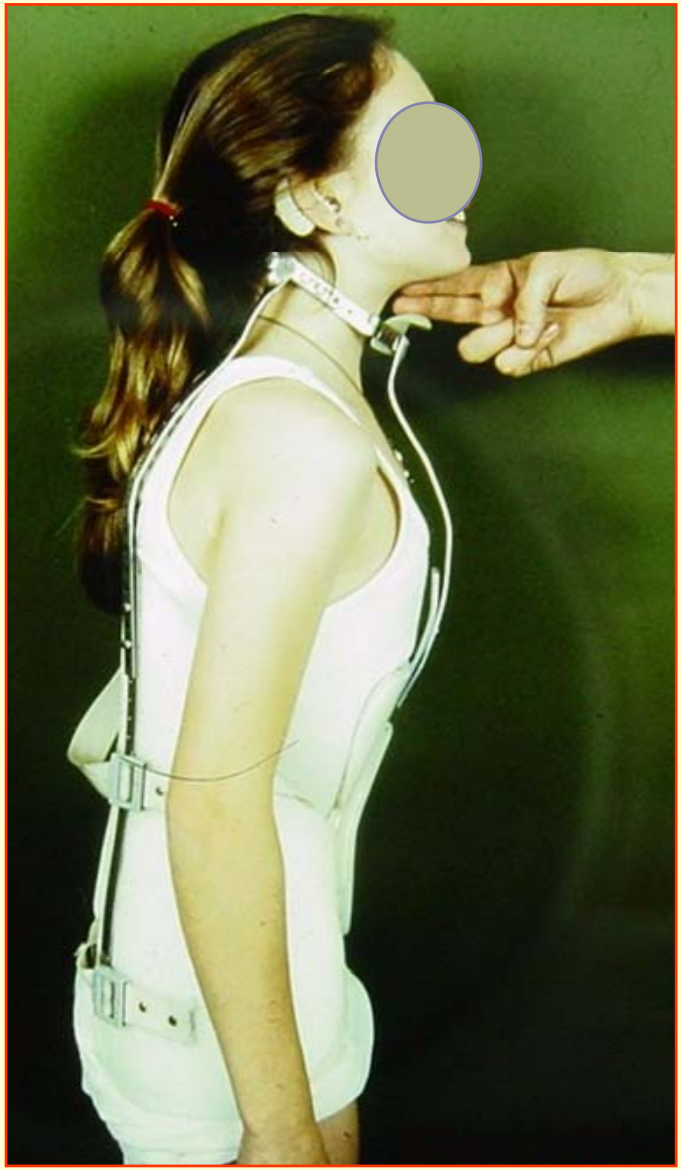



Low-Profile Brace
New York Orthopaedic Hospital
For thoracolumbar
or lumbar curves


For thoracic or double major curves
(illustrated with kyphosis outrigger)
Anterior view of open
brace with pads
*Designed by Isidore Zamosky, Inc





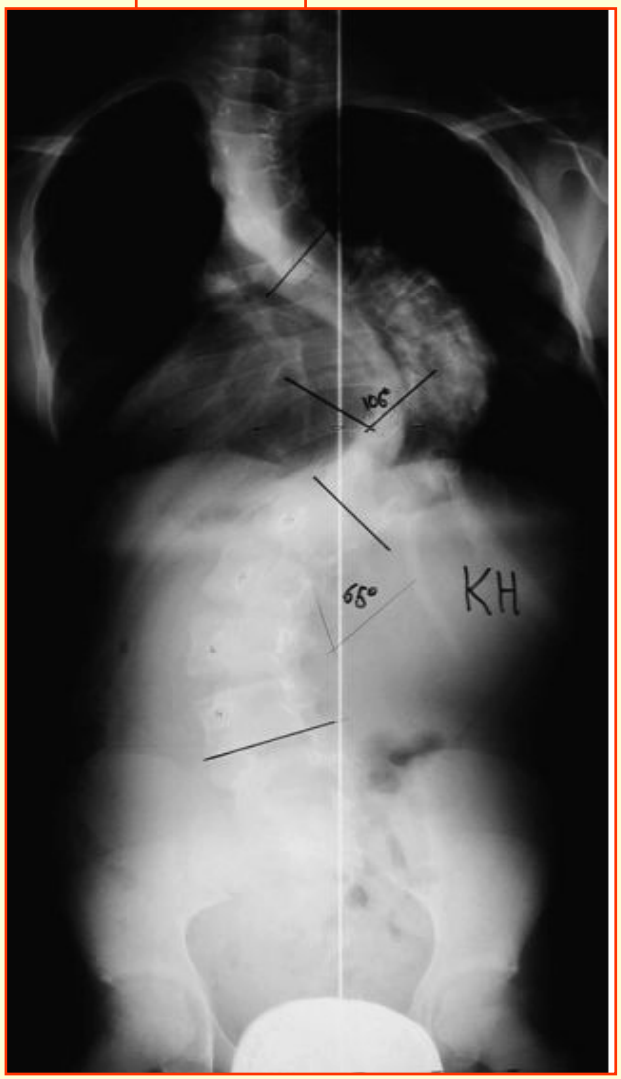


Surgical Treatment

When ?

