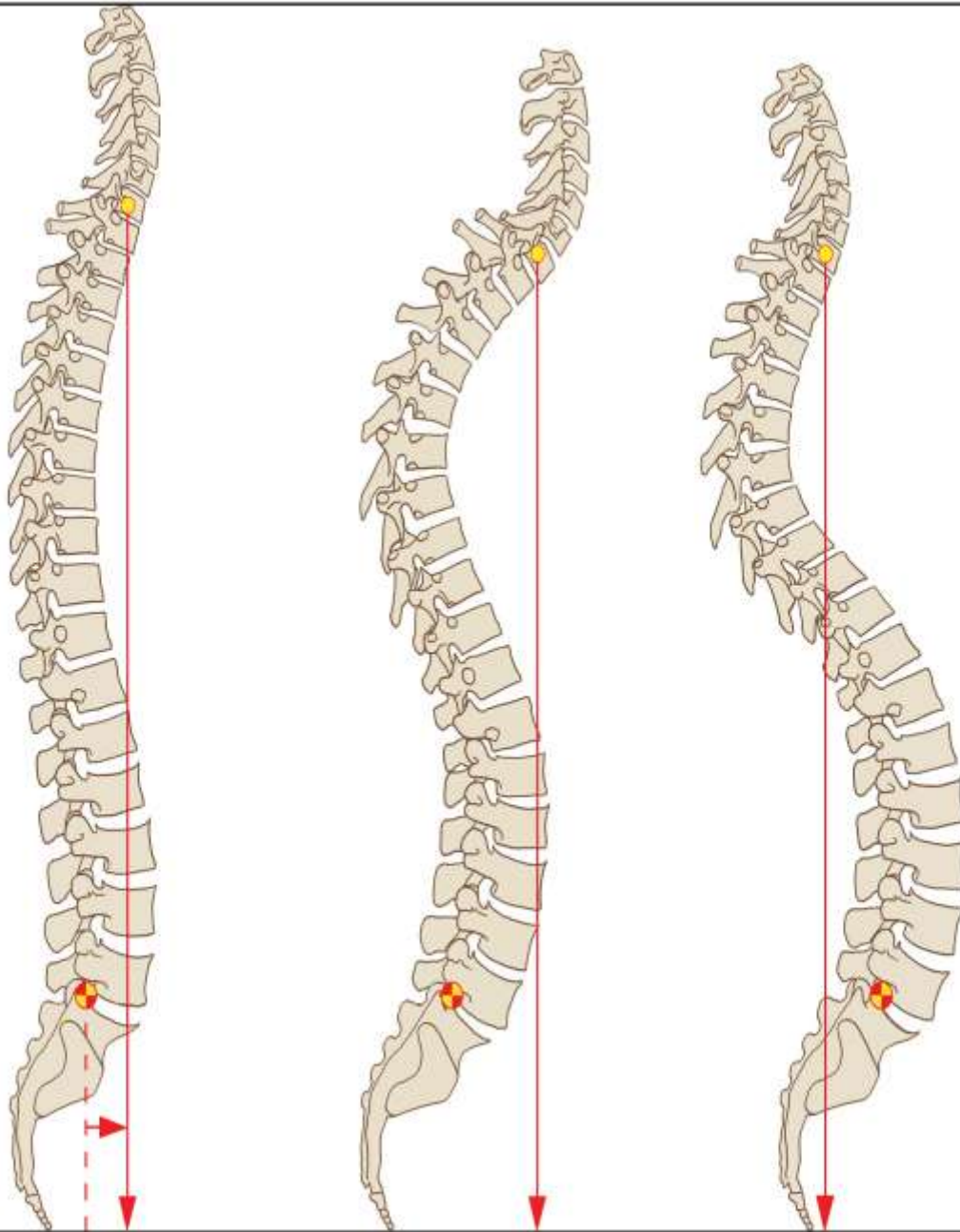


11.Symposium der Oesterreichischen  
Gesellschaft für WS Chirurgie  
Wien, 30.1.2010



# Kyphose in der Adoleszenz

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Klinik Bern, Bern (Schweiz)  
McGill University ,Montreal (CND)



- a) The spine is sagittally balanced, when the plumb line from C7 falls into the posterior corner of the S1 endplate
- b) Spinal imbalance is positive when the line falls in front of this point.
- c) It is negative when the plumb line falls behind this point.

# **Scheuermann Kyphosis:** iuvenile and adolescent Kyphosis (jugendlicher Rundrücken)

**Scheuermann described 1922 the „Rundrücken“ which appears more frequently in boys than in girls in the prepuberty and puberty**

**Can be without pain**

**Affects the thoracic spine with a kyphosis and the lumbar spine with a loss or lordosis**

**Hormonal dysregulation because it is combined with other disorders which have this origin:**

**Epiphysiolysis of the hip, genua valga of the puberty and the painful pes valgus et planus in the puberty, and hypopituitary long stature etc.**

**Hereditary disposition: families with higher frequencies**

# Growth disturbance

**Increase of somatotropic growth hormones combined with  
Insufficient production of sexual hormones responsible for:**

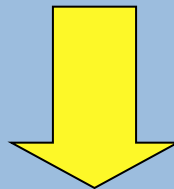
- **irregular formation and development of the endplates and growth rims**
- **irregular ossification and formation of defects (Schmorl's nodules) (former Chorda) big ant. growth rim defects.**
- **narrowing of the disc space → decrease of the disc „ puffer „**
- **ant. part of the vertebral body with decreased growth → wedge or trapezoid formation → vertebral body → and kyphosis**

# Etiology

## \* Disturbance of enchondral ossification

### \* Causes

- mechanical
- genetic
- hormonal



### \* Result

- growth disturbance of vertebrae

# Kyphosis in Adolescence

**The sagittal alignment of the human spine develops during growth and shows great variability.**

**The range of thoracic kyphosis in healthy people range from 10 to 60 degrees. There are no evidence based “Norm values”**

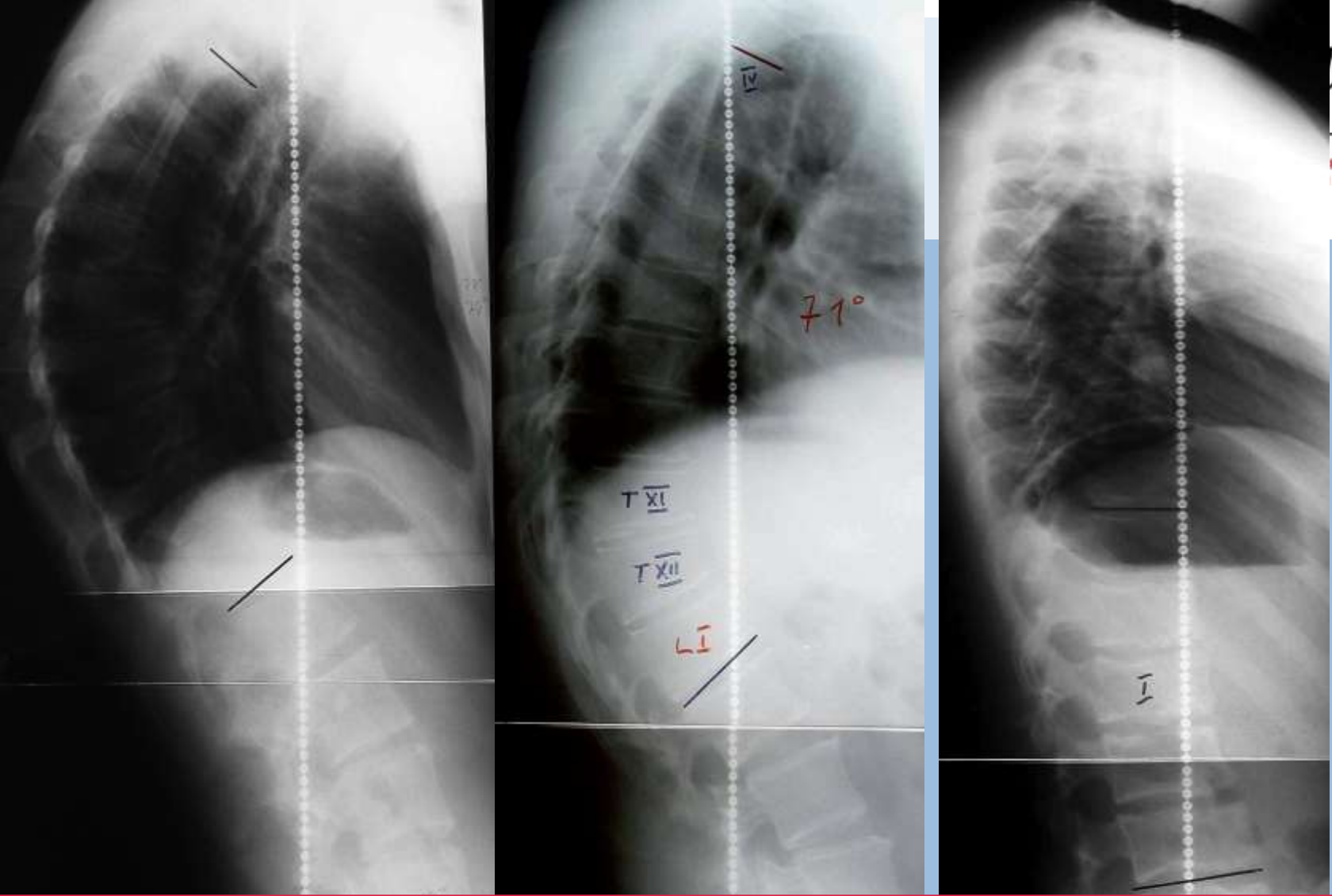
The classic juvenile kyphosis (**type I**) is a **rigid thoracic or thoracolumbar hyperkyphosis** due to wedge vertebrae development during adolescence.

The incidence is 1 – 9%.

