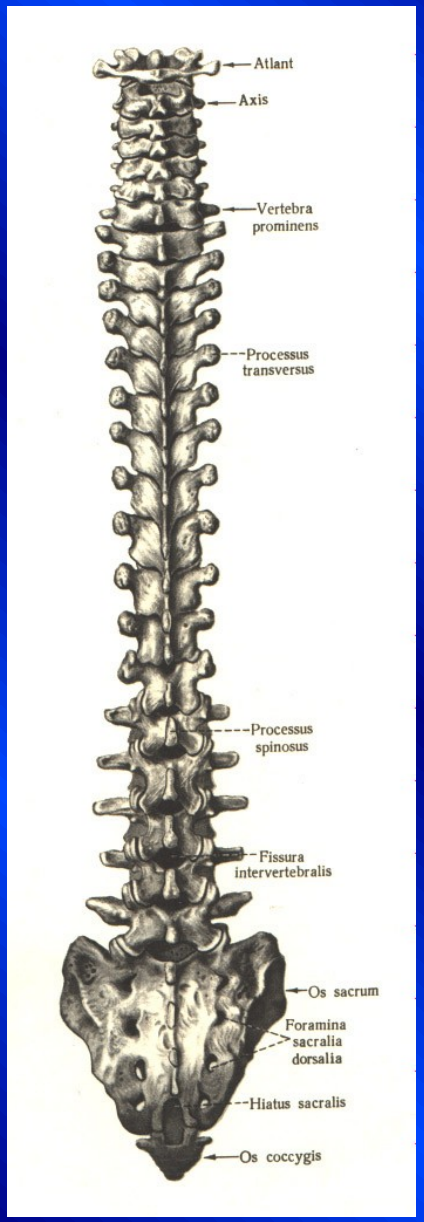
Spinal deformities

Physiological curves of the spine

Frontal level



Sagital level

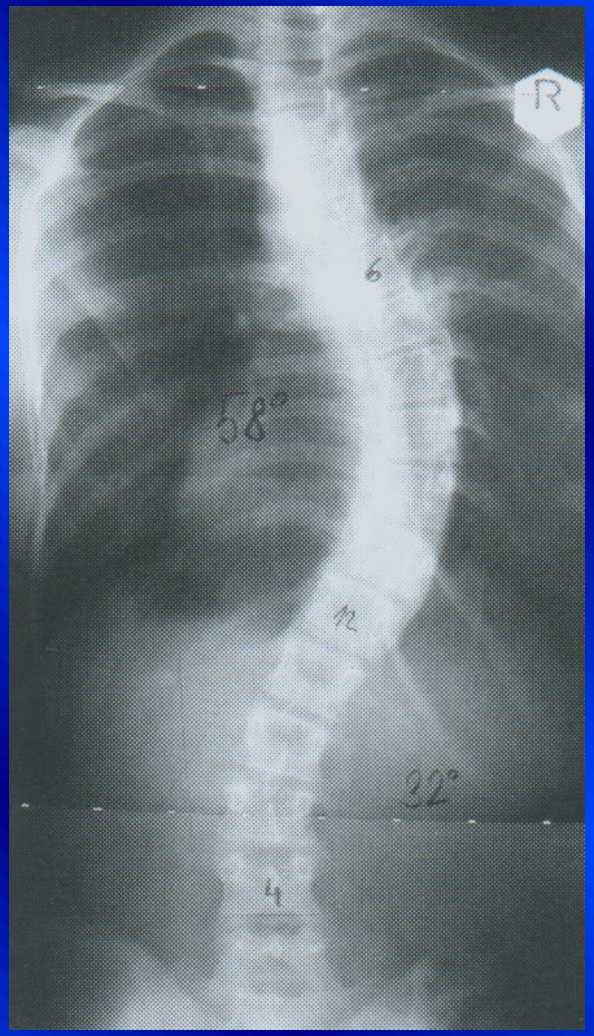
Cervical lordosis

Thoracis kyphosis

Lumbar lordosis

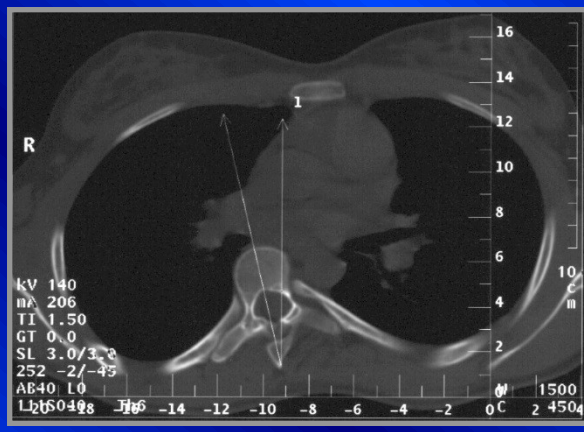
Sacral kyphosis

Scoliosis is a deformity in frontal level in sagital level and in transversal level

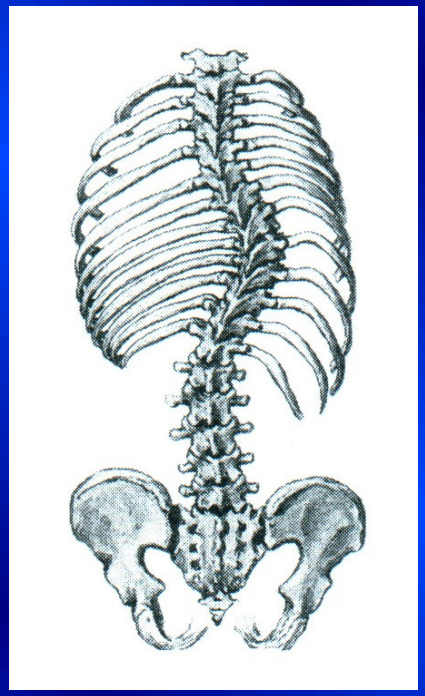


Scoliosis is 3D deformity

- frontal level – scoliosis
- sagital level – hypo, hyperkyphosis
- transversal level – rotation, torsion
  - rib prominence
  - proc. spinosus tilted to concave side
  - narrowing of spinal canal



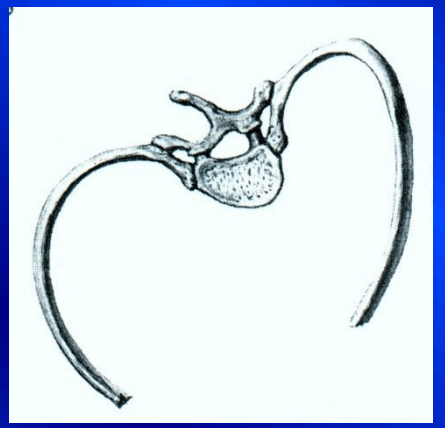
concave



convex

concave

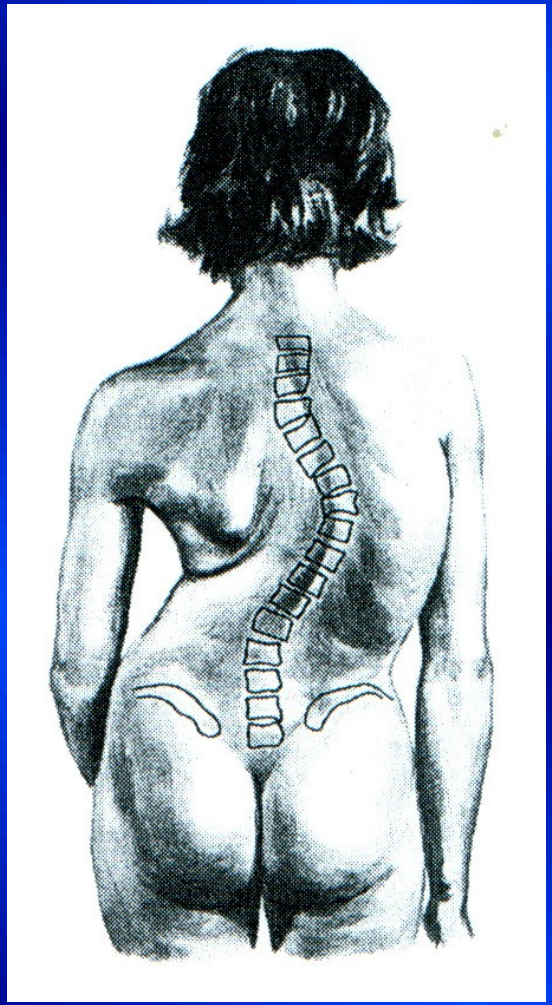
convex



Curve

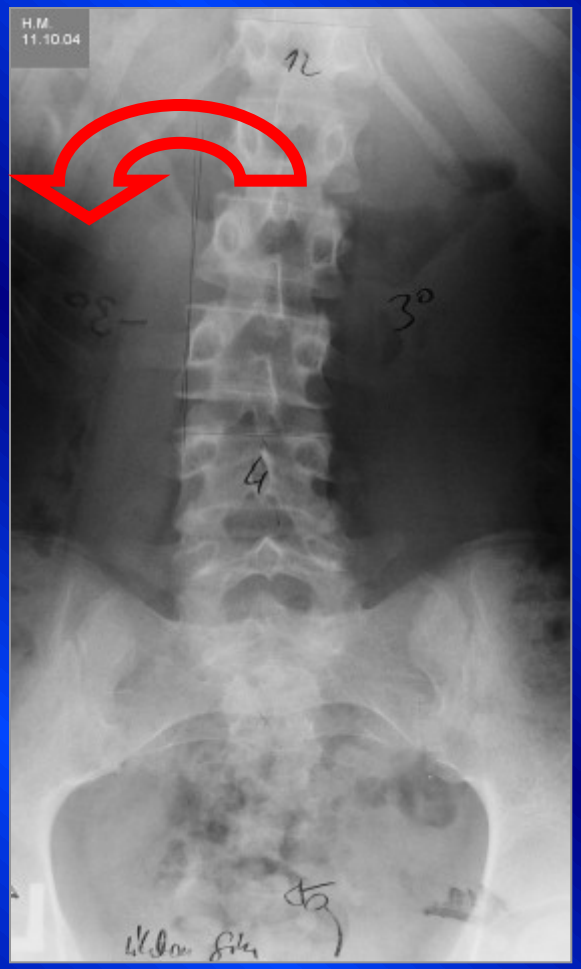
Structural curve
- no flexibility
- based on structural changes

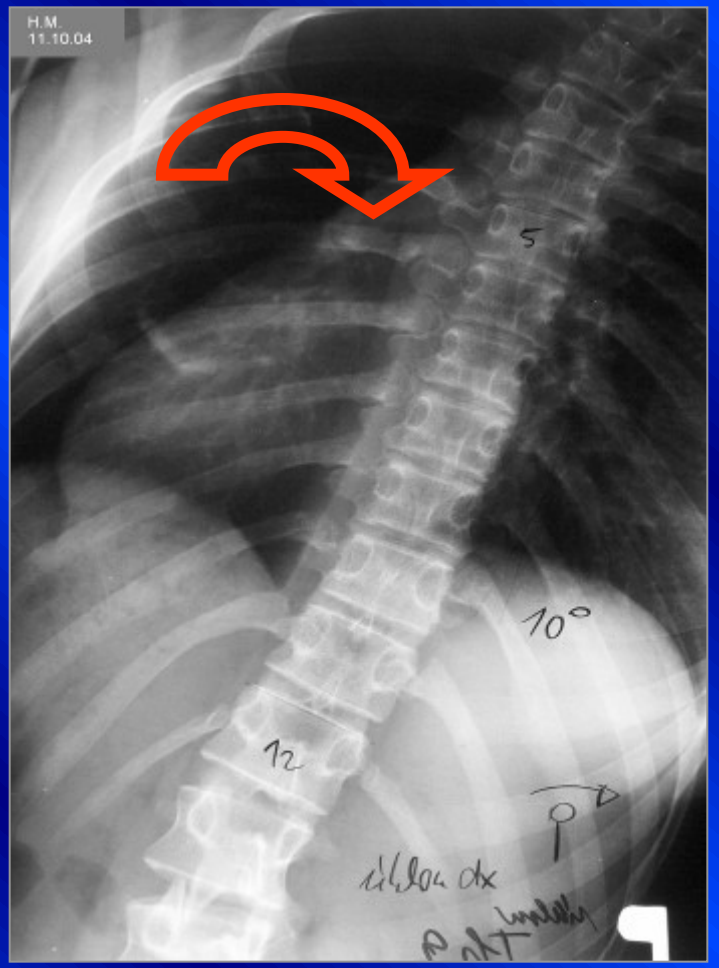
Nonstructural curve
- is flexible
- nonbased on structural changes