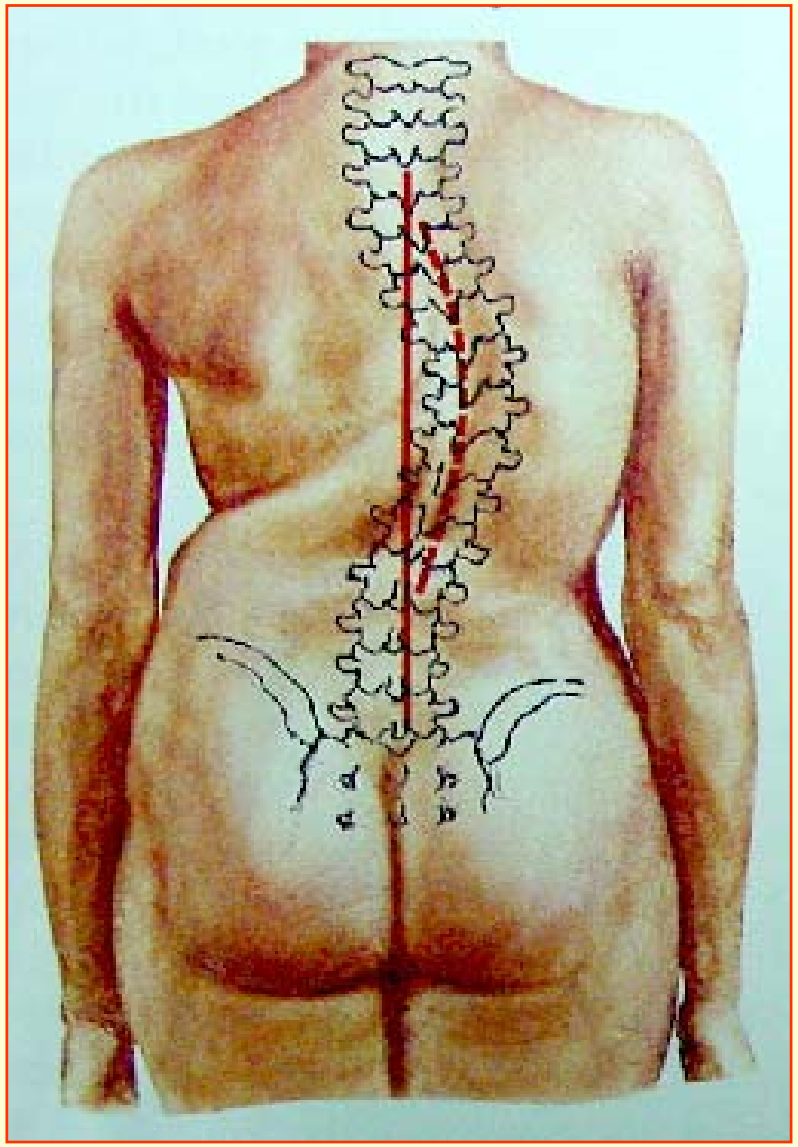
Failed bracing
Severe curvature
Expected progression
Beyond acceptable degree of deformity