Atypical juvenile kyphosis (**type II**), (“lumbar” Scheuermann’s Kyphosis) affects mainly the **lumbar spine** and is characterized by endplate changes or the vertebral bodies without a significant wedging and leads to **loss of lumbar lordosis (flat back)**.

## Diagnostic criteria for juvenile kyphosis (Type I)

- wedging of more than 5 degrees in one or more vertebrae in the thoracic or thoracolumbar region
- disc space narrowing
- endplate irregularities
- increased thoracic or thoracolumbar kyphosis



b  
 ERSITÄT

**Types of juvenile kyphosis**  
**a** Standing lateral radiographs of juvenile kyphosis Type I changes in the thoracic spine in an 18-year-old male and **b** thoracolumbar area in a 52-year-old male. Scheuermann's **c** Type II changes from L1 to L4 in an 18-year-old female gymnast. The thoracolumbar junction is slightly kyphotic. Note the decrease in thoracic kyphosis.

The sagittal profile develops during growth and changes throughout adult life

# Clinical Picture

## Rigid hyperkyphosis



**Pain +/-**



**Hyperkyphosis**



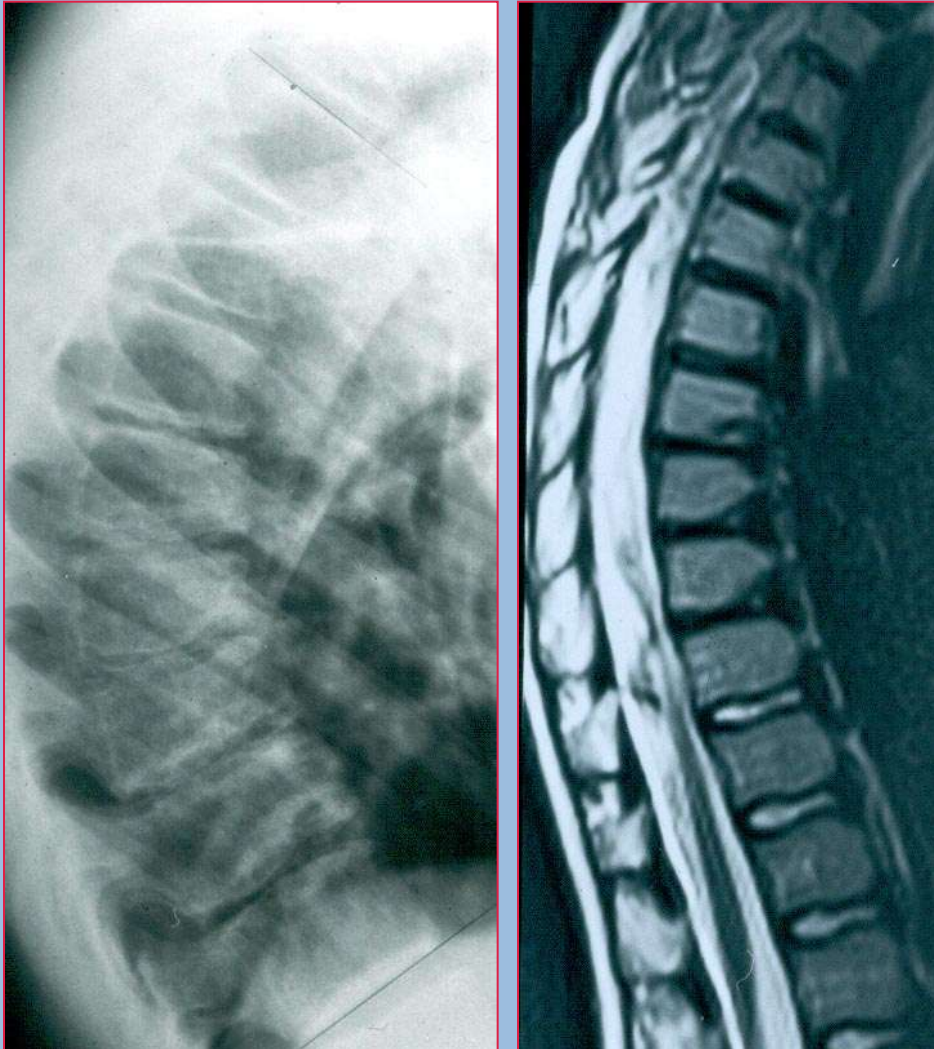
**normal**



**Different levels of apex**



# Imaging



Wedge vertebrae

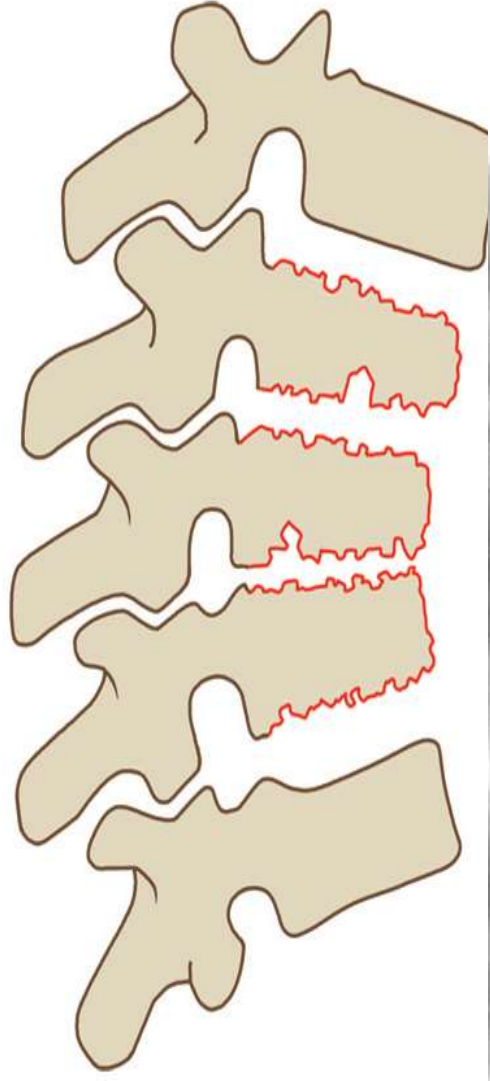
— hyperkyphosis

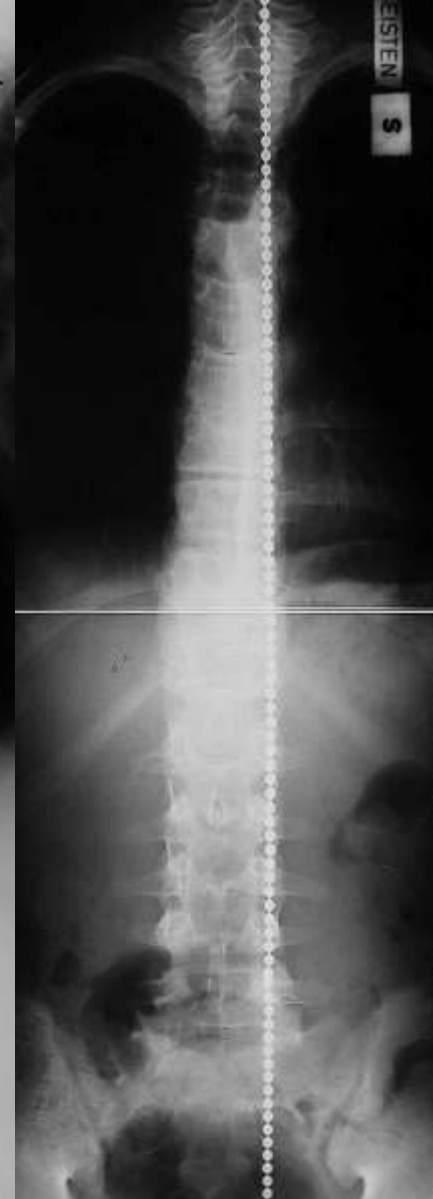
Irregularity of endplates

Length of vertebral bodies  
increased

Disc height decreased

Schmorl's nodes





# Functional x-ray

**In juvenile kyphosis**, MRI is the imaging modality of choice to demonstrate:

- irregularity of the ossification
- wedge shape of the vertebral bodies
- premature degeneration of intervertebral discs
- Schmorl's nodes
- spinal cord compression at the curve apex (in severe cases)



### **MRI findings**

**a** MRI characteristics of juvenile kyphosis at different ages. In a 14-year-old boy endplate defects, disc narrowing and disc dehydration are visible.

**b** In a 17-year-old boy vertebral wedging and disc space narrowing

**c** In a 57-year-old male more pronounced. the final stage is visible. Note kinking of the myelon over the apex of the relatively sharp-angled kyphosis. The patient has no neurological symptoms.