Structural curve

Structural and nonsctructural curve





Curves

Main curve

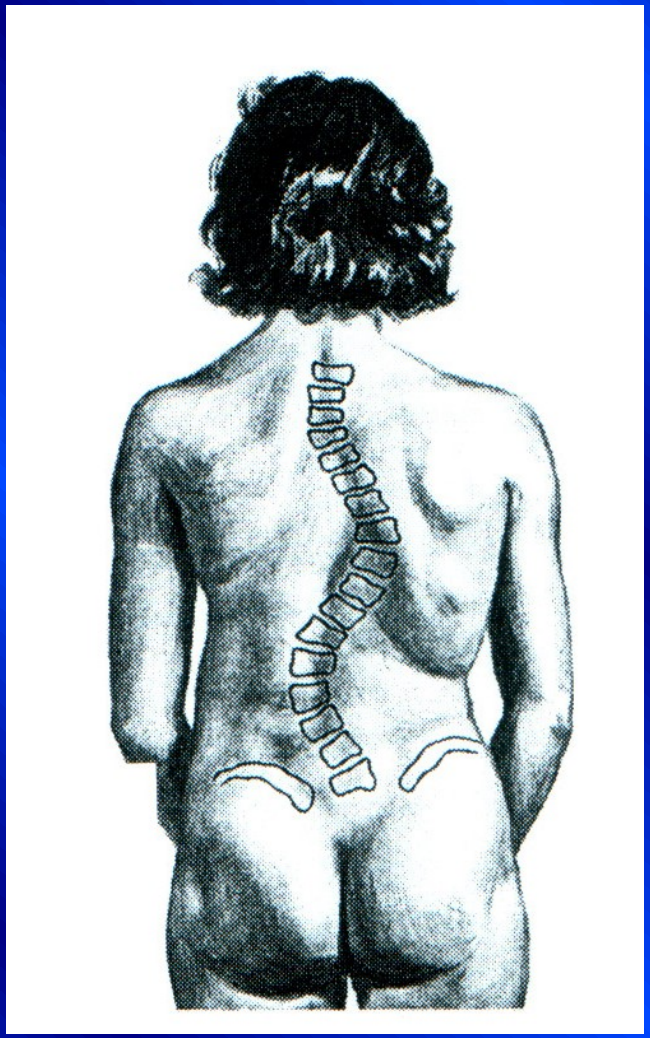
- occurs earlier
- structural
- more serious