50^0

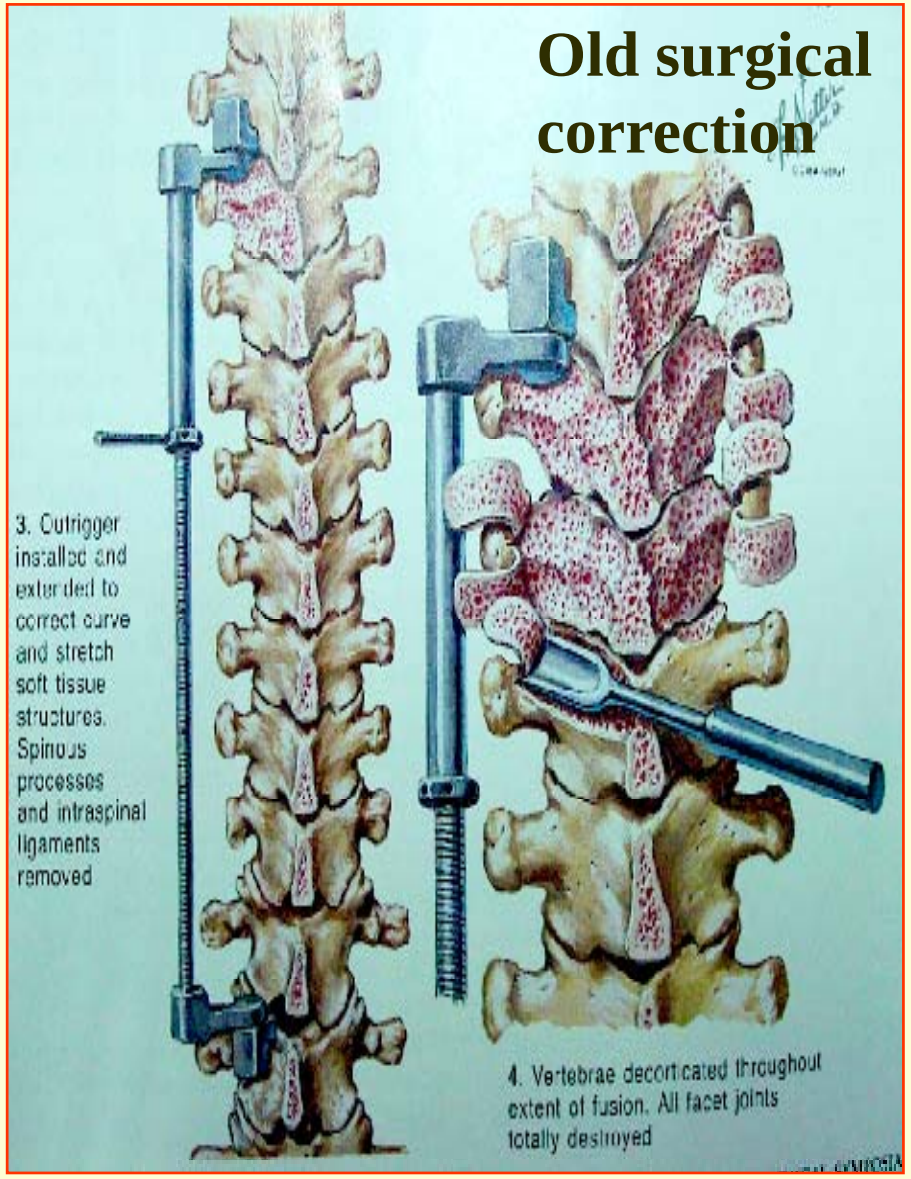


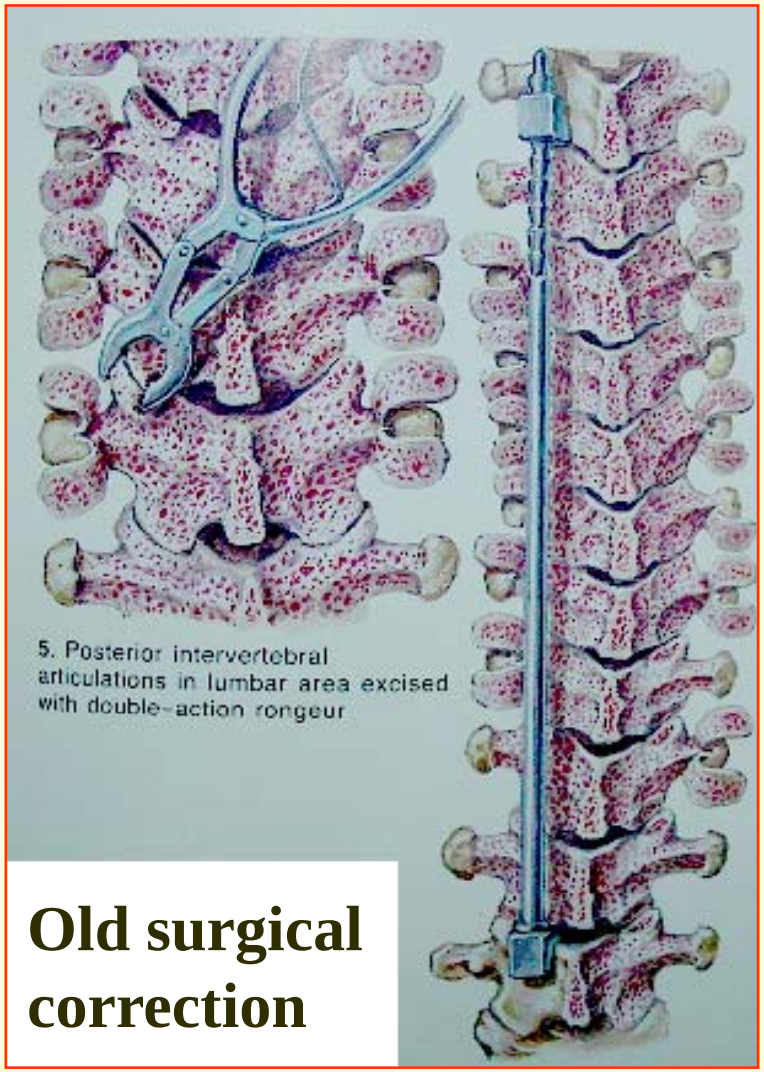
Goals of surgery

= Arrest progression
= Achieve balance of the spine
= Obtain safe degree of correction
= Ensure a fused spine