**a**



**b**



*u*<sup>b</sup>

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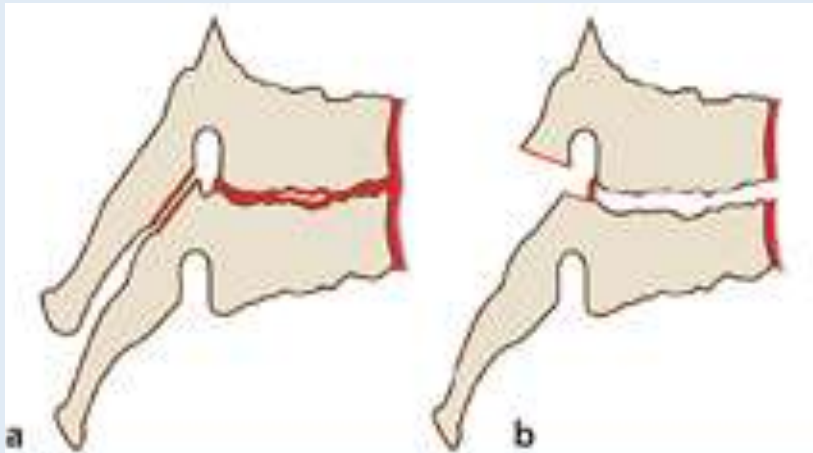
## Structural changes in juvenile kyphosis

### Anterior column

- wedged vertebral bodies
- disc space narrowing
- premature disc degeneration
- contracture of the anterior longitudinal ligament

### Posterior column

- relative overgrowth of posterior elements (broad laminae, long spinous processes)
- reduced mobility of intervertebral joints
- narrow interlaminar spaces



**Typical for the thoracic and Thoracolumbar spine**

# Juvenile Kyphosis

## Differential diagnosis of juvenile kyphosis

- idiopathic hyperkyphosis (“roundback”)
- neuromuscular (paralytic, spastic)
- spinal cord tumor
- post-laminectomy kyphosis
- post-traumatic kyphosis
- connective tissue disorders
- congenital kyphosis
- skeletal dysplasia
- infection (tuberculosis, pyogenic, fungal)
- tumor

# Scheuermann's Kyphosis



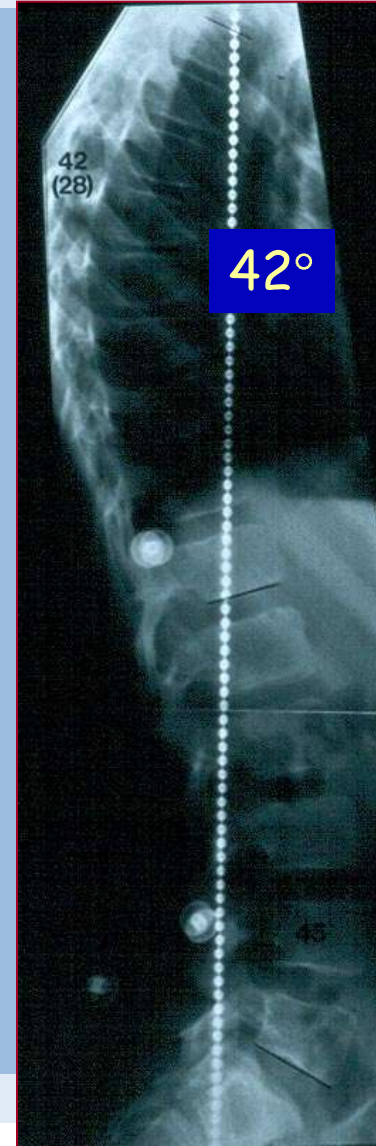
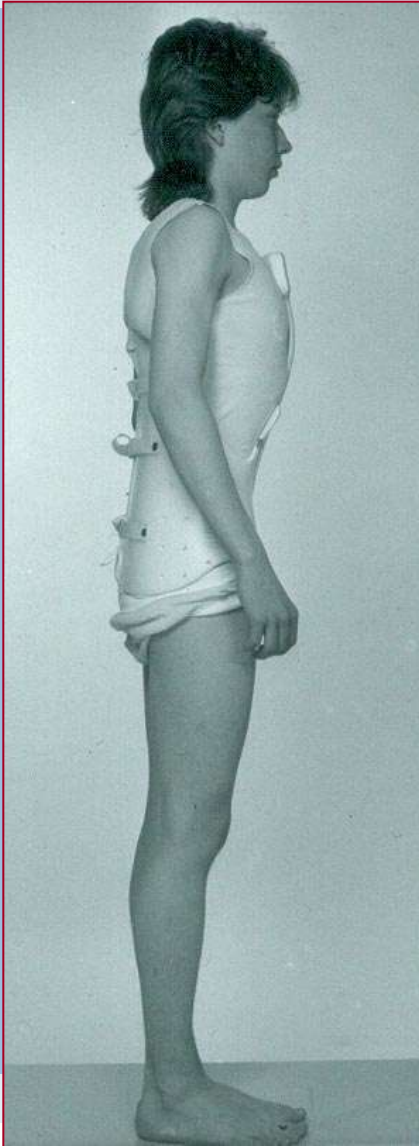
- > Natural history is benign
- > Cosmesis
- > Mild pain is common
- > Severe pain is rare

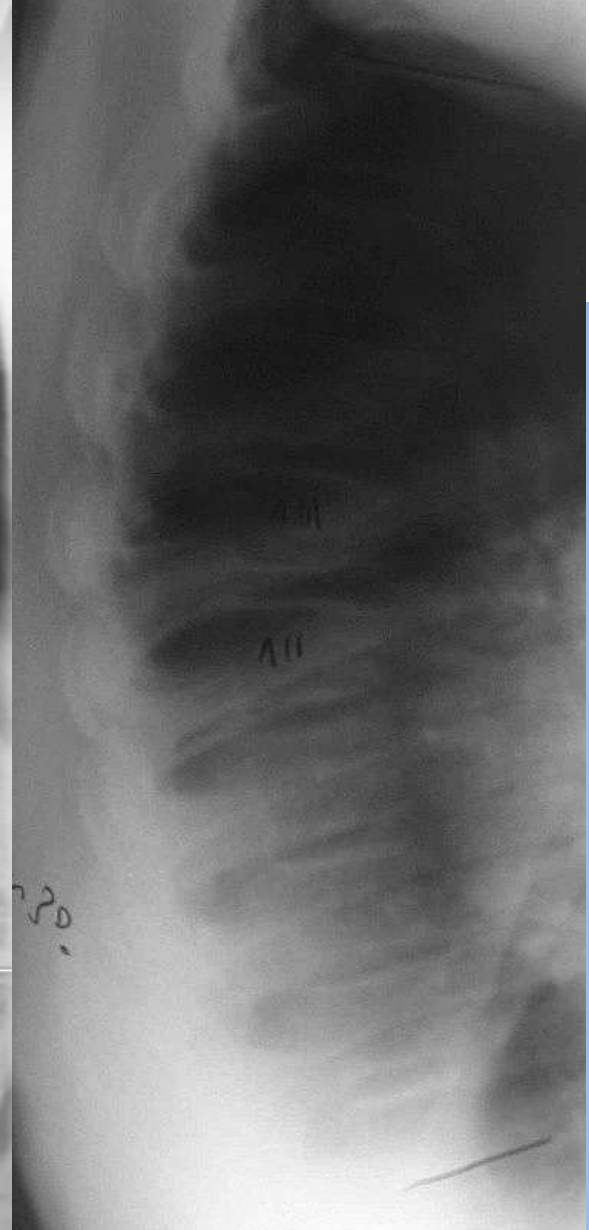
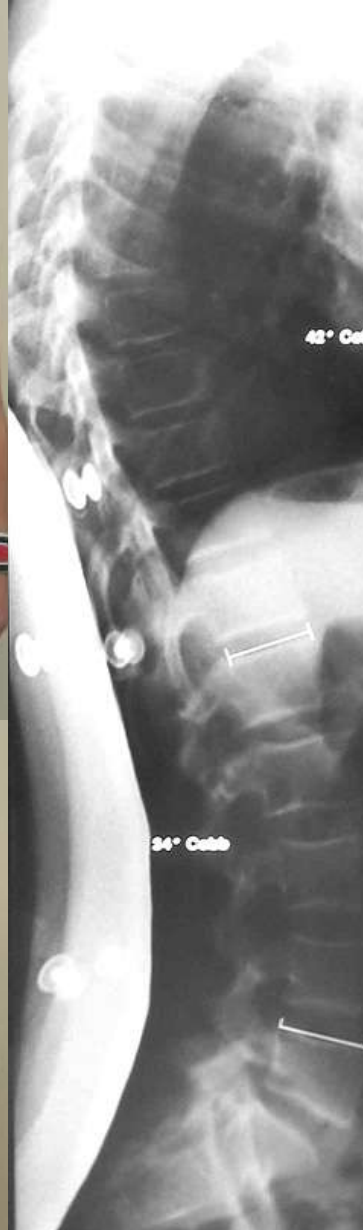
# Non-Operative Treatment