Compensated curve

Above and bellow main curve

Compensates stability of the trunk

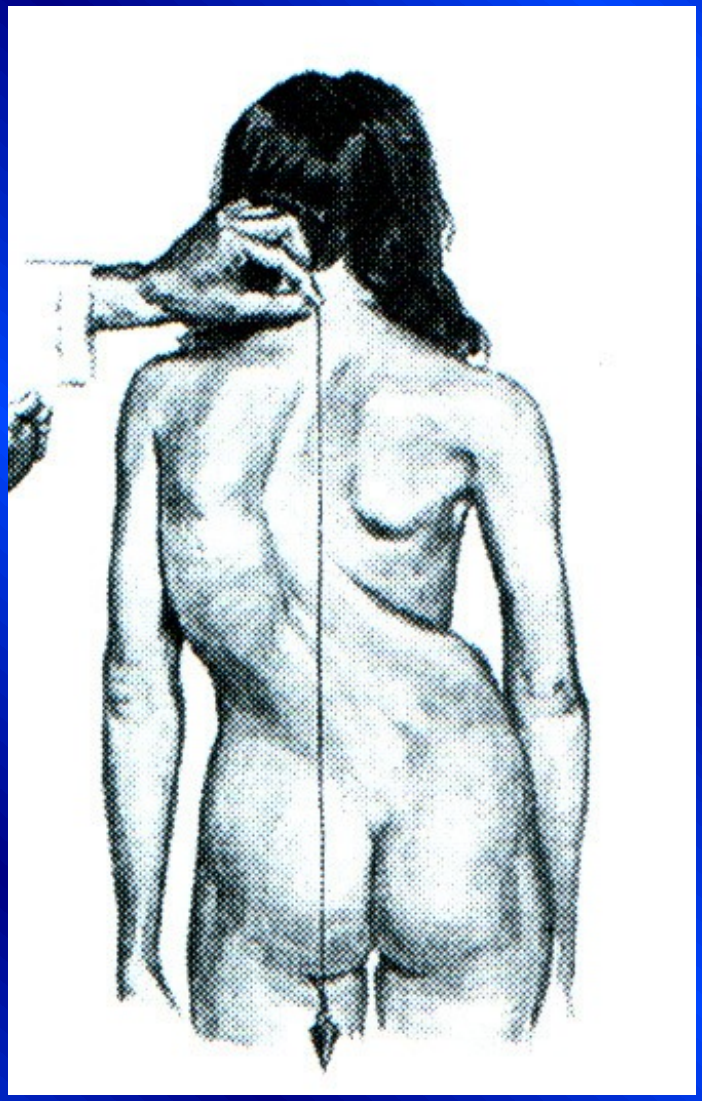
Later on changes into structural one



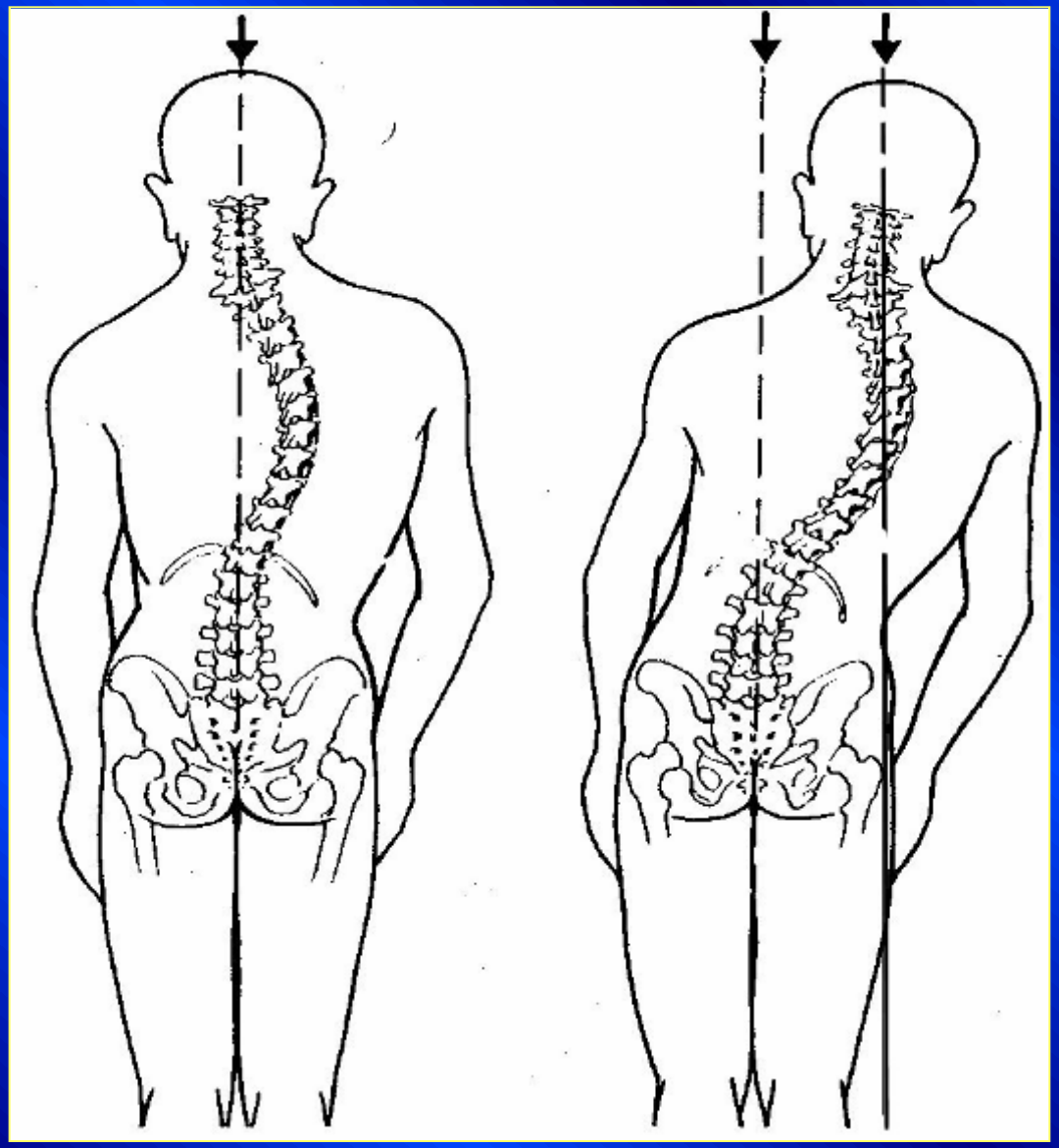
Scoliosis

Compensated

Decompensated

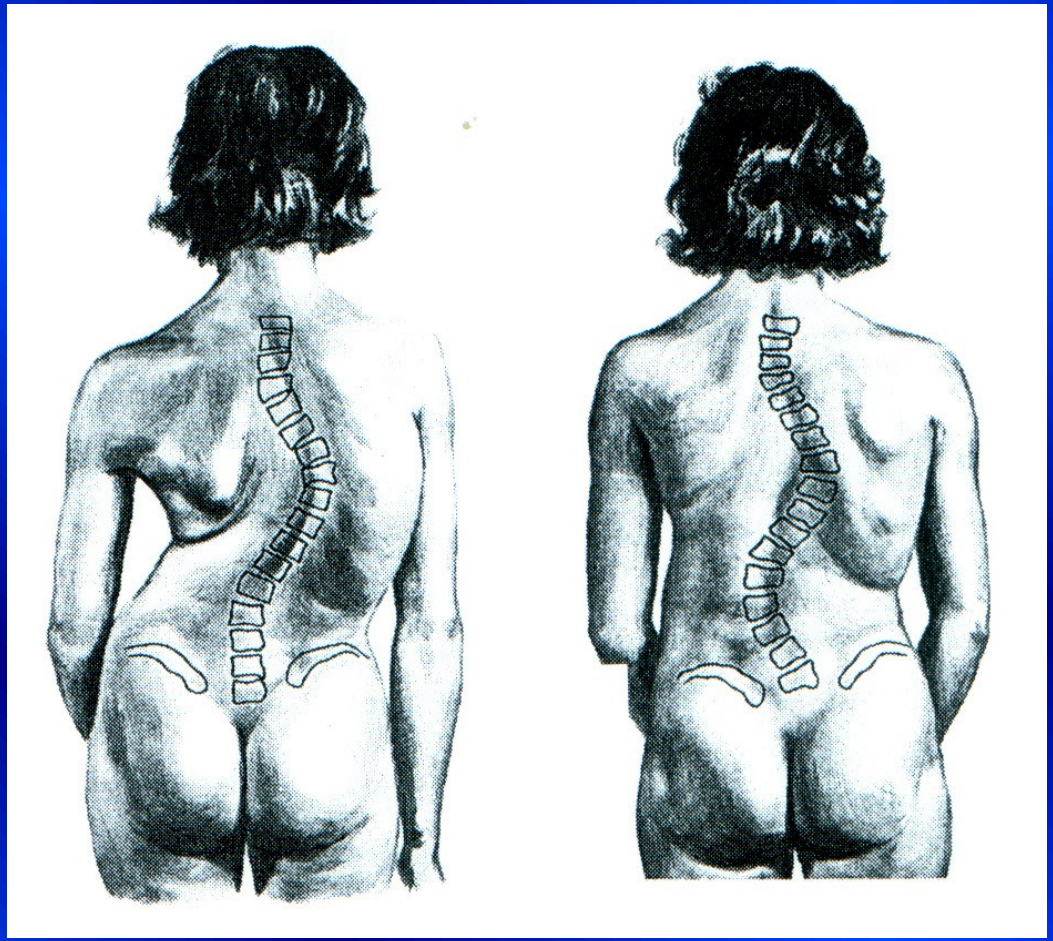


Trunk compensated/ decompensated



Curves

Cervical
Cervicothoracal
Thoracal
Thoracolumbar
Lumbar
Lumbosacral

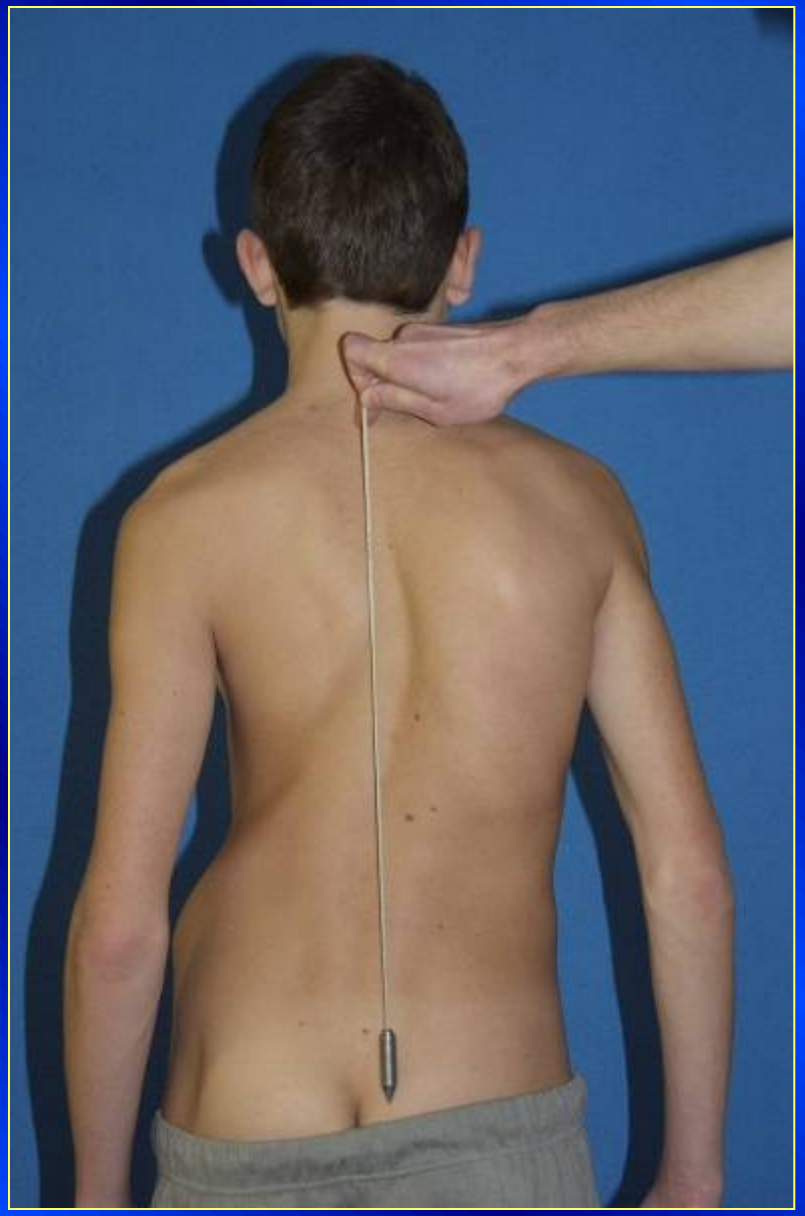


Thoracal Thoracolumbar

Clinical examination

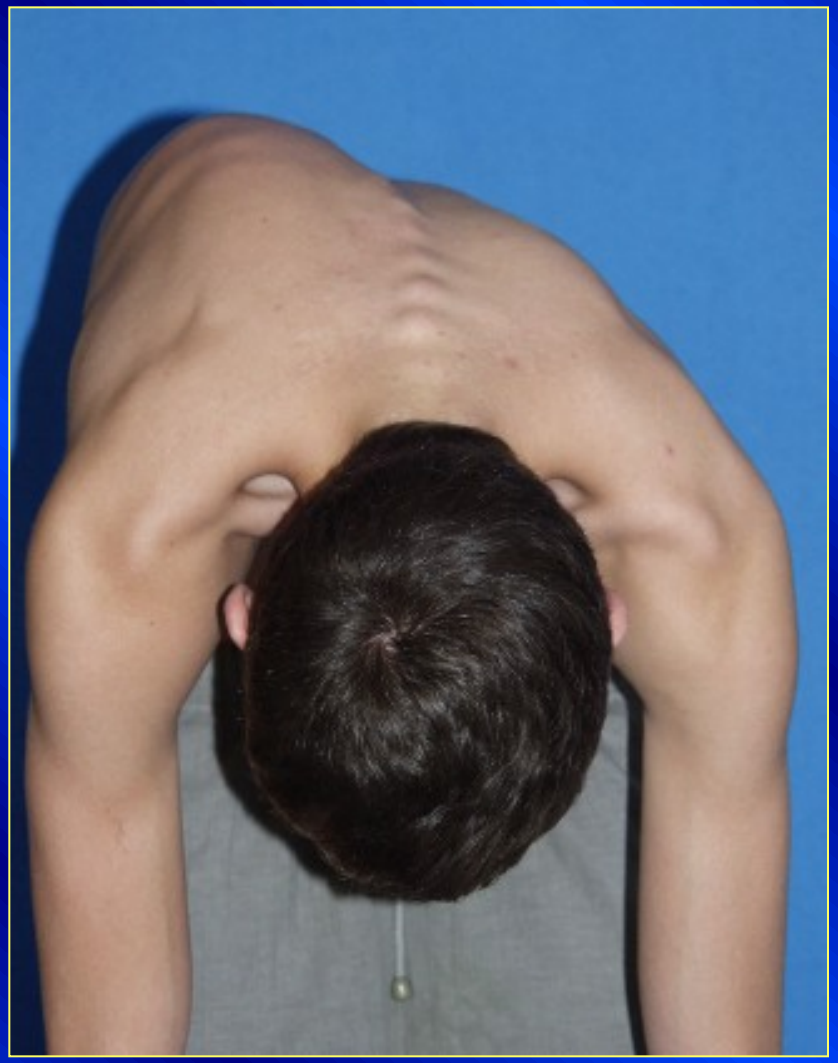
- Compensation of the trunk
- Level of shoulders
- Asymetry of the waist
- Position of the pelvis
- Flexibility of curves
- Gibus in flexion
- Others: laxity, sexual development, lenght of extremities
- Functional examination of lungs- spirometry