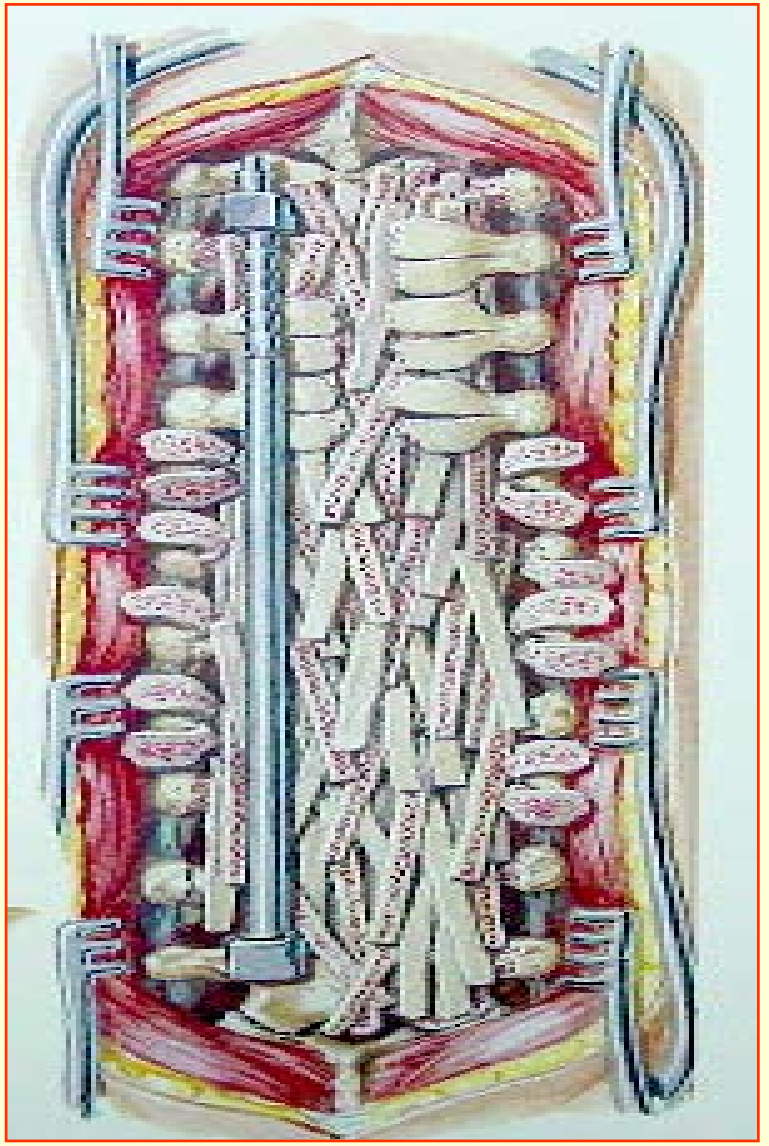


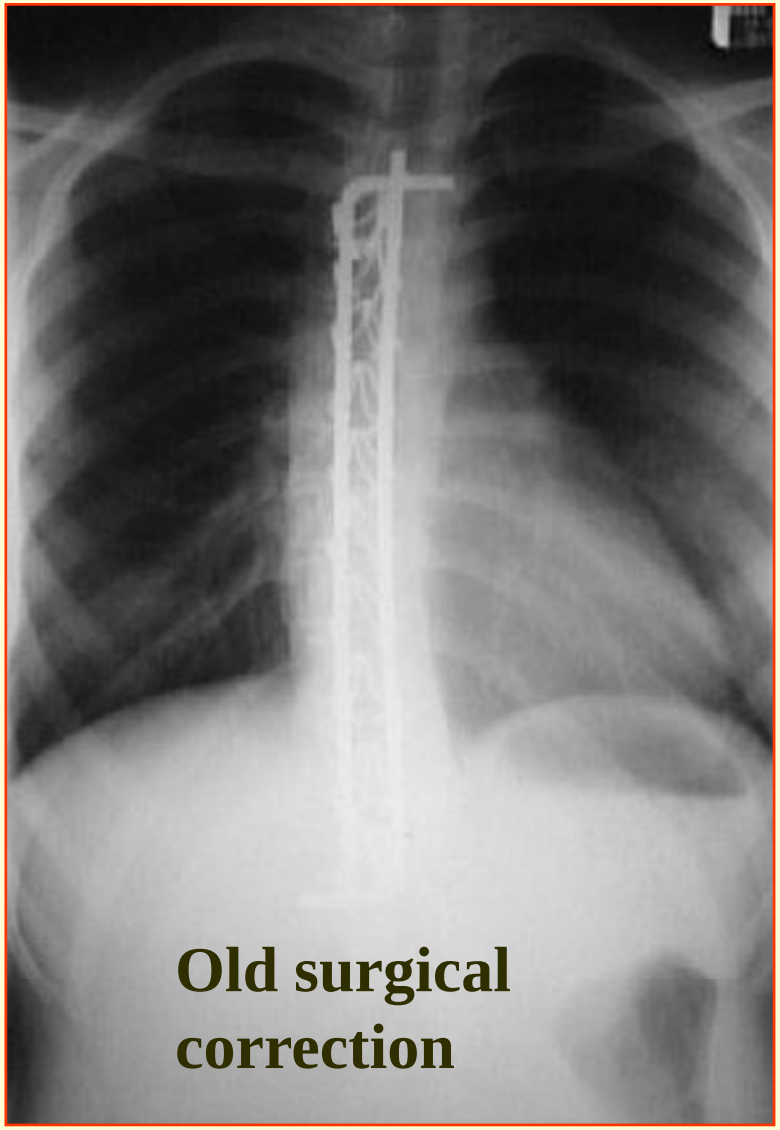
Old surgical correction

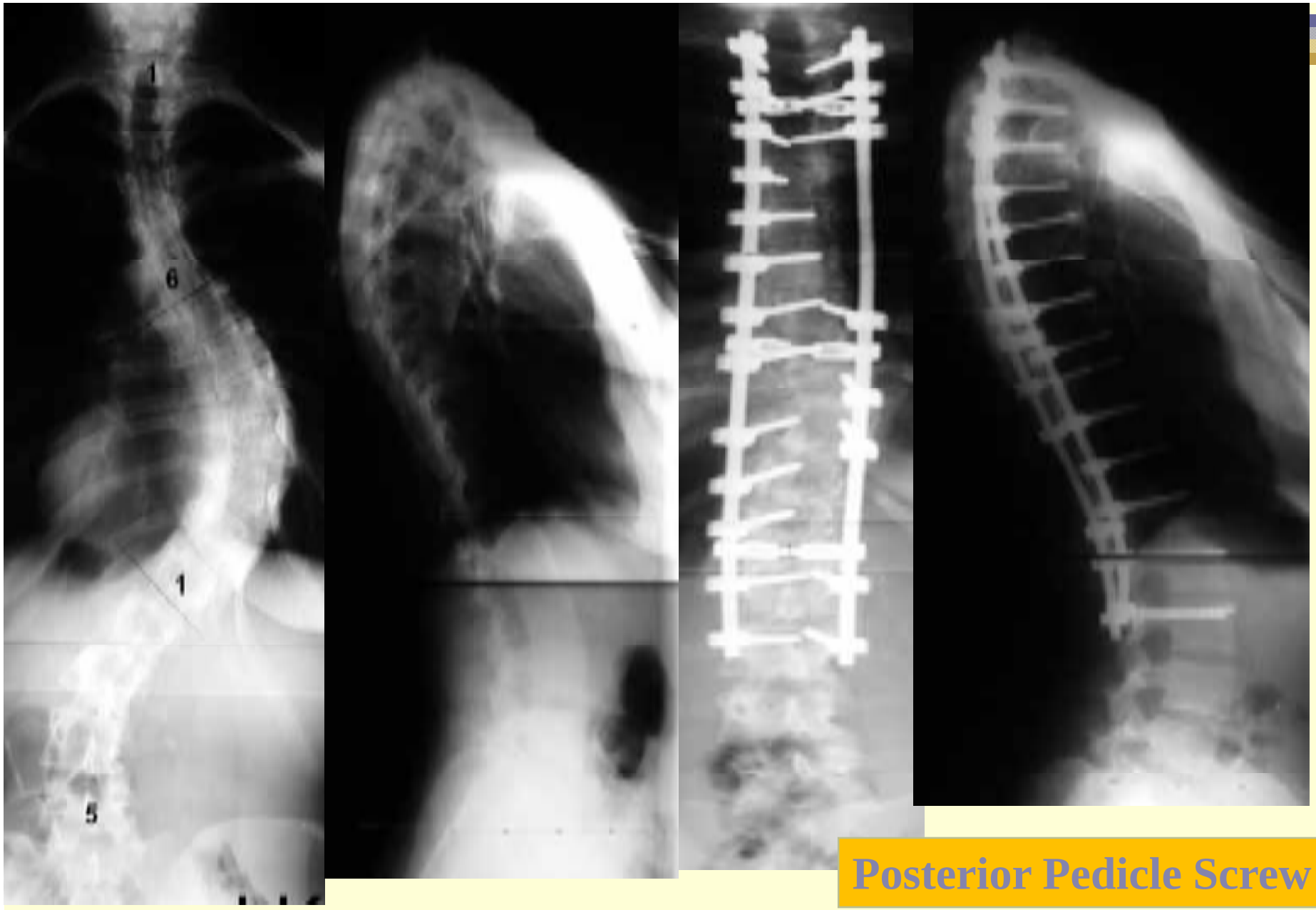




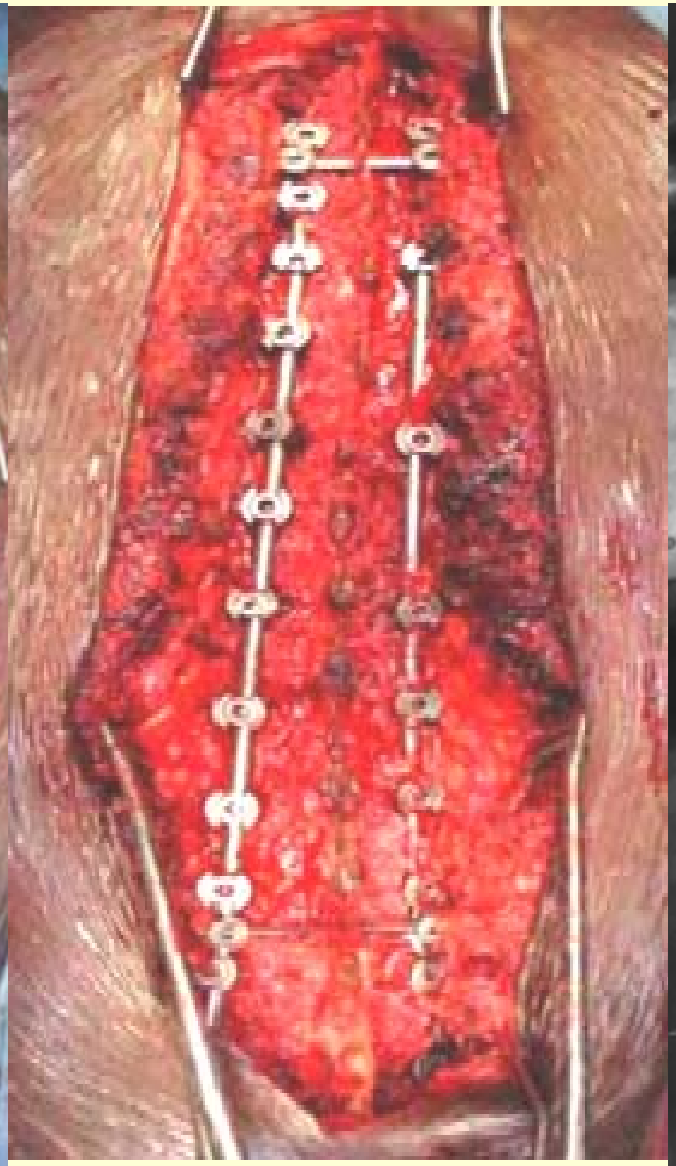