- Exercises
- Bracing
- Casting

- \* Mobile deformity
- \* Growth remaining

# Brace Treatment





# Operative Treatment

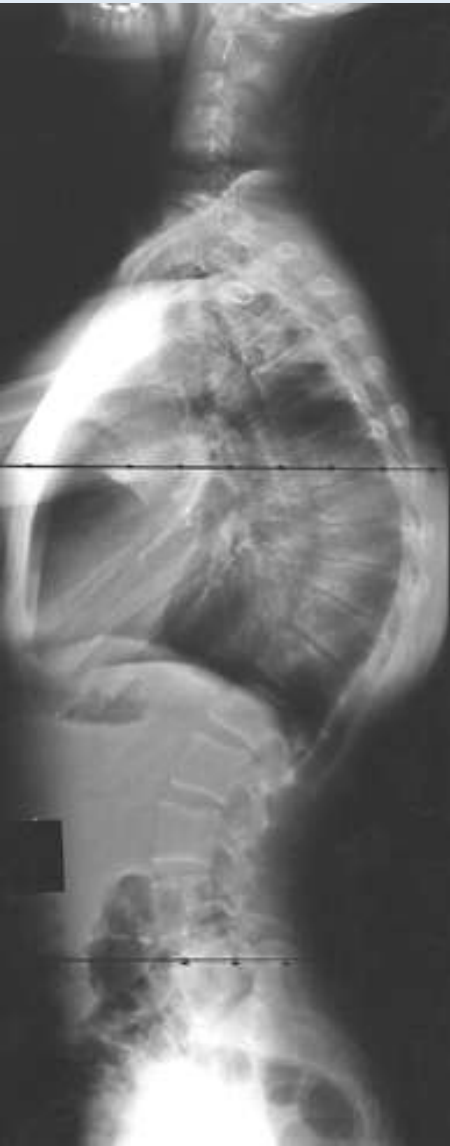
## Instrumentation/Fusion

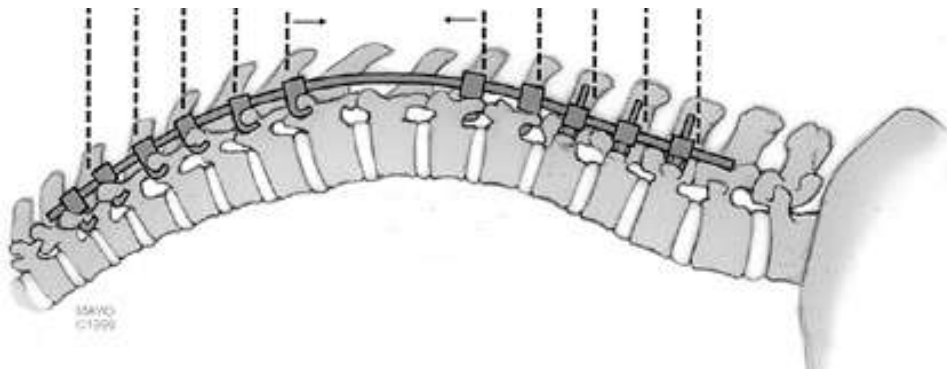
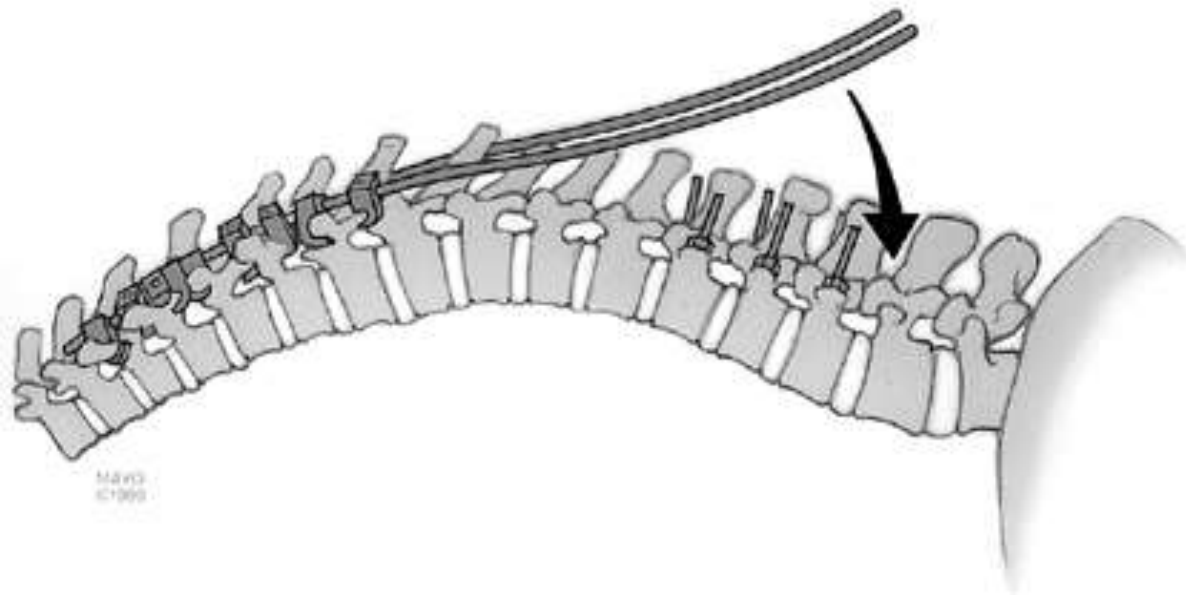
Severe rigid deformity and/or pain

**\* Posterior instrumentation/fusion**

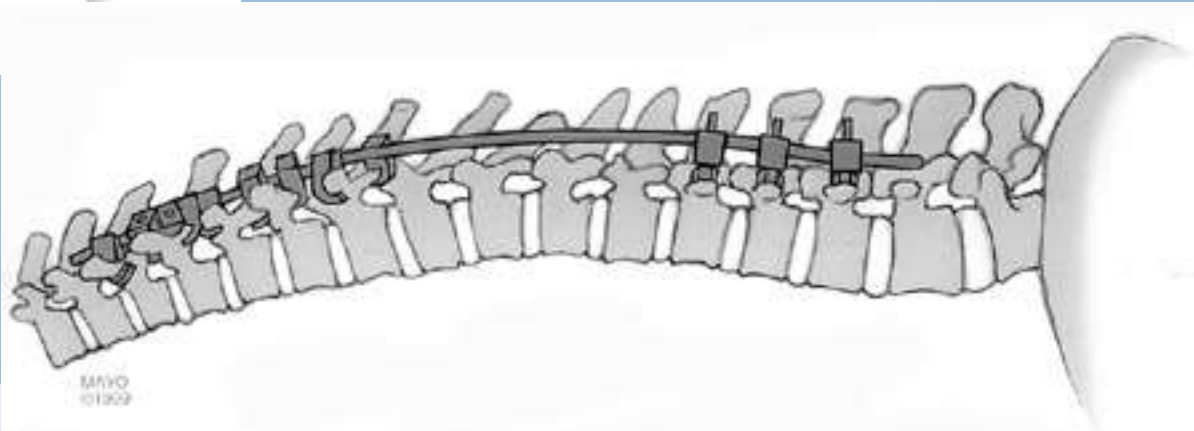
**\* Combined fusion**

# Posterior Surgery: Hooks or screws or hybrid?

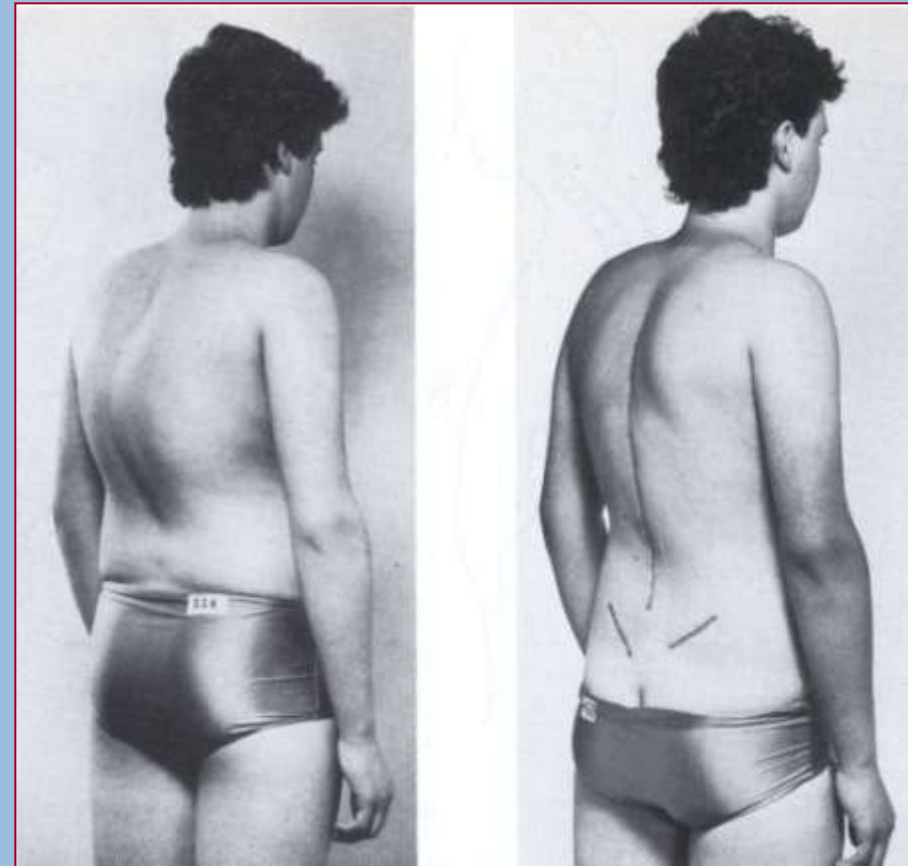
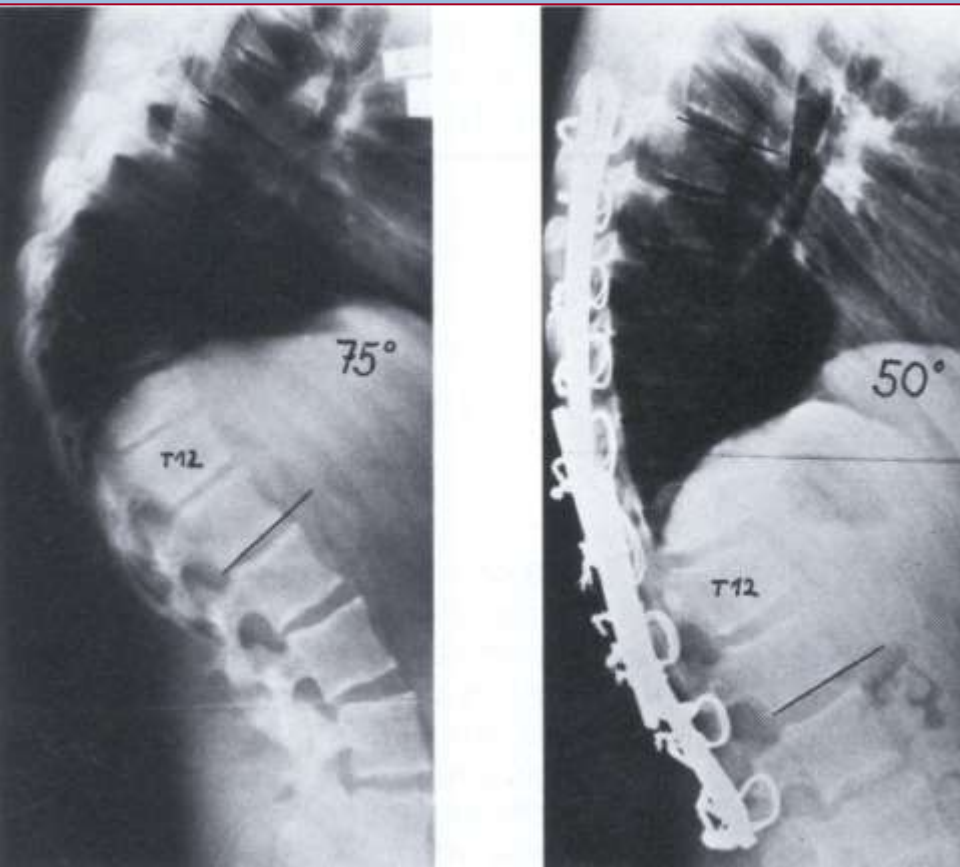