Compensation of the trunk

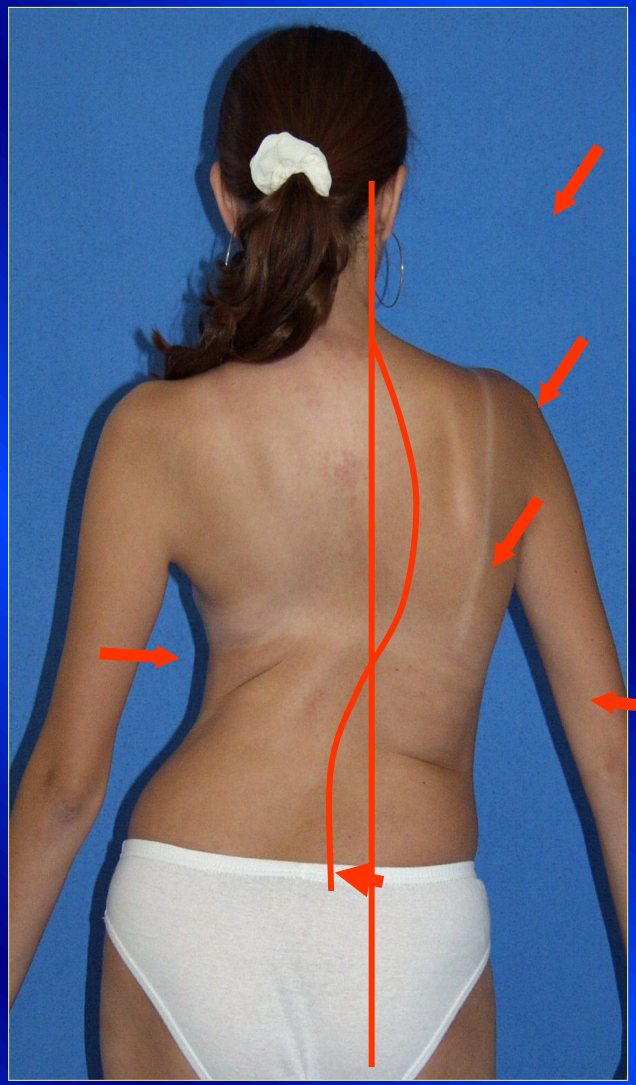


Level of shoulders

Gibus (hump) in flexion



Frontal balance



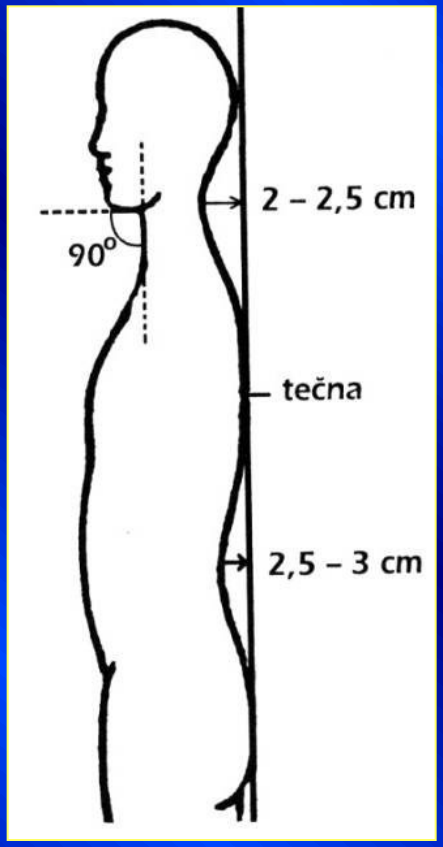
Shoulders

Hump

Asymetry of the pelvis

Decompensation of the trunk

Sagital balance

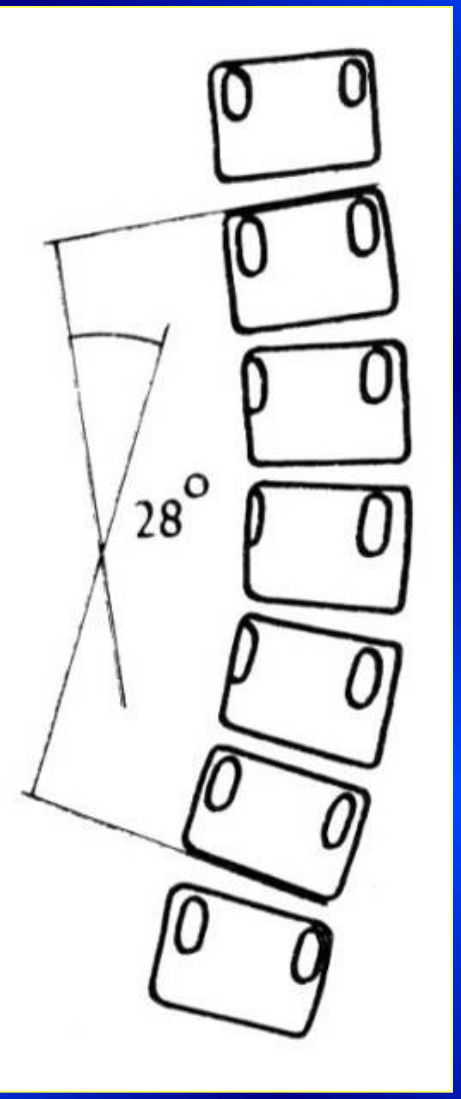


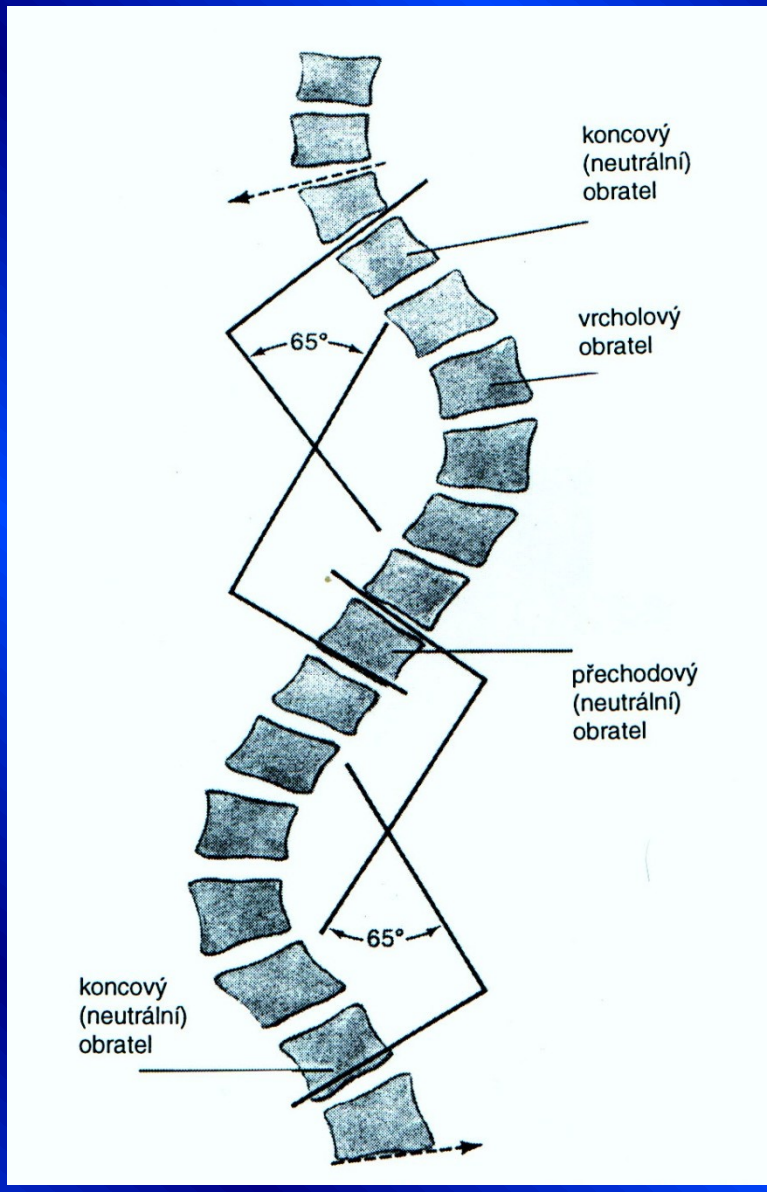
Neurofibromatosis
„café au lait“

X- ray examination

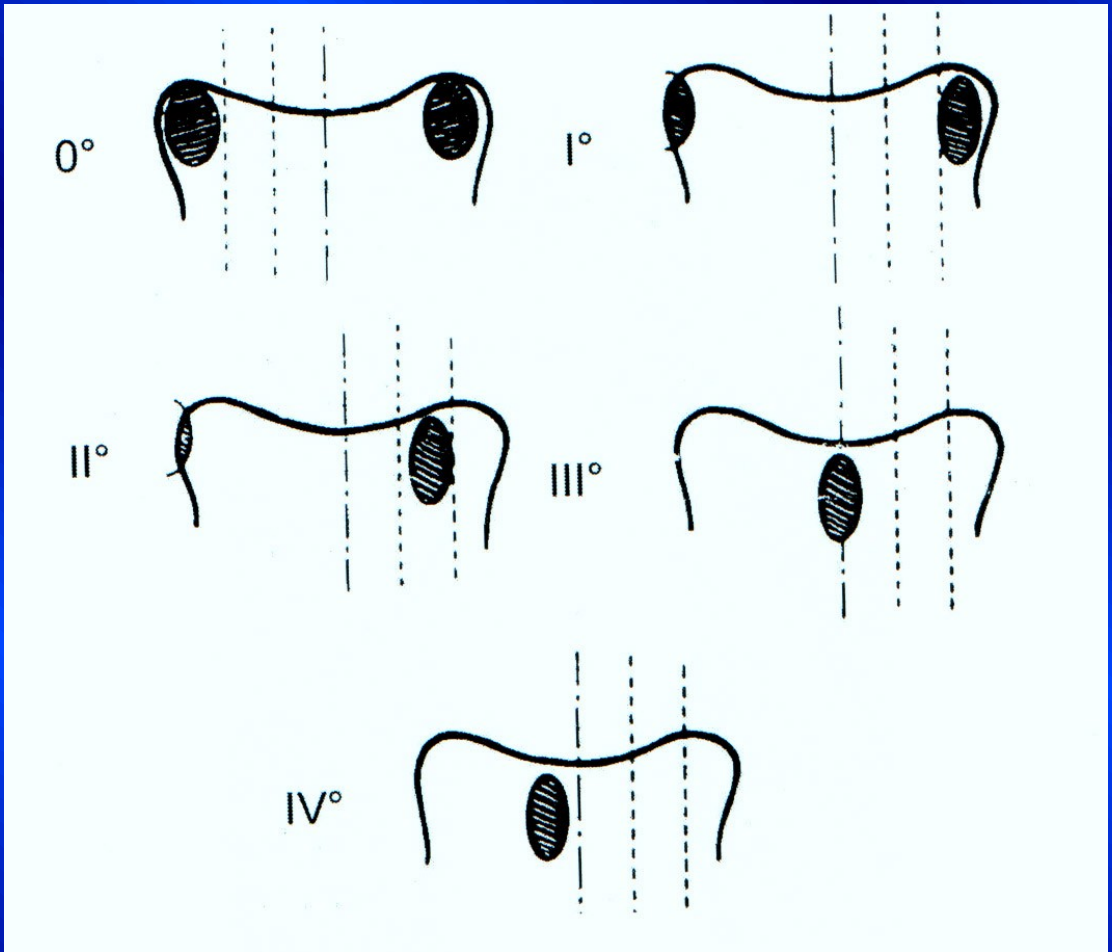
- Long films 30x90 cm
- AP, lateral, in bending , in distraction
- Check up in 6 months
- Cobb angle
- Skeletal development

Cobb angle


28°

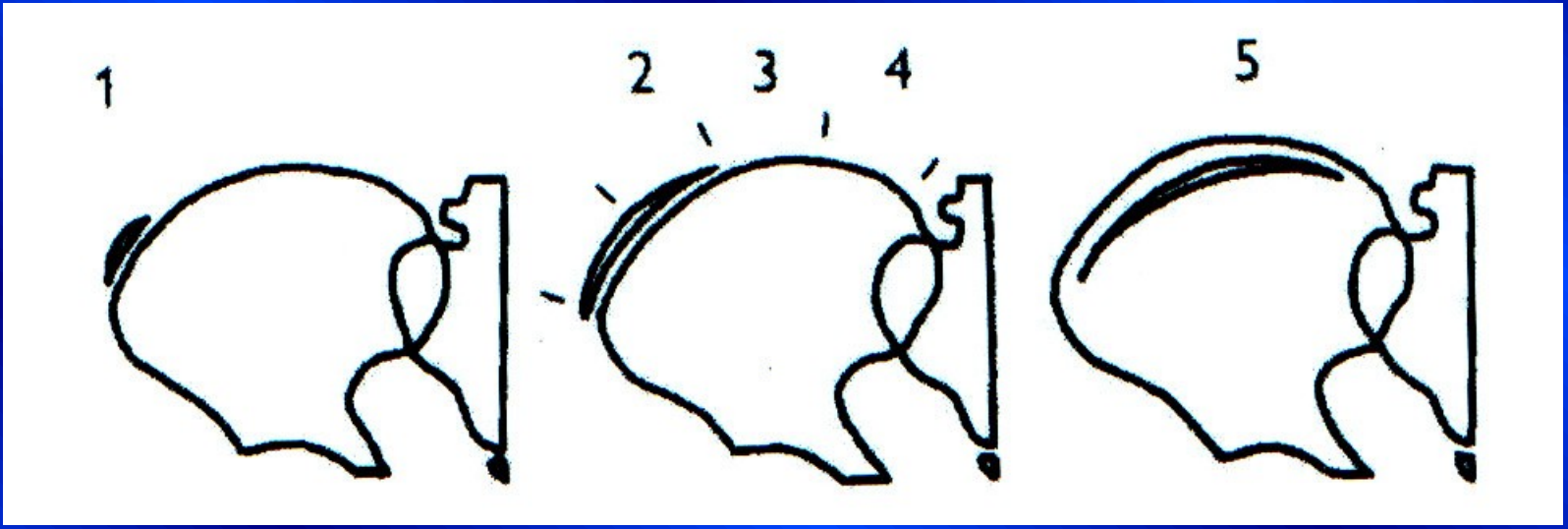

koncový
(neutrální)
obratel
vrcholový
obratel
65°
přechodový
(neutrální)
obratel
65°
koncový
(neutrální)
obratel

Rotation of vertebrae- pedicles



Risser sign

0 no apophysis
1 25%
2 50%
3 75 %
4 100 %
5 Fusion with iliac bone



Classification

- Orientation – right, left
- Localisation, C, CT, T, TL, L, LS
- Severity of the curve- Cobb angle
- Etiology