Old surgical correction

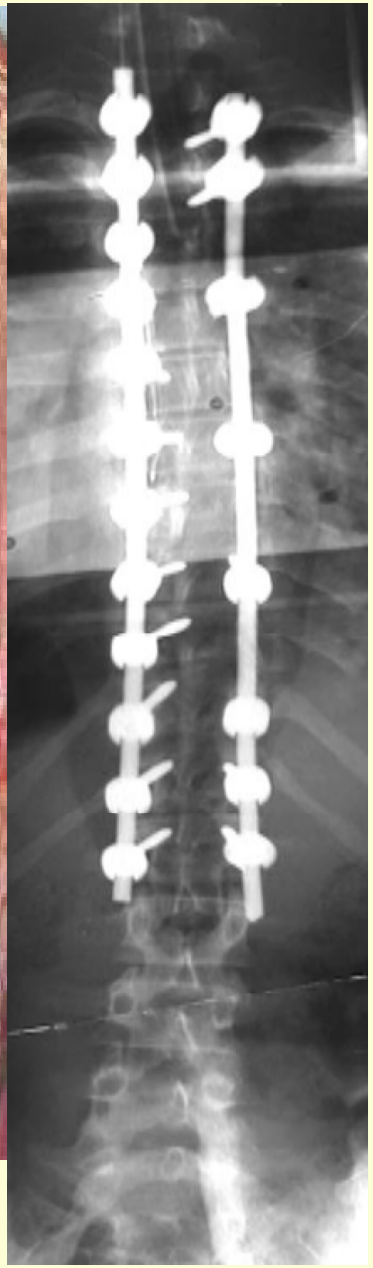


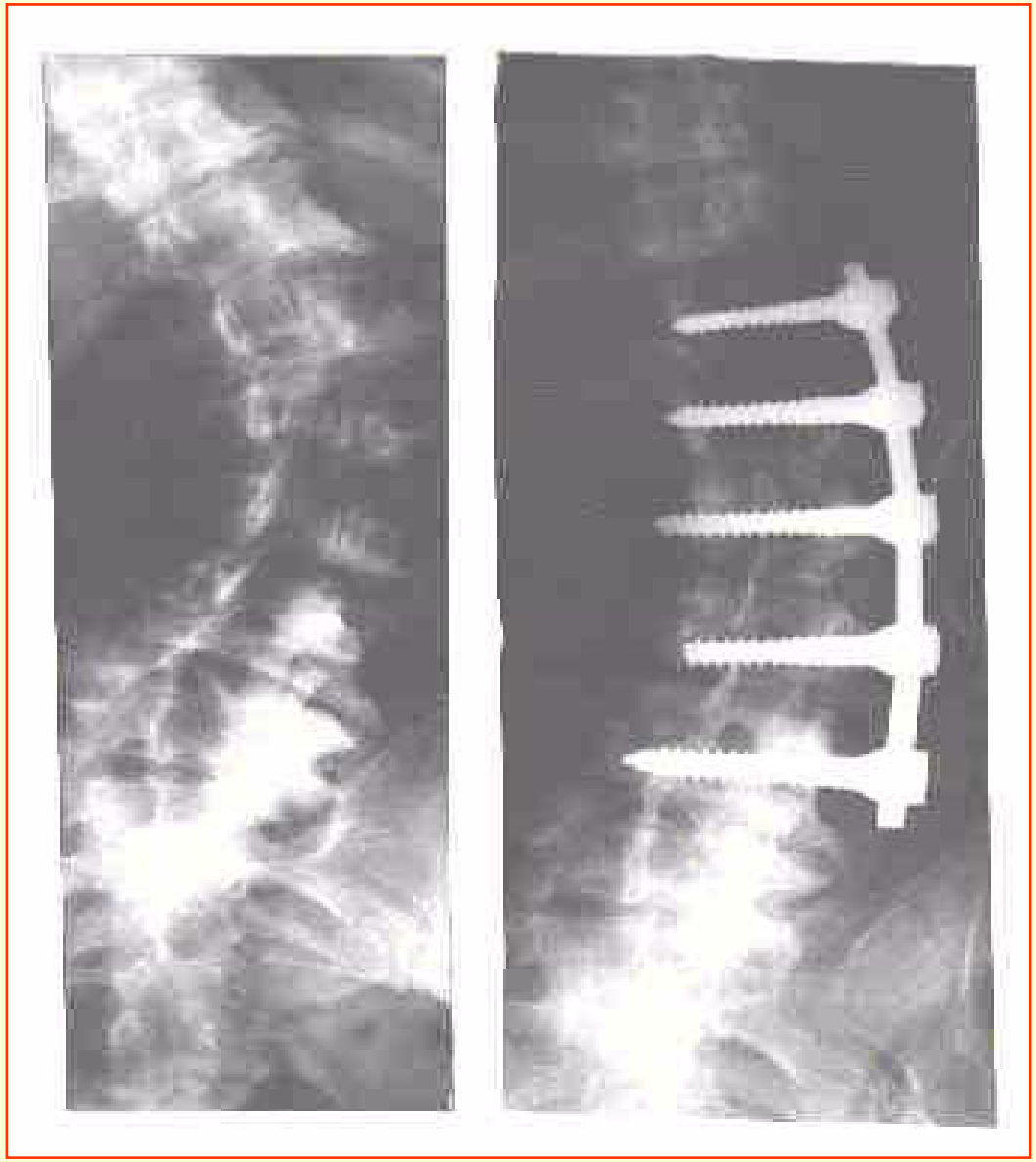

Old surgical correction

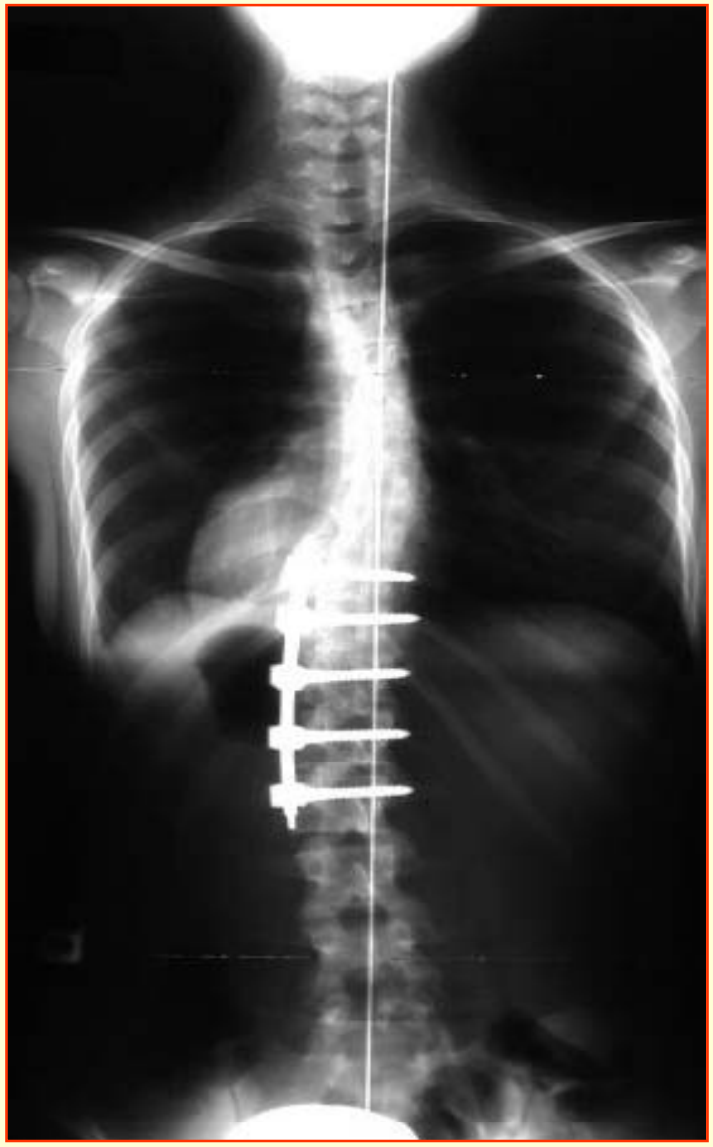