**Hooks only like originally  
Harrington: key is  
post.tension banding**

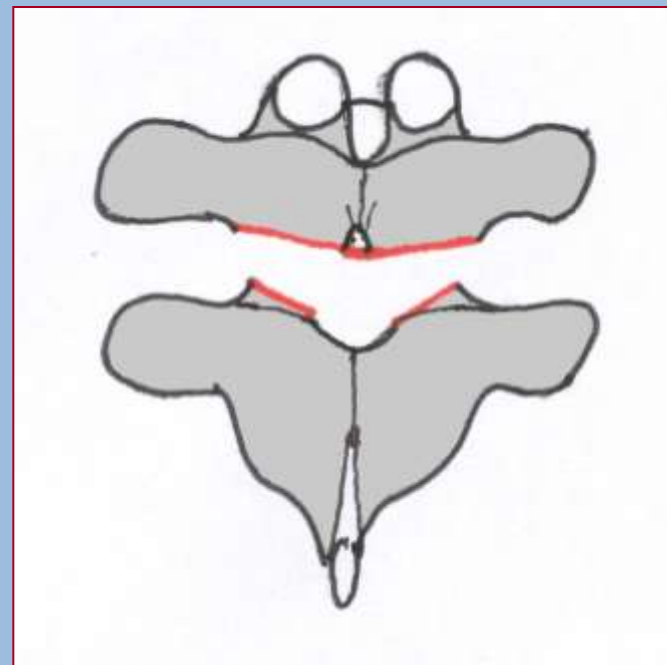
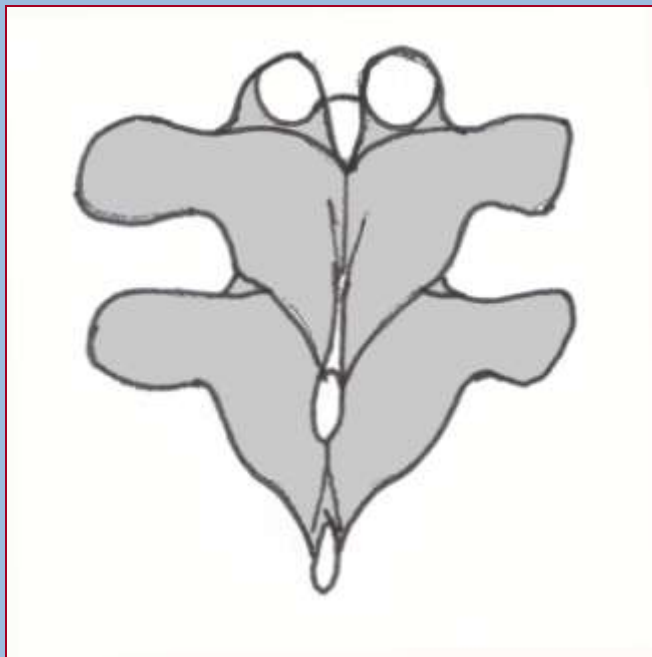


# Posterior Instr./ Fusion



# Posterior approach

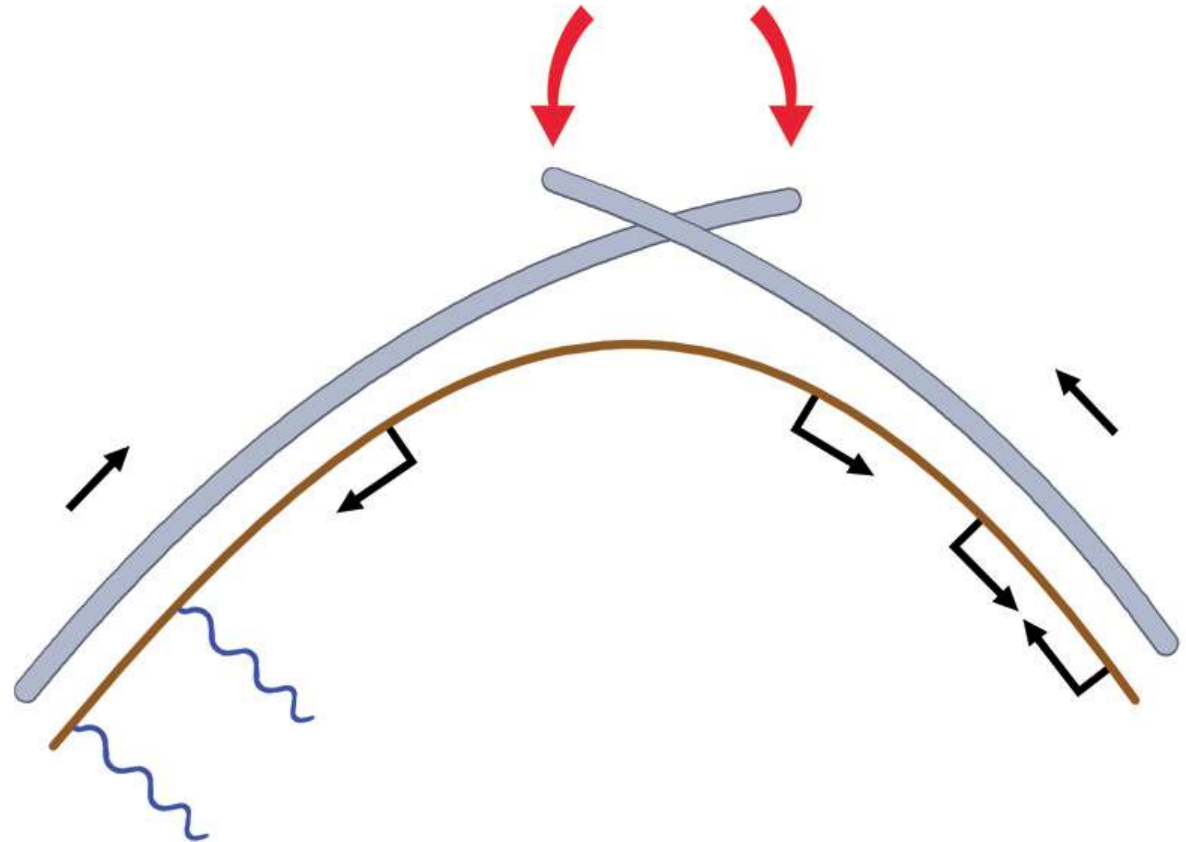
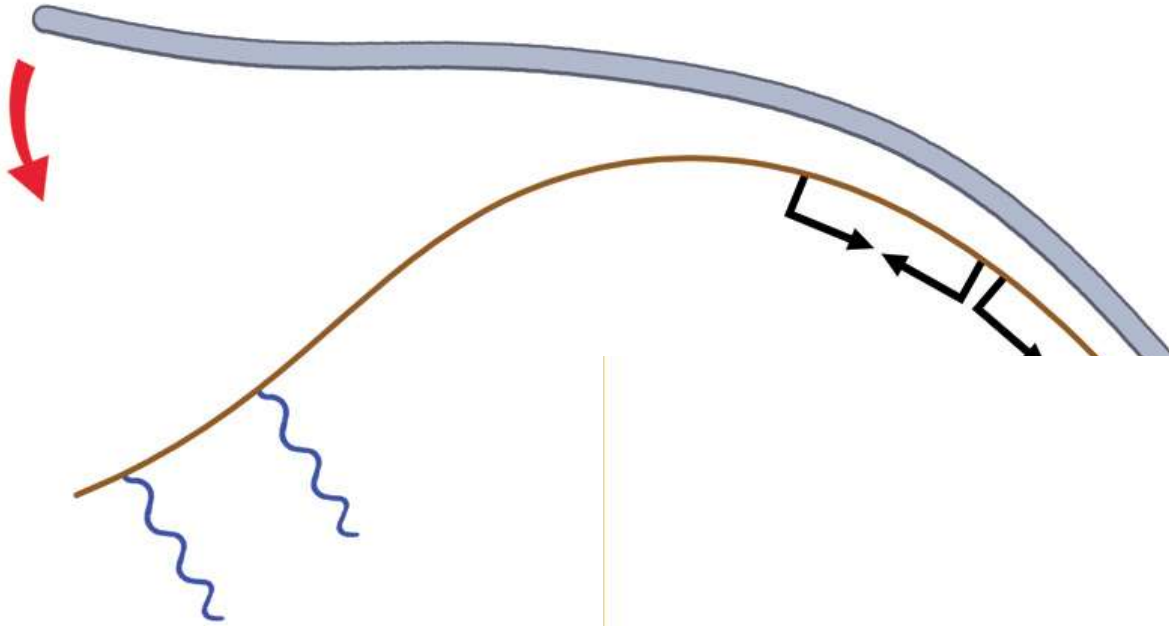
\* Resection of joints and laminae



# Posterior approach

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## Cantilever technique

Instrumentation/correction  
using cantilever and  
posterior tension band  
principle: **a** two-rod  
technique and **b** four-rod  
technique.