Classification

- Structural
  - Congenital
  - Idiopathic (80%) – infantile, juvenile, adolescent
  - Neuromuscular – neuropatic, myopatic
  - In neurofibromtosis
  - Secondary scoliosis Marfan sy, Ehlers-Danlos sy
  - Degenerative scoliosis
- Nonstructural
  - Postural
  - Hysteric
  - in other morbidities – tumor, infection

Idiopathic scoliosis

- Etiology unknown, multifactorial
- Genetic background
- Prevalence in girls 1,5 more often
- Progression- in girls 8 times more

Treatment

Up 10° - no scoliosis

10-20° - exercise therapy, follow up

20 - 40° - orthesis, exercise therapy

Above 40° - surgery

Scoliosis in adults

Progresion of the curvature

- low, in Cobb angle less than 30°
- often, in Cobb angle over 50 ° in thoracis and over 30° in lumbar spine

Limited breathing in thoracic curves over 90°

Back pain

Idiopatic scoliosis

- Infantile
  - – Up to 3 years of age

    usualy spontaneous resolving (90%),

    in less cases severe progression
- Juvenile

  3 years of age – to onset of puberty
- Adolescent

  Puberty - the end of growth

Exercise therapy

- Exercise, correct posture
- Pelvic alignment
- Strenghtening of trunk and abdominal muscles
- Breathing
- High level activities
- Follow up in 6 moths regime

Exercise + bracing

- To prevent progression
- Effective only in low curves
- Over 45° no effect

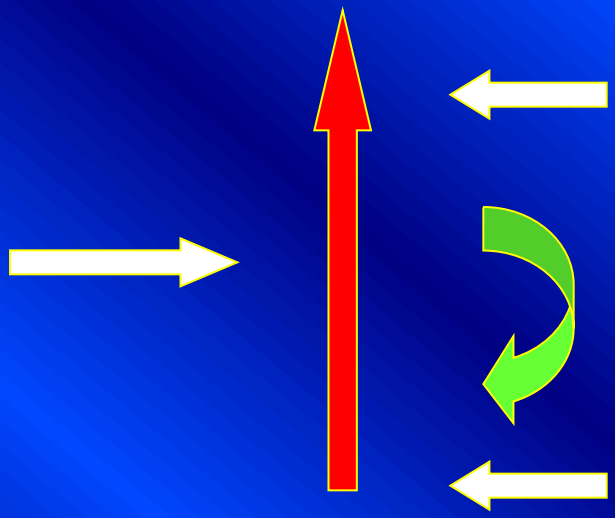
- Indication: in growing children with flexible curve

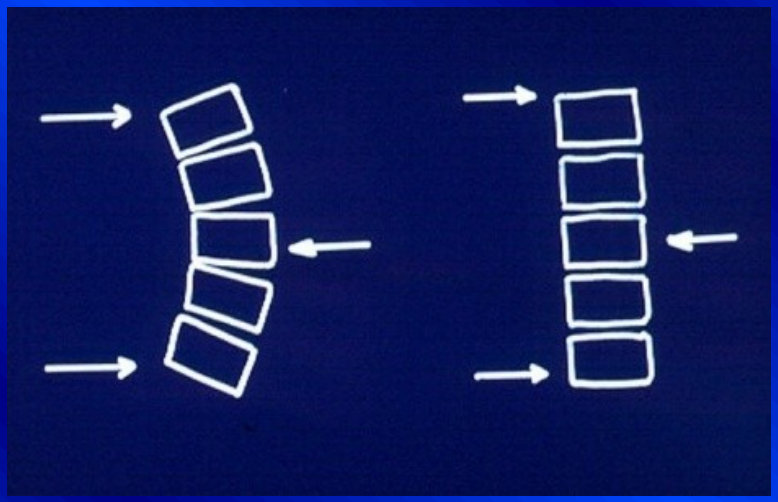
- Curves are progressive in fast growing periods

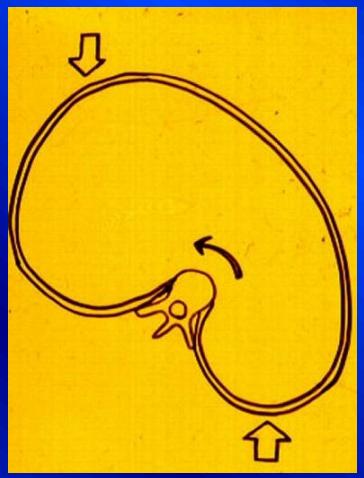
- To wear 23 hours per day, up to the end of growth (16-17 years) gradually to wear less hours per day.

Principles of the brace

- distraction
- derotation
- three point system







Milwaukee orthesis – curves T6 and above

TLSO orthesis
- curves in Th7 and lower

Exercise in a brace

- stretching
- correct posture
- exercise using balls
- activation in sports

- Without a brace

  - swimming

  - hippotherapy

- Breathing therapy

  - *deep breathing*
  - *bottles*
  - *derotation breathing*

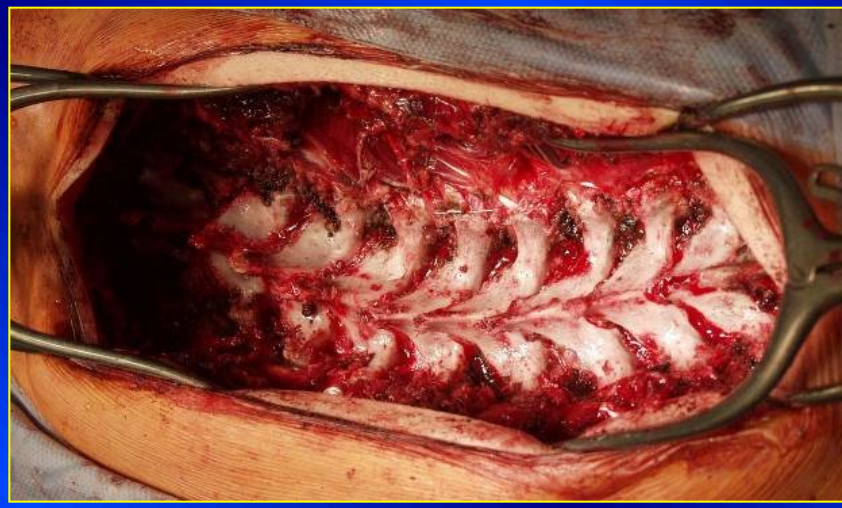
Surgery

- Indication:
  - Above 40° in fast progression
  - Above 50° in all
- Principles:
  - Correction of the curve (distractions, derotation, translation of vertebrae)
  - Repeated distraction in younger patients (HRI)
  - growing rods
  - spondylodesis
  - Postoperative bracing

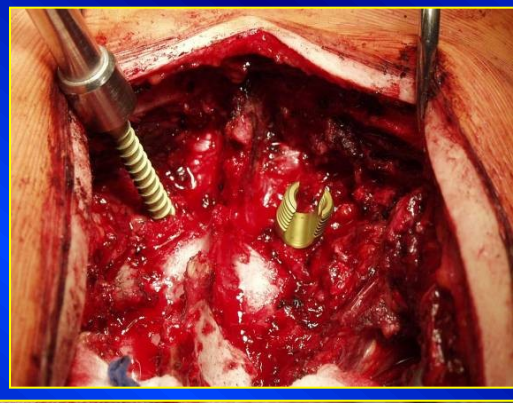
- The aim of surgery:
  - Correction of the curve
  - Prevent progression
  - Influence worsening of pulmonar function (cor kyphoscolioticum- ischemic heart disease)
  - Improve situation for better muscle function
  - Prevent degenerative changes (spondylosis and spondylarthrosis)
  - Cosmetic effect

Dorsal approach

skeletizace, resekce kloubů, dekortikace zadních elementů



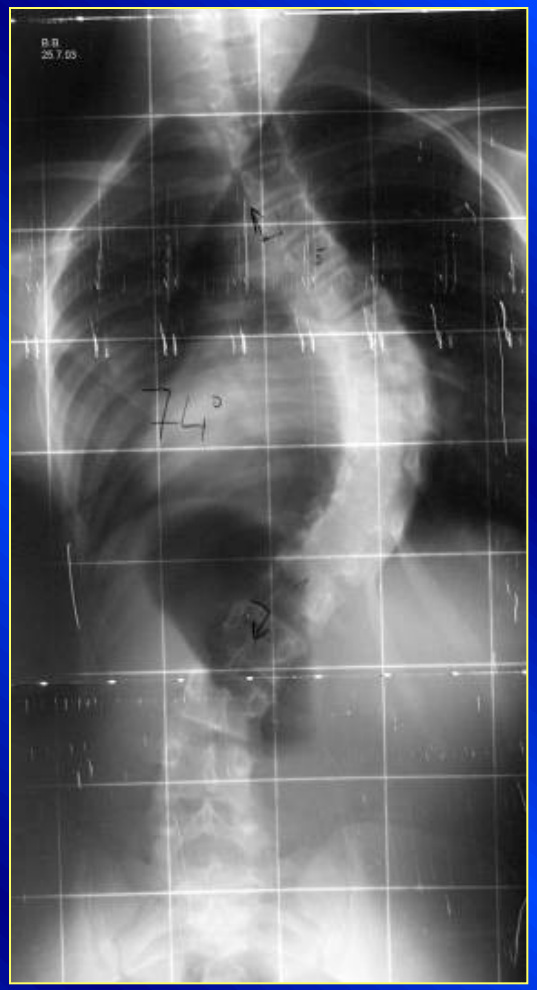
Transpedikulární šrouby či pedikulární háčky