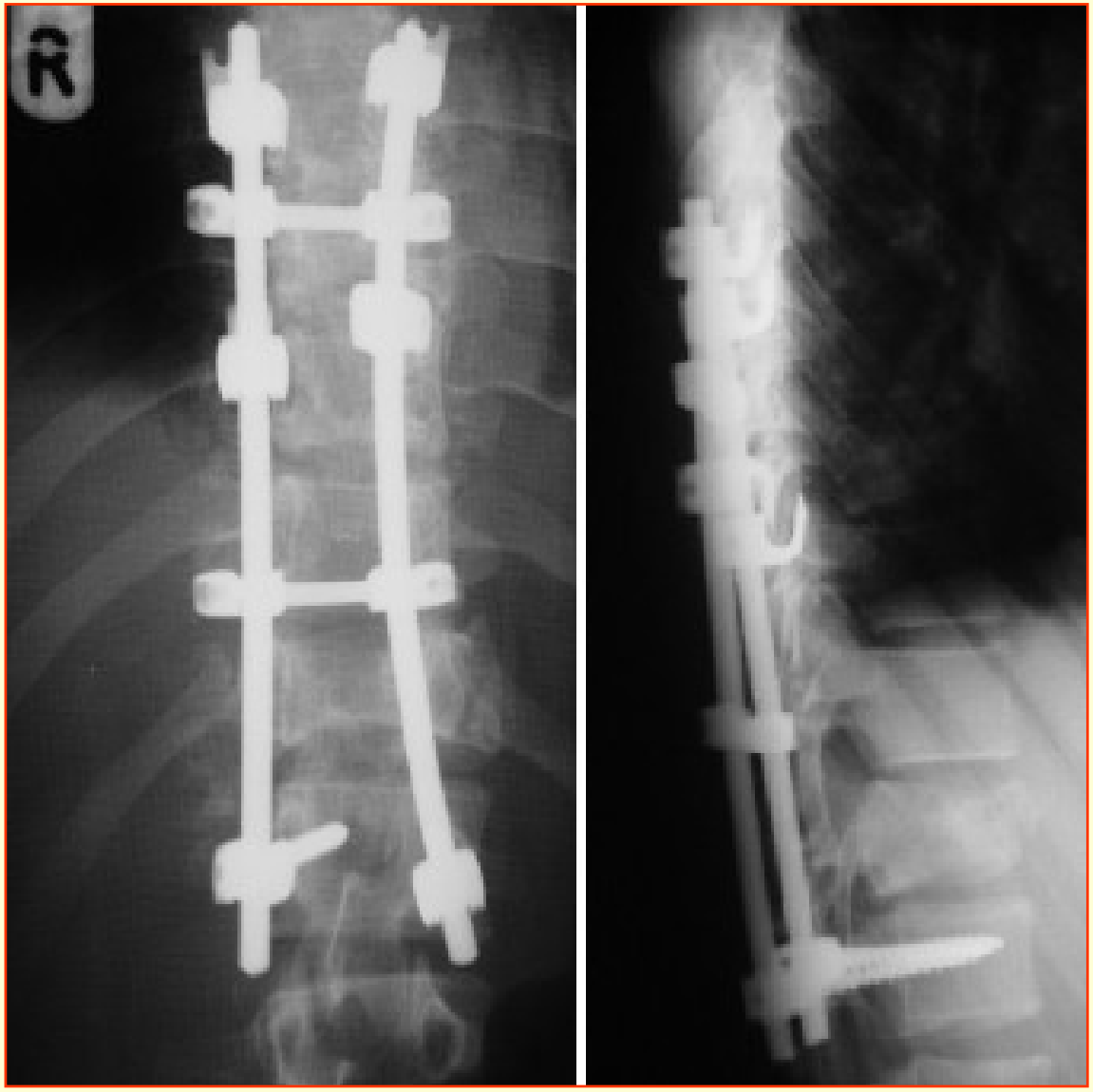
Posterior Pedicle Screw







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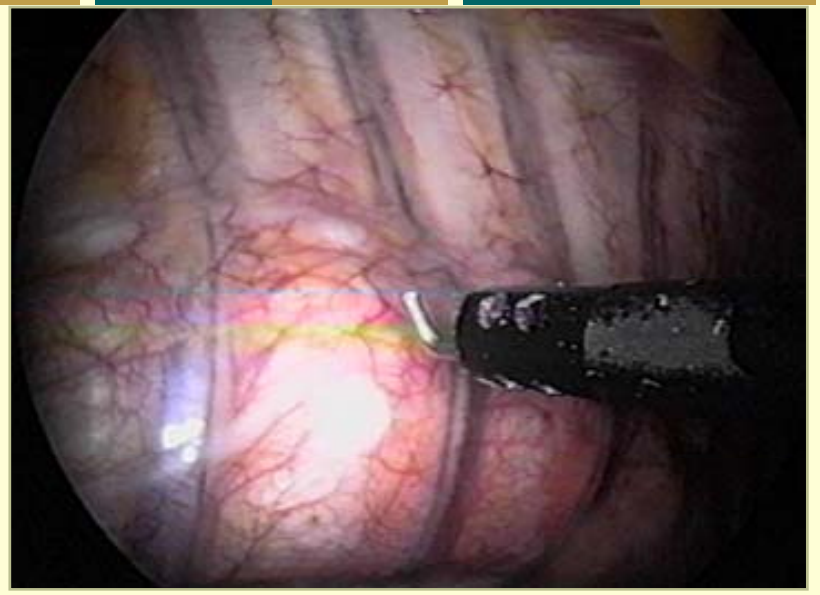
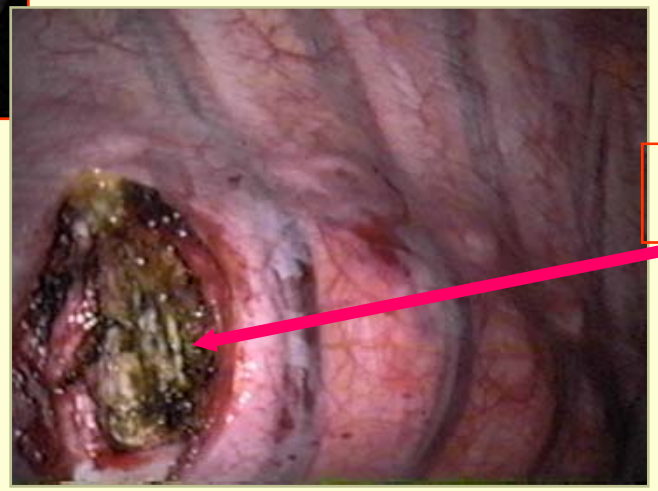
Endoscopic Surgery

* Can permit much smaller incisions for surgery of the anterior spinal column.
* Faster recovery possible.
* Less tissue damage.
* Less blood loss possible.