# Präoperative imaging

15 yrs old boy



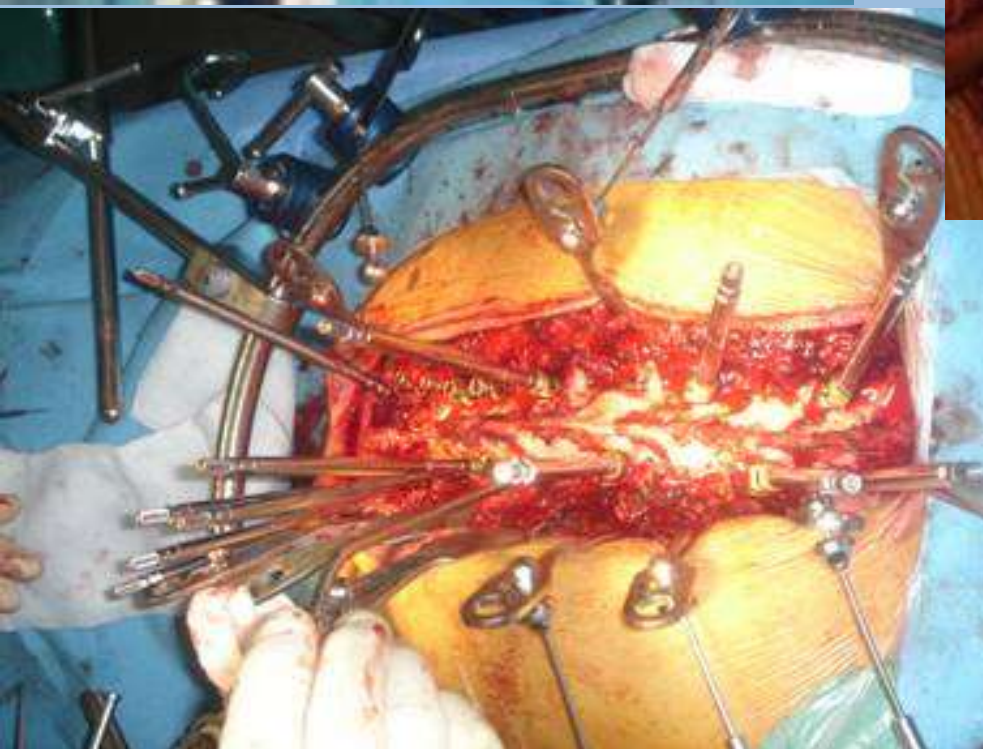


**With hypomochlion  
under the apex  
(Functional x-ray)**

# Intraoperative: posterior approach only



**Neuromonitoring**

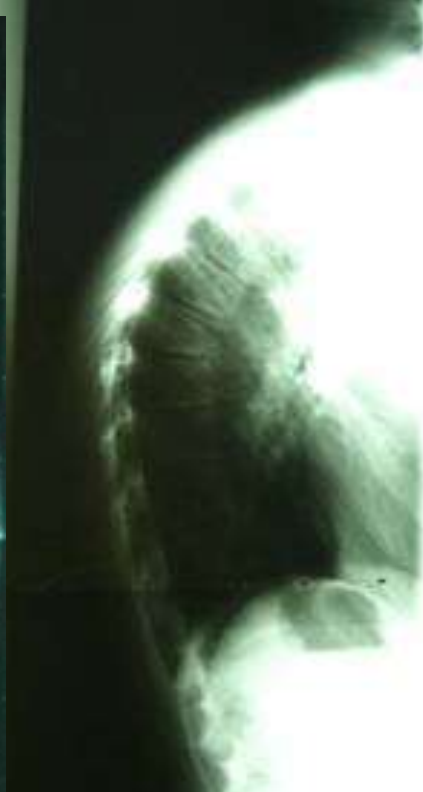




15. Februar 2010

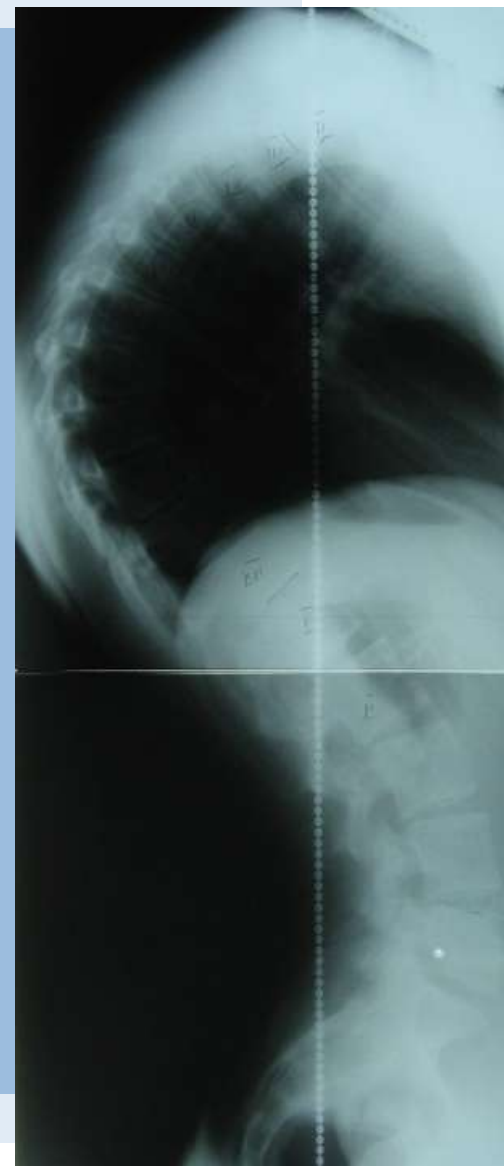


**Prä- und  
postoperative**

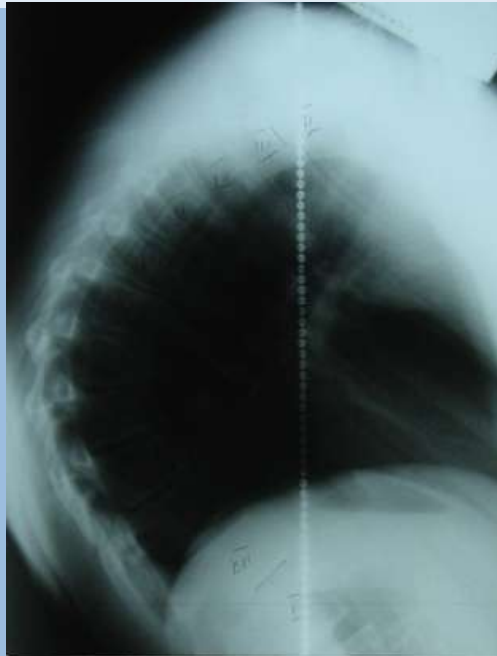


ITÄT

# Posterior approach



# Posterior approach



# Posterior approach



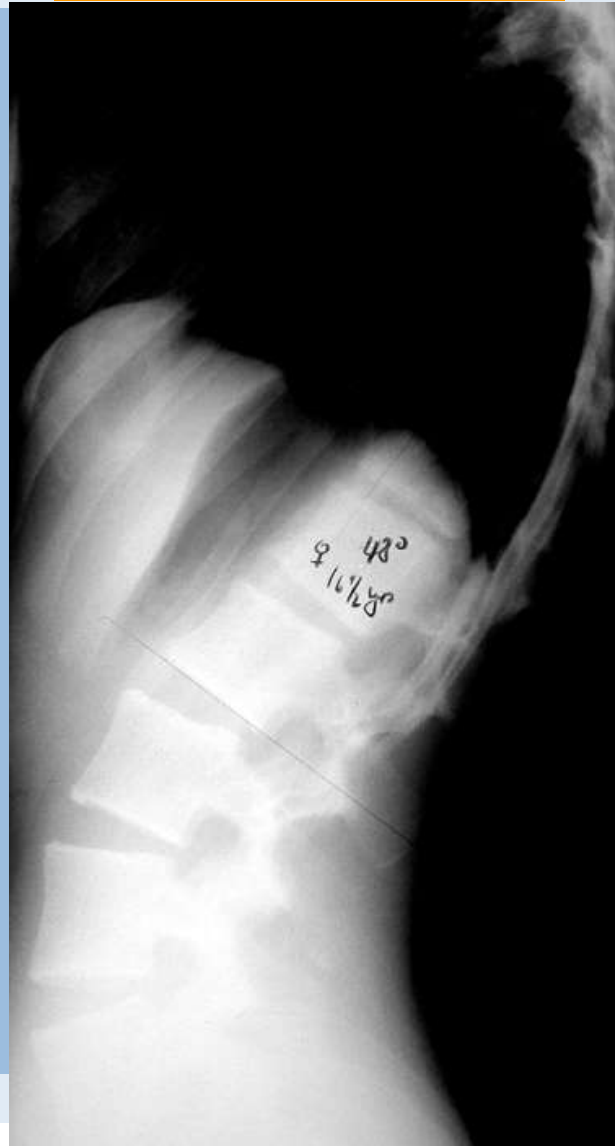
17,5 yrs old girl: post. approach only

$u^b$

13 yrs old



14,5 yrs old

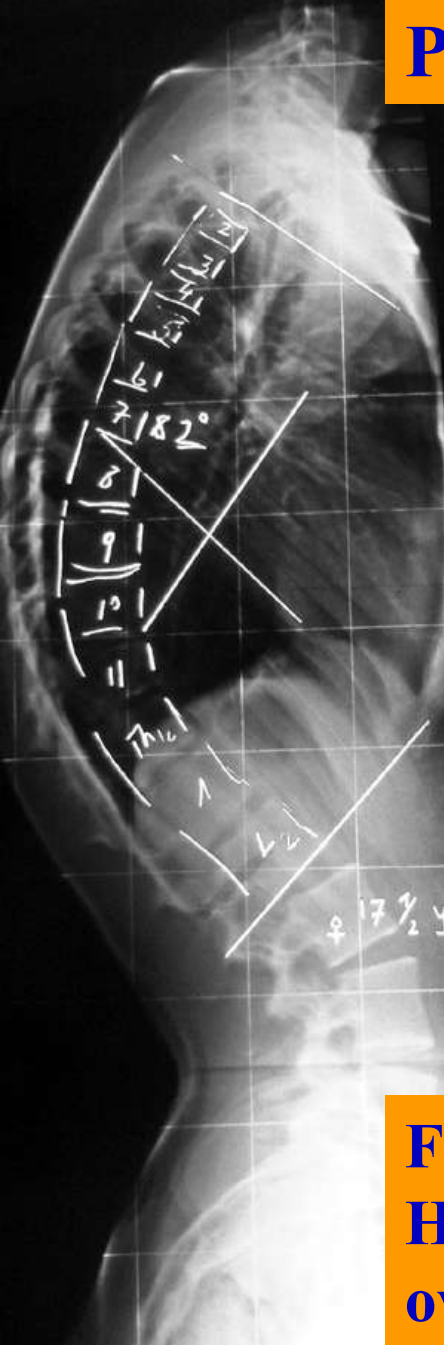


17,5 yrs old



Preop.