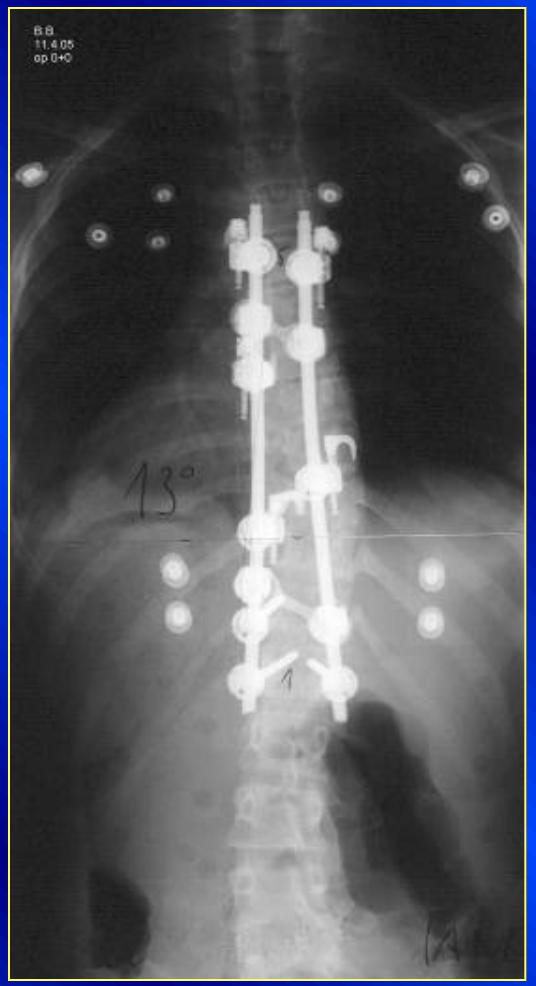


Dokončení, propojení, štěpy

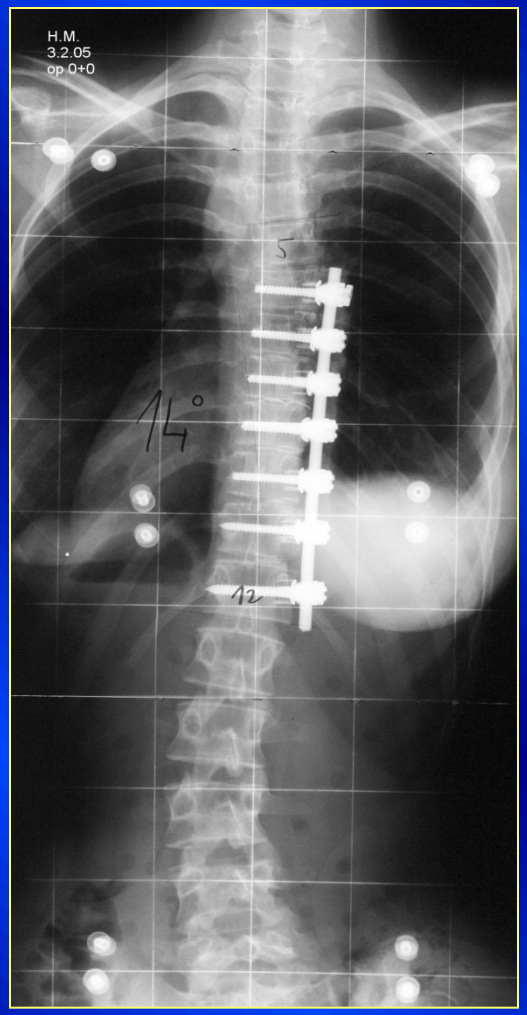
Juvenile scoliosis

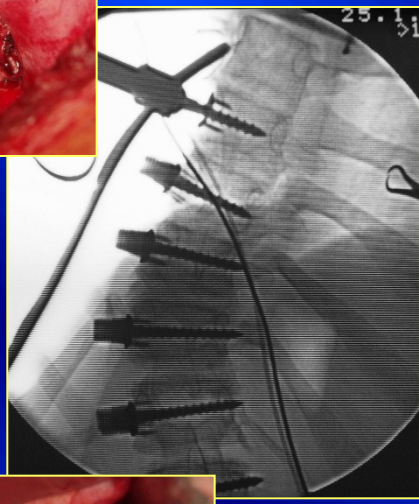
HRI + repeated disctraction, fusion later on