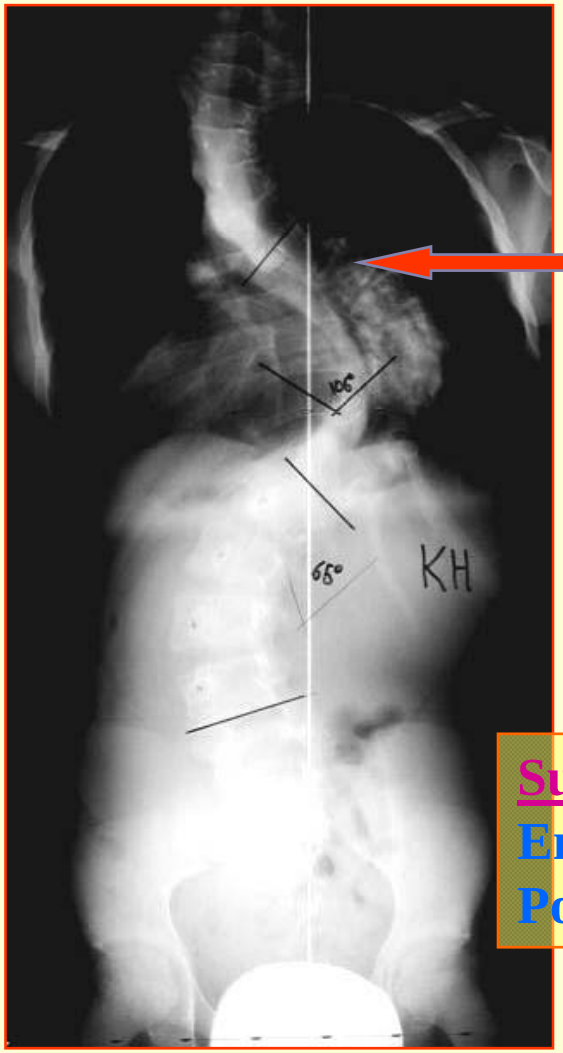
Endoscopic Surgery





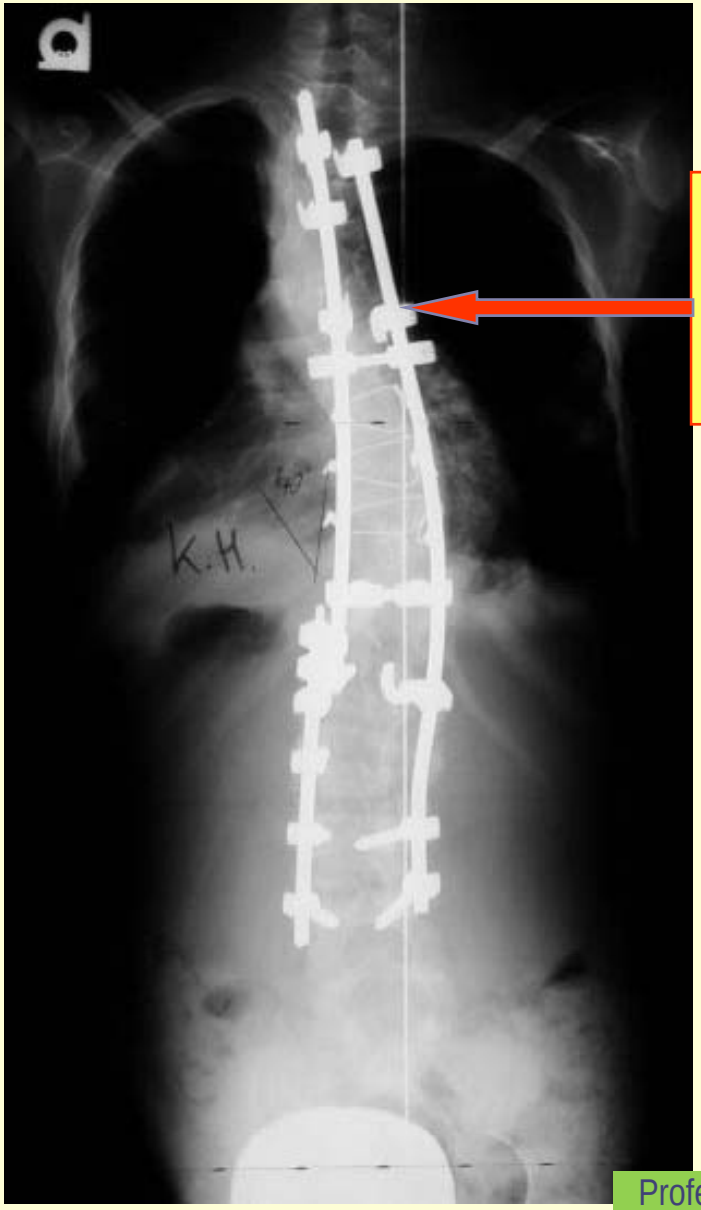
Release of disc

Views into chest cavity With thoracoscope

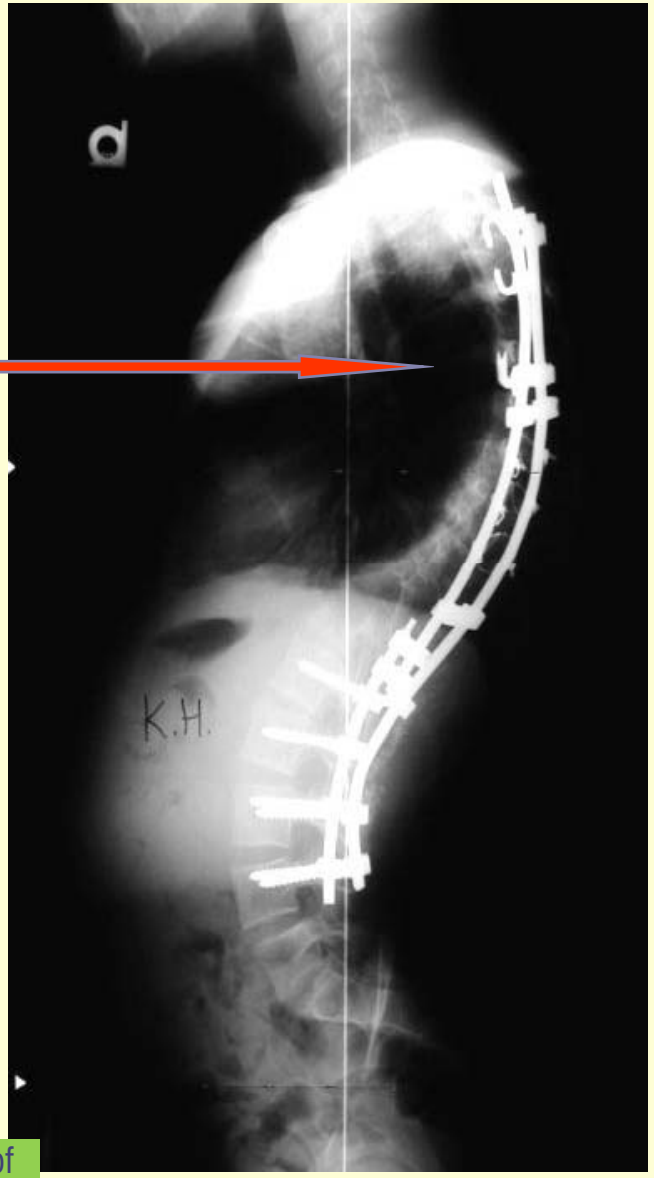


Scoliosis 106^0
Kyphosis 67^0

Surgical plan:
Endoscopic ant. release
Post. instrumentation



Post-operative:
Scoliosis 40^0
Kyphosis 45^0



Summary

- **Proper Screening/Evaluation**

= All suspicious exams → X-ray evaluation.

= Thorough PE, R/O non-idiopathic etiology.

= All suspicious curves → MRI, CT.

- **Treatment**

= Mild curves (10^0 – 25^0)→ Observe

= Moderate, progressive curves (25^0-40^0) →Brace

= Severe, progressive (~ 50^0) → Surgery