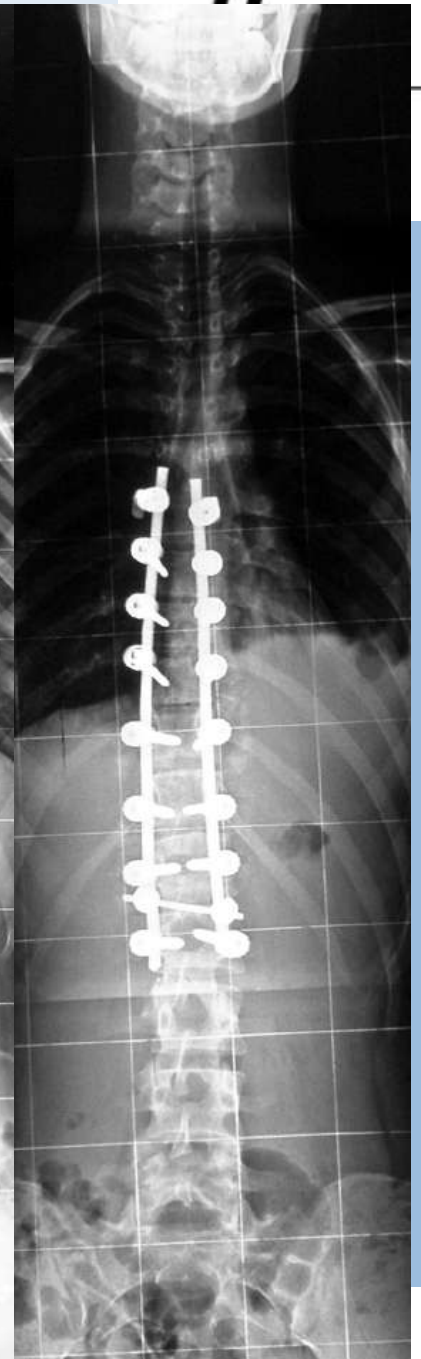
**17,5 yrs old girl  
Post. Approach only**



**Functional x-ray:  
Hyperextyension  
over a hypomochlion**



**16 yrs old girl**  
**Post. Approach only**

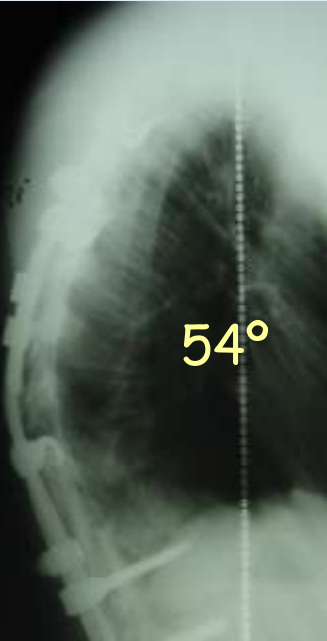
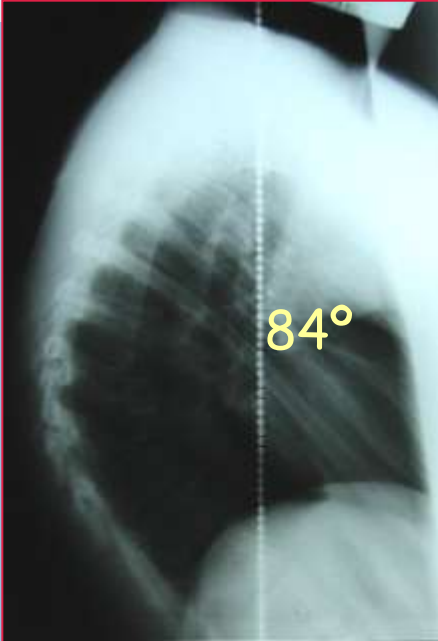


# Combined Fusion

- \* Anterior approach
  - Discectomy
  - Bone grafting

- \* Posterior approach
  - Resection of joints and laminae
  - Instrumentation/Correction
  - Fusion

# Combined Fusion



# Combined Fusion



**Thoracotomy:  
Open or  
endoscopically**

Vincent Arlet

## **Anterior thoracoscopic spine release in deformity surgery: a meta-analysis and review**

### Indications for thoracoscopic release in kyphotic deformities

In Scheuermann's disease the classical indications for surgery are curves of more than 75°. The treatment of the deformity is still controversial and the need for anterior release of flexible curves is questionable given the availability of modern segmental instrumentation and the possi-

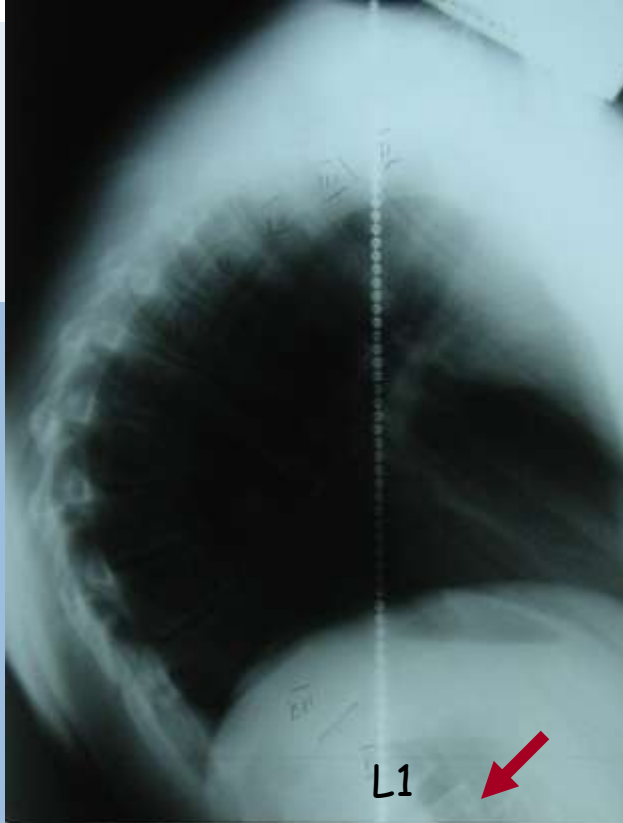
# Fusion Length

## \* Proximally

- Endvertebra of kyphosis

## \* Distally

- Include first lordotic disc



L1

L2



48° Cobb

41° Cobb

L1

L2

R. W. Poolman  
H. D. Been  
L. H. Ubags

## **Clinical outcome and radiographic results after operative treatment of Scheuermann's disease**

## Conclusions

Our series showed a relatively fair outcome after operative treatment in Scheuermann's disease. Collapse and loss of correction of the sagittal plane occurred after implant removal, and therefore the indication for instrumentation removal in patients with painful prominence of hardware should be discussed carefully with the patient. The indication for surgery in the patient with Scheuermann's disease can be questioned if one looks at the fair overall results of the presented series.

# Junctional Kyphosis

**\* Overcorrection**

**\* Fusion too short**

# Complications

- \* Dura lesion
- \* Spinal cord damage
- \* Lamina fracture
- \* Instrument failure
- \* Loss of correction

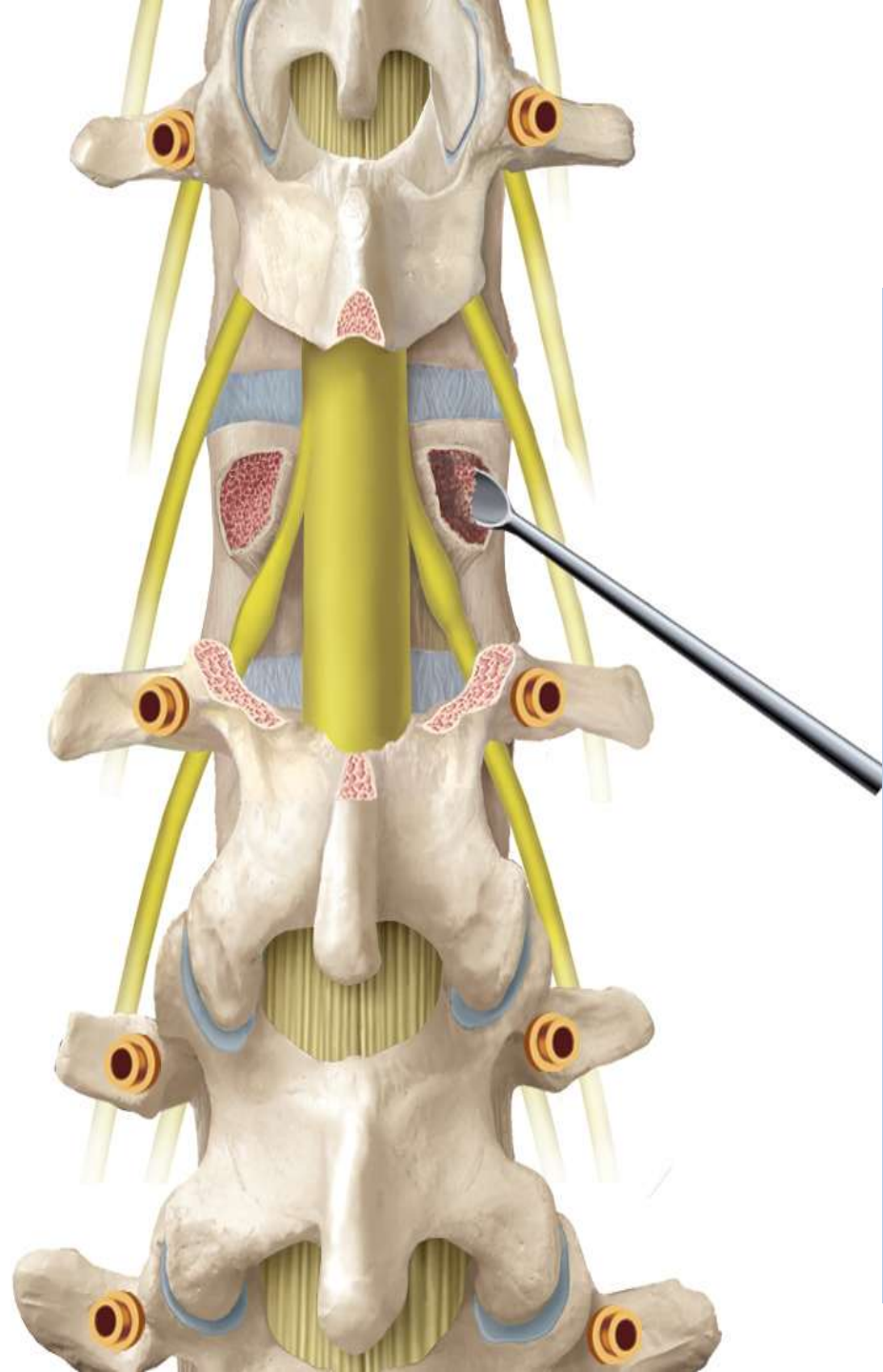
# Lumbar "Scheuermann's"