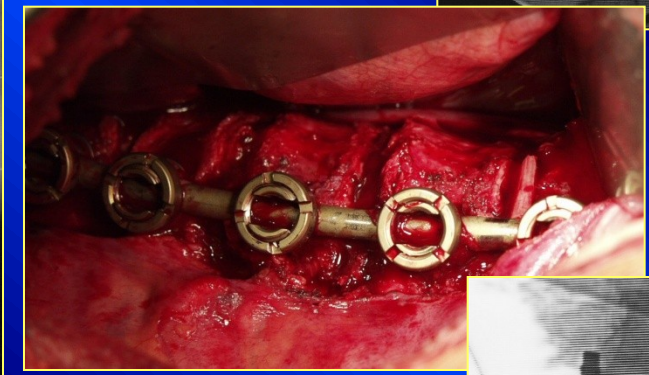


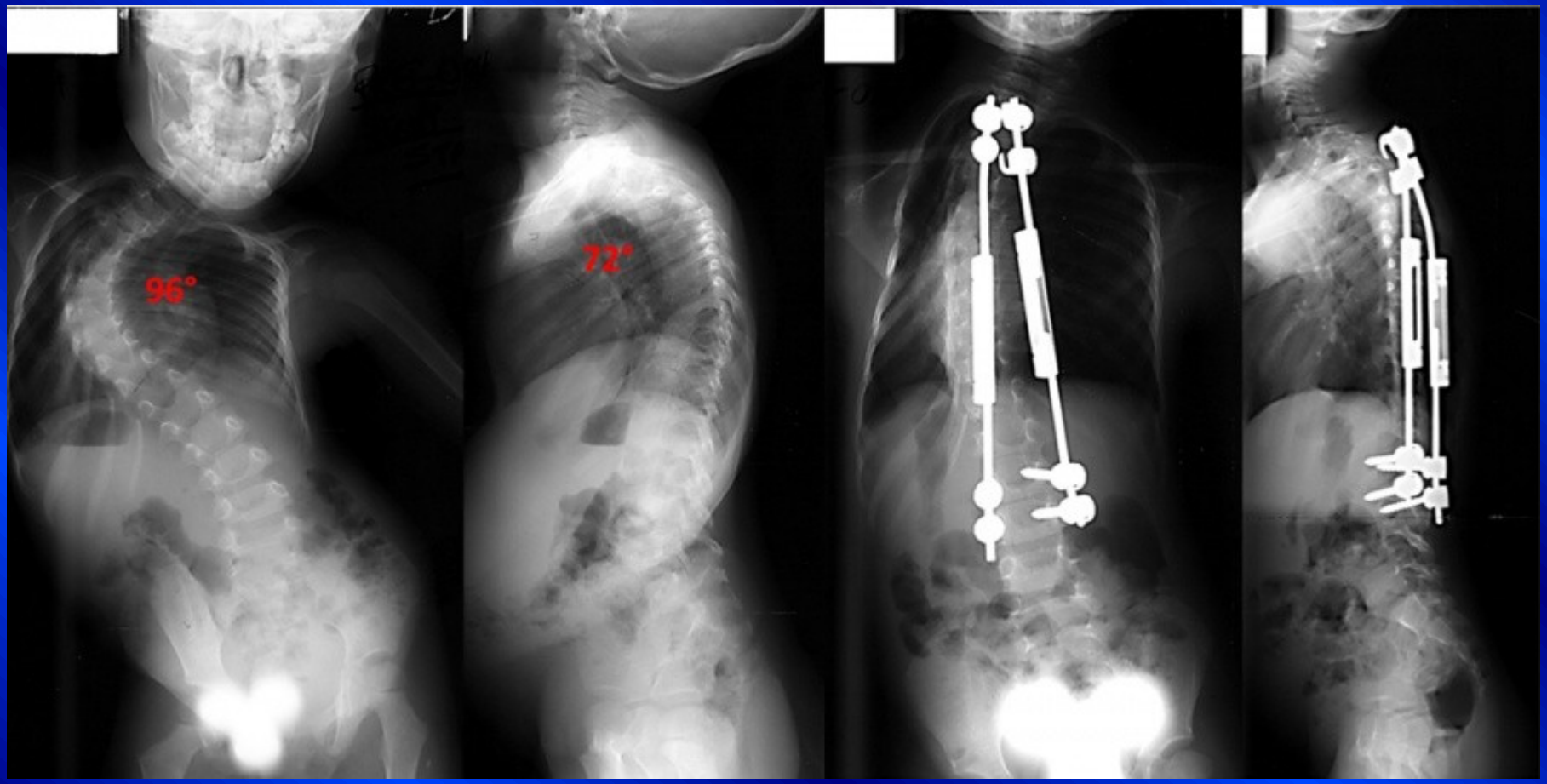


Dorsal approach







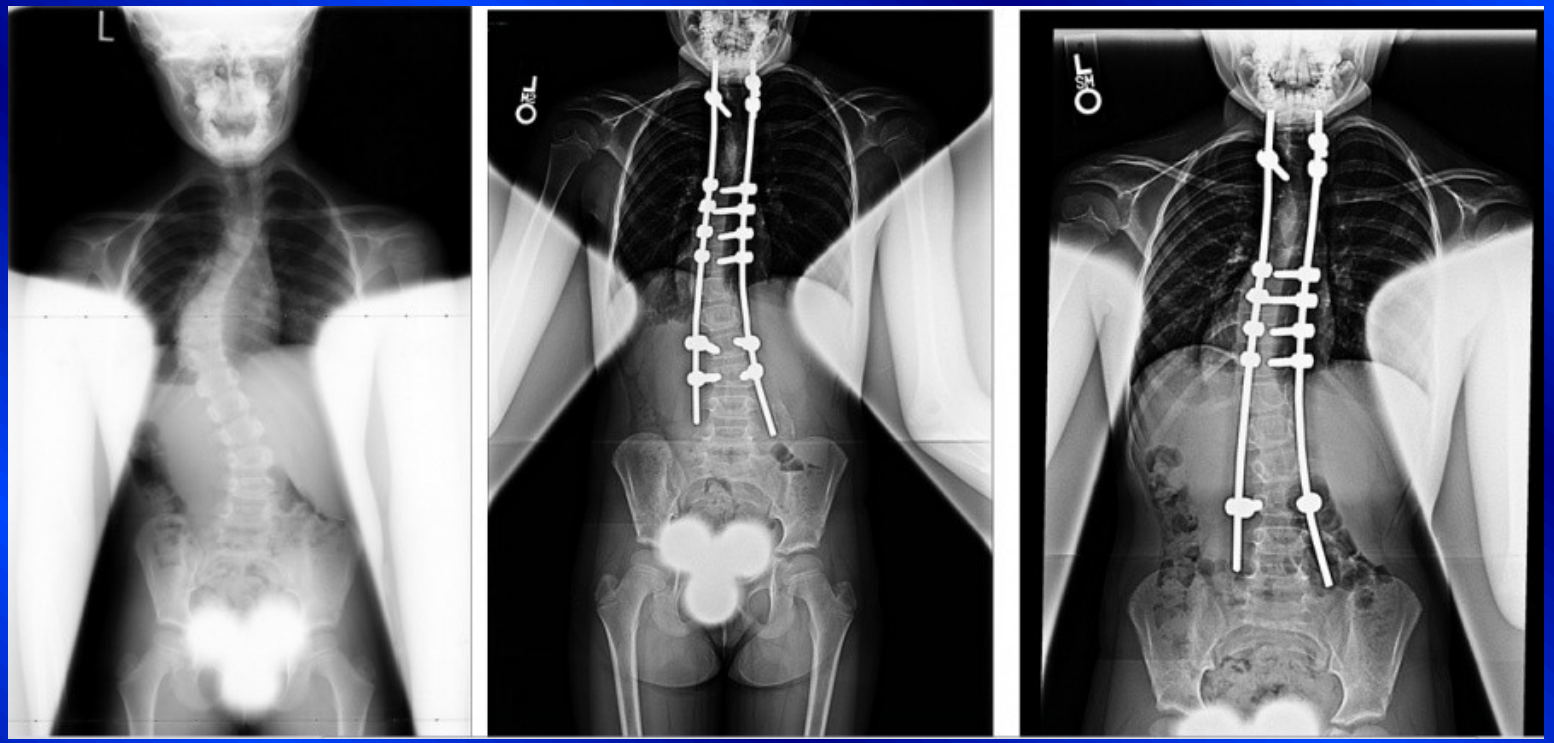


Traditional Growing Rods for Pediatric Scoliosis

Children younger than age 8 have years of growth ahead,

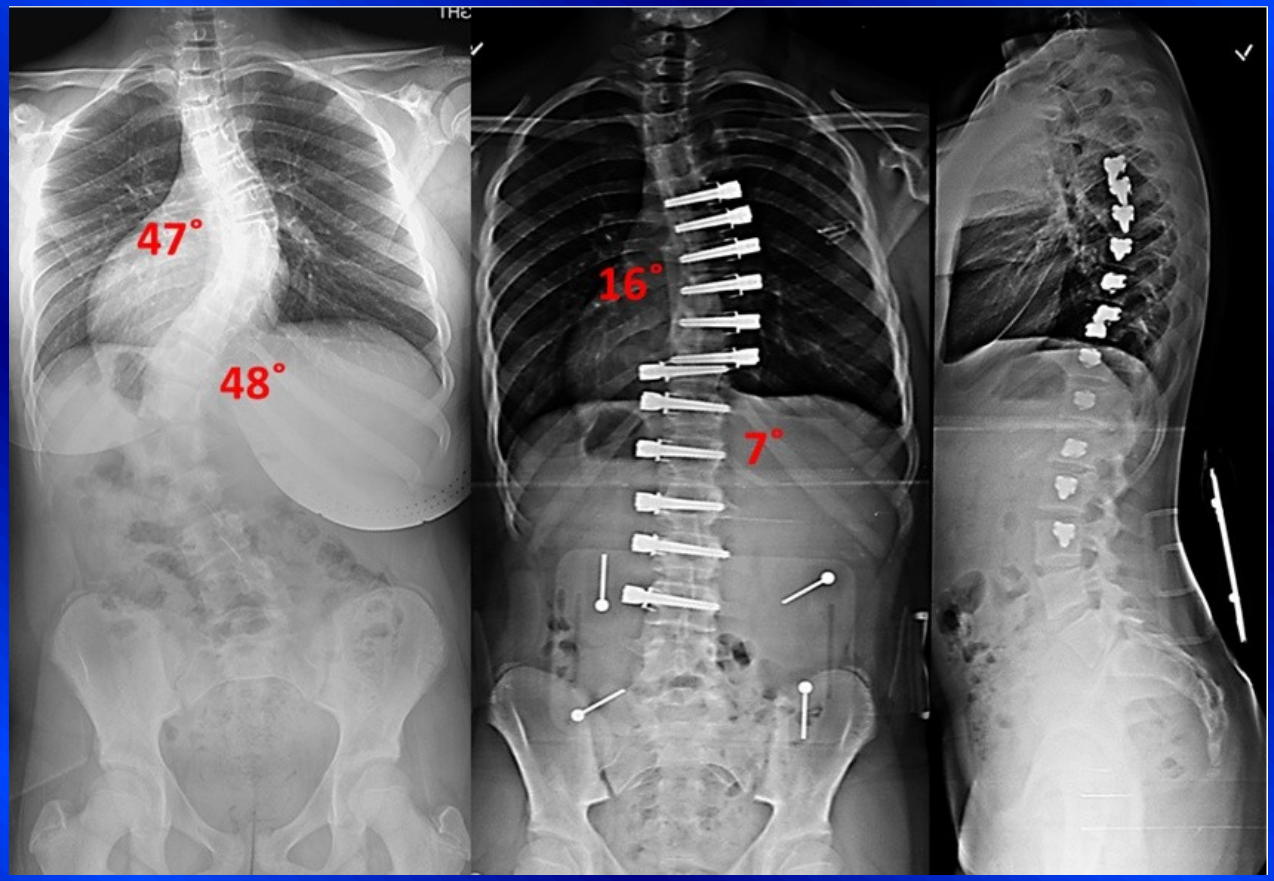
Repeated surgery is needed

Magnetically Controlled Growing Rods for Pediatric Scoliosis
No other surgery



Growth-Guided Devices for Pediatric Scoliosis

Instrumentation designed to correct the scoliosis while allowing the child to grow.



Vertebral Body Tethering:
Fusionless Pediatric Scoliosis Correction

Congenital scoliosis

- from the childbirth
- asymetric growth of the spine
- more often fast progression

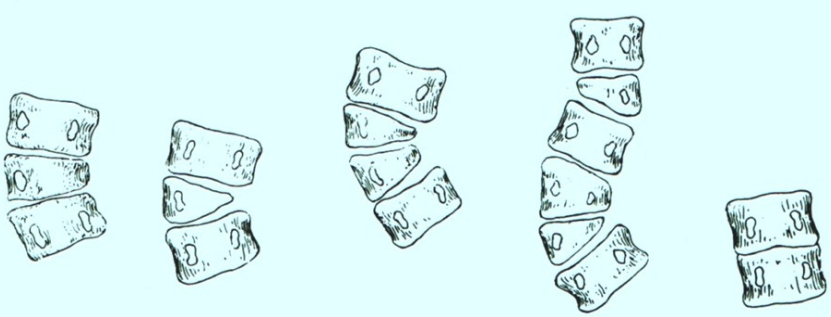
Etiology:

1. Disturbance of the form
2. Disturbance of segmentation
3. Combined disturbance

- Management: surgery
  - fusion
  - osteotomy + fusion
  - hemivertebrectomy

Disturbance of the form

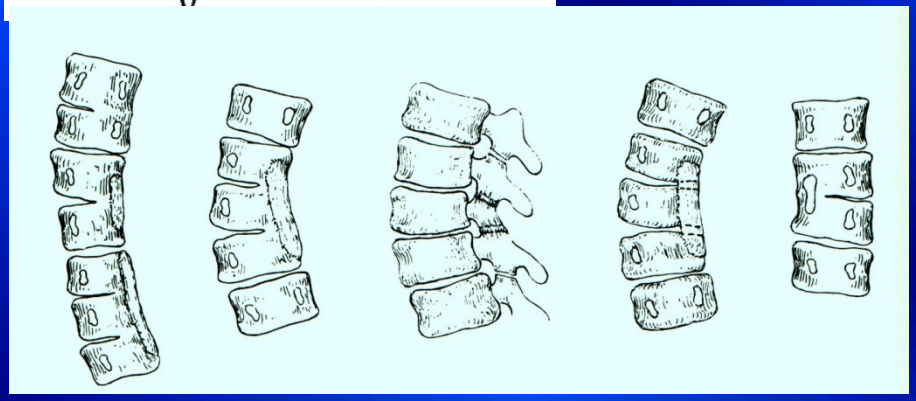
Wedge vertebra
Hemivertebra



Hemivertebra

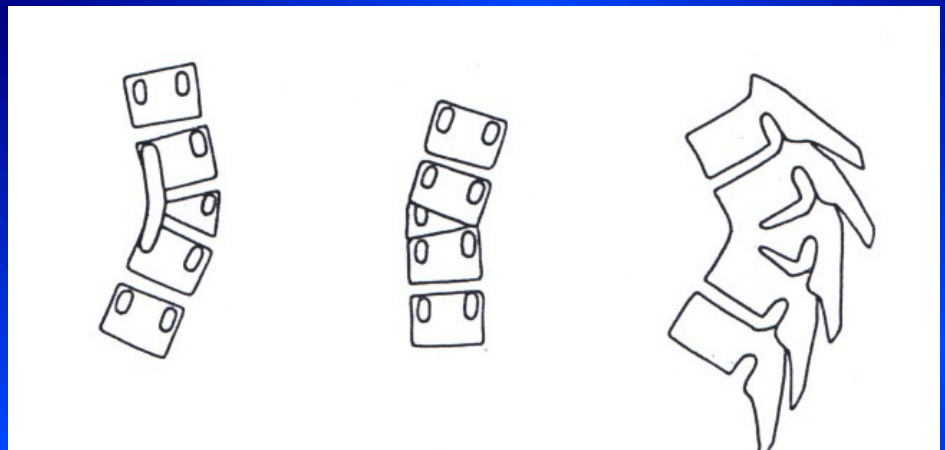
Disturbance of segmentation

Nonsegmented bone rod



Bone block

Combined disturbance



Neuromuscular scoliosis

Neuropatic: recebral palsy polio,
spinal dysraphism

Myopatic: muscles dystrophy,
arthrogryphosis

„ paralytic scoliosis“

Long, severe curves

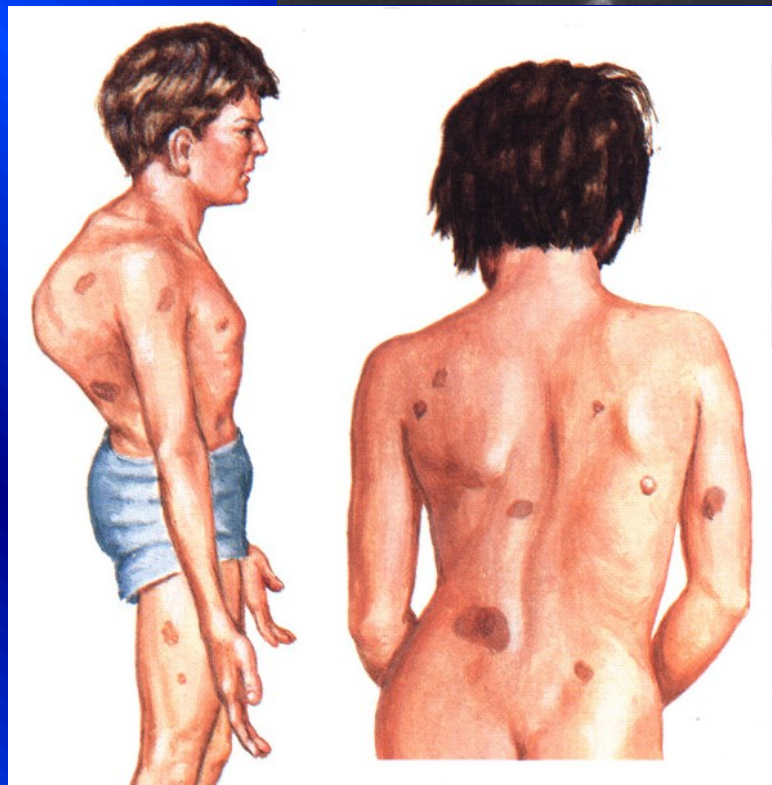
Therapy:
Surgery, long fusion

Scoliosis in neurofibromatosis

- short curve
- atypical shape of vetebrae
  severe rotation
- changes of ribs

Typical:
Progressive
Surgery is necessary

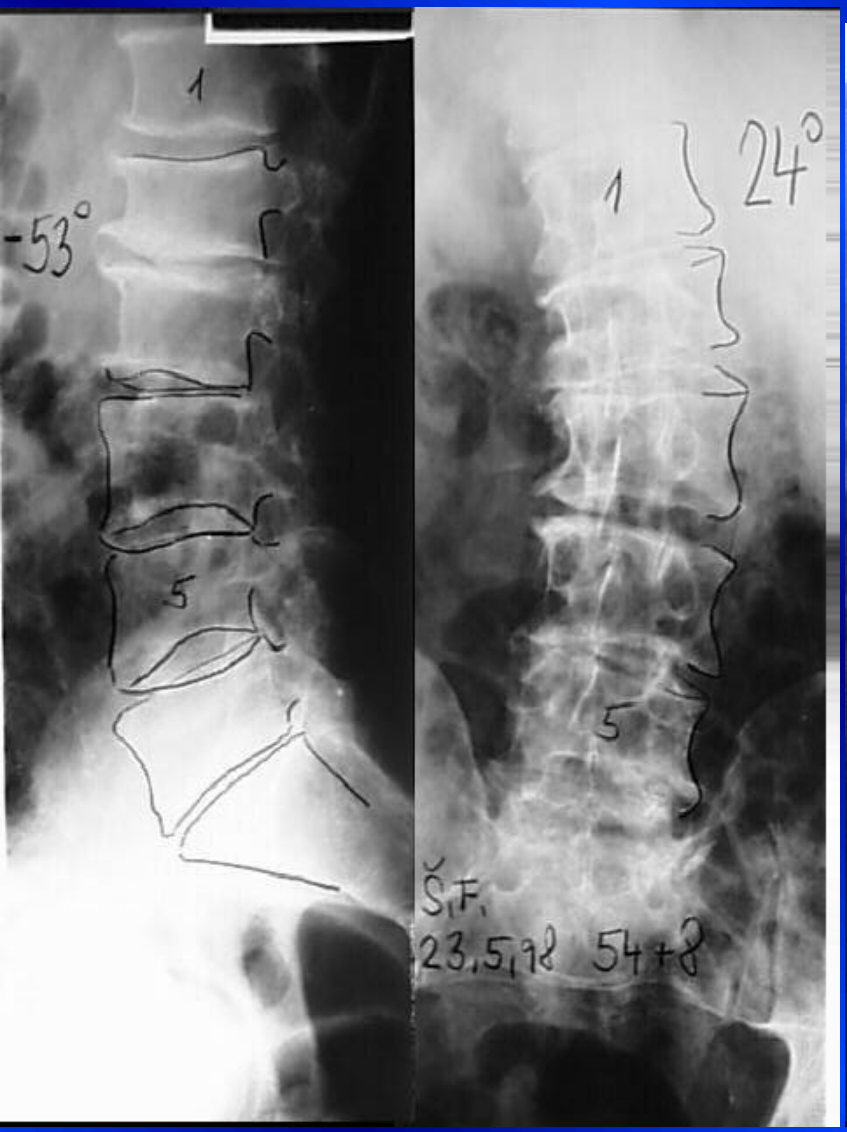
Atypical:
Progression as in idiopatic scoliosis- treatment the same

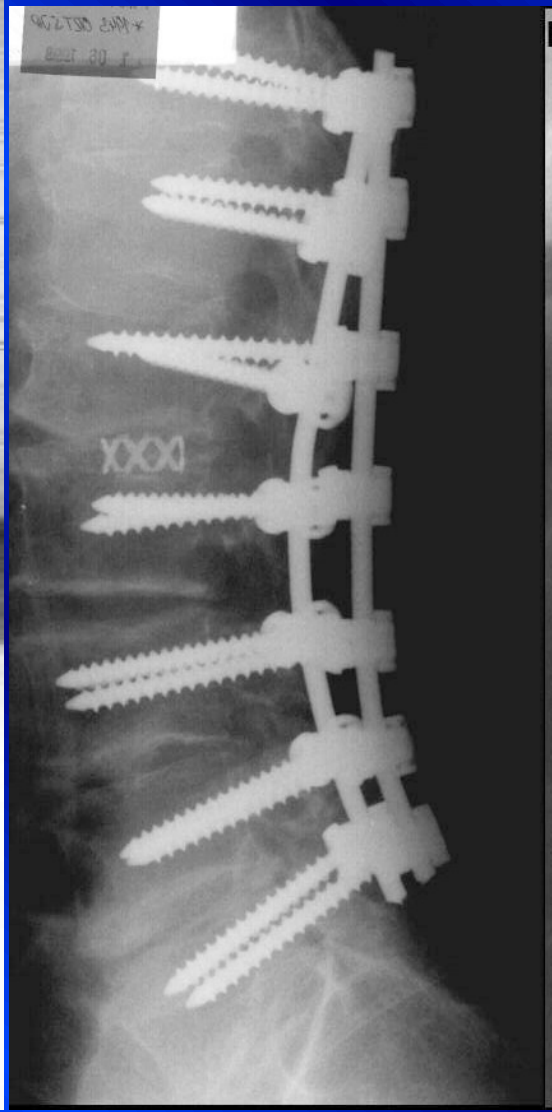


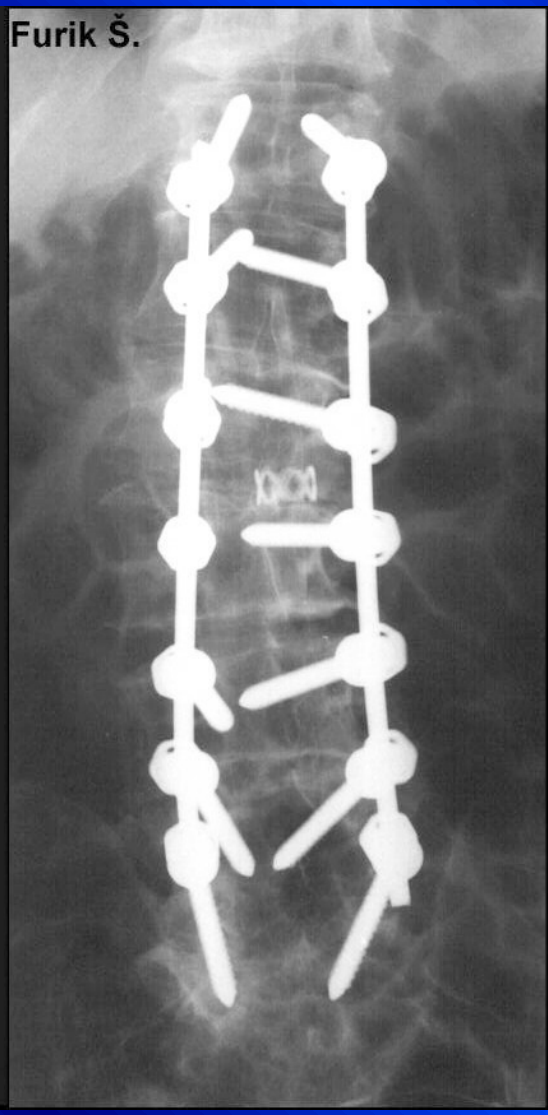
Secondary scoliosis

- Osteogenesis imperfecta
- Spondyloepiphyseal dysplasia
- Diastrophic nanism
- Rickets
- Marfan syndrom
- TB
- Injuries
- Degenerative scoliosis

Degenerative scoliosis







Nonstructural scoliosis

- Postural
- In sciatica
- Tumors
- Spondylodiscitis
- Leg length discrepancy
- Contractures in hip region
- Hysterical

Pathological kyphosis

- Congenial
- Neuromuscular
- Juvenile kyphosis

Others

- congenital deformity (achondroplasia, mucopolysacharidosis)
- postraumatic (+ after laminectomy)
- after spondylodiscitis, TB)
- in tumors
- in osteoporosis, osteomalatia
- Postural kyphosis

Juvenile kyphosis

- 0,5 - 8 % of population
- boys more often
- age 12-18 years
- Etiology- idiopatic, multifactorial
- distal thoracic region more often

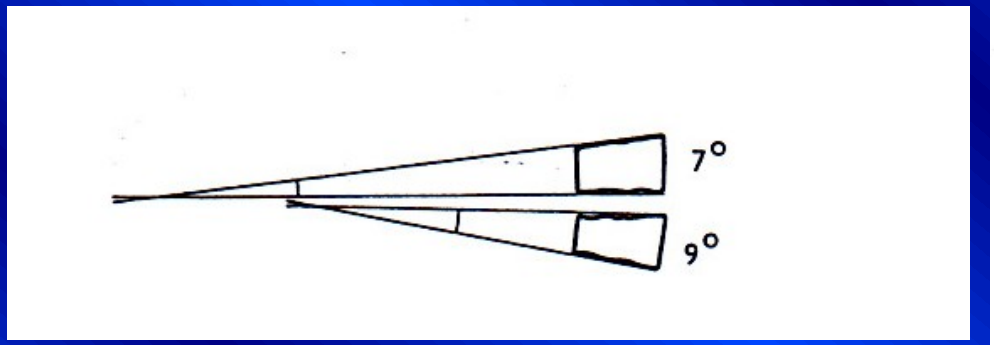
Juvenile kyphosis

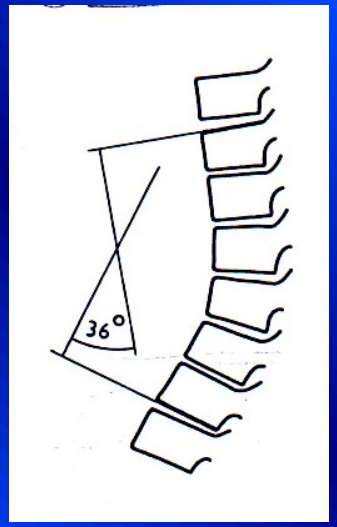
- Increased thoracic kyphosis above 40°
- Fixed kyphosis (hyperextension test)
- Pain
- Limited movements
- Limited dynamics of the spine
- Progression of degenerative changes

Juvenile kyphosis

X ray findings:

- kyphosis above 40°
- Irregularities of end plates
- Schmorl´s nodes
- Narrowing of intervertebral disc spaces
- Wedge deformity above 5°
  at least in 3 vetebrae





Juvenile kyphosis

Stages

- I. stage - florid (9-12 years, flexible, round back, painful spine, muscle changes)
- II. stage- deformity (13-16 years, fixed advanced X ray changes)
- III. stage- consequences (chronic back pain)

Juvenile kyphosis

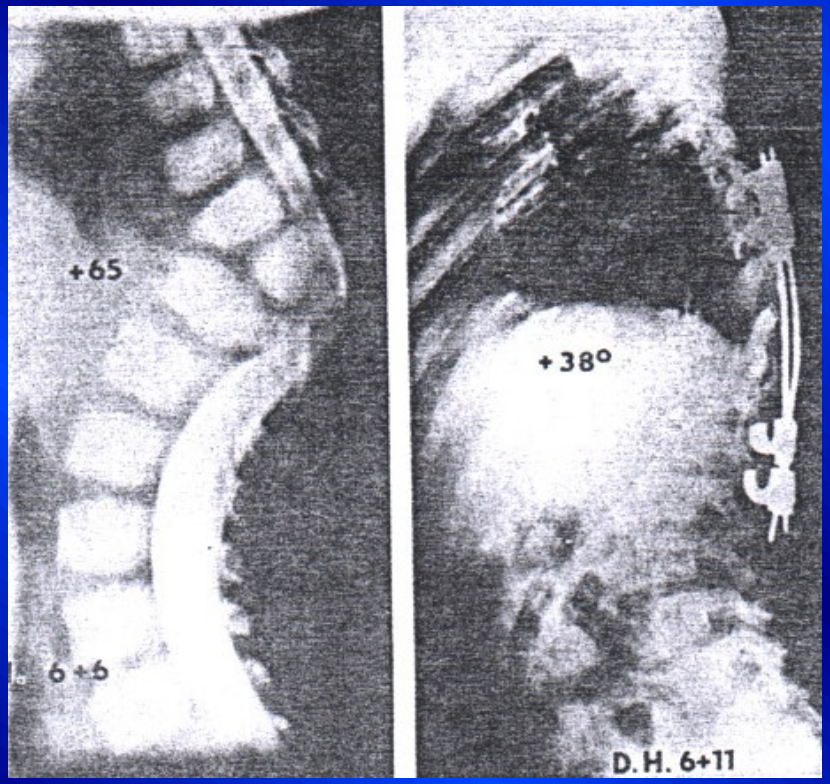
Therapy:

- Conservative
  - – exercise therapy
  - - orthesis
  - - plaster of Paris brace, later on orthesis + exercise
  - - in florid stage- no sports, no weightbearing
  - - NSAD, analgetics, myorelaxans

- Surgery + bracing + exercise

Congenital kyphosis

Etiology
- Disturbance of the form
- Disturbance of segmentation
- Combined disturbance



Therapy:
- to prevent progression
- Surgery in progressive curves
- Spondylodesis – fusion + bracing
  till the end of the growth
- anterior osteotomy with correction of the curve
  + posterior fusion with instrumentation

Postural kyphosis

- in muscle imbalance
  lack of exercise, lack of sports
  sedentary way of life
- weak trunk and abdominal muscles
  increased lumbar lordosis and thoracic kyphosis

Management:

- regular exercise of muscles- trunk, abdominal ..
- sports activities
- adherence to active life
- profesional fysiotherapy