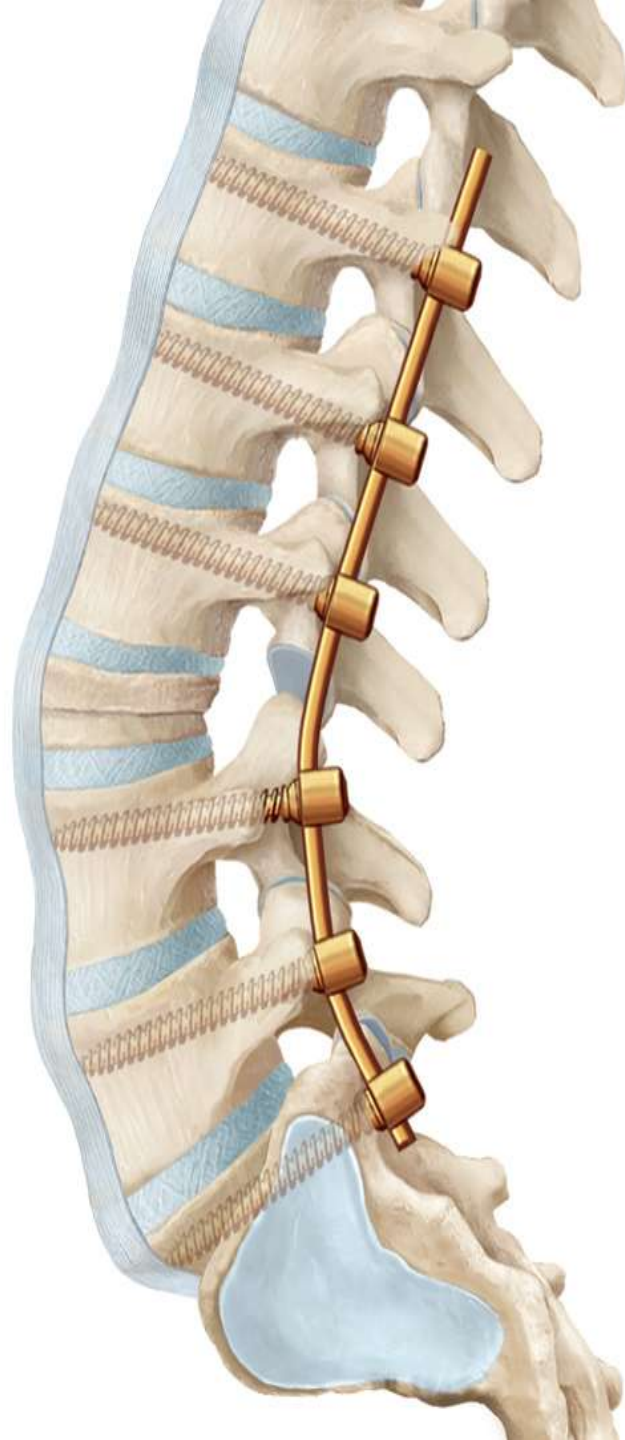
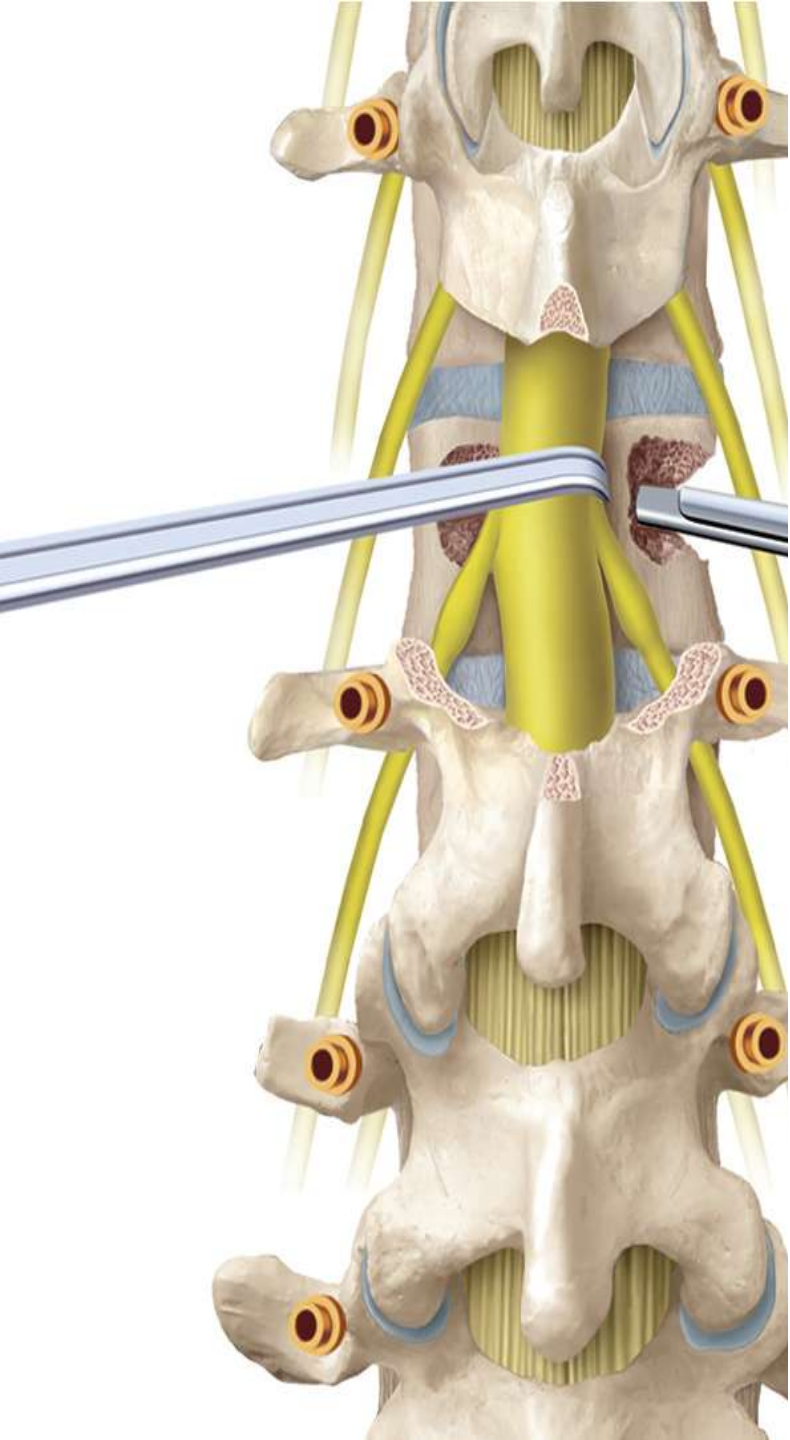


# Lumbar "Scheuermann's"

= Osteochondrosis juvenilis lumbalis  
(EDGREN)

- \* Mechanical aetiology (gymnasts)
- \* Symptoms more frequent (?)
- \* Spinal stenosis (?)





## Conclusions

- benign deformity
- cosmetic impairment
- severe pain is rare
- early detection
- brace treatment during growth
- rare indication for operation

# Core Messages

- ✓ **Scheuermann's disease (Type I, "classic" Scheuermann's)** is a thoracic or thoracolumbar hyperkyphosis due to wedged vertebrae developing during adolescence
- ✓ **Atypical Scheuermann's disease (Type II, "lumbar" Scheuermann's)** affects the lumbar spine and/or the thoracolumbar junction. It is a growth disturbance of the vertebral bodies without significant wedging causing loss of lumbar lordosis or mild kyphosis

# Core Messages

**The sagittal profile of the spine is largely variable**

**Normal kyphosis is in the range of 10° to 60°**

**Thoracic kyphosis is more prominent in males**

**Lumbar lordosis is more pronounced in females**

# Core Messages

**Rigid thoracic hyperkyphosis is the cardinal physical finding**

**Distinguish juvenile kyphosis from idiopathic roundback**

**Juvenile kyphosis is diagnosed on standard radiographs**

**MRI is indicated in unclear cases or for surgical planning**

# Core Messages

- ✓ The natural history of the deformity is benign in the majority of cases
- ✓ Back pain is common but usually mild and rarely interferes with daily activities or professional career
- ✓ Lung function is impaired only in very severe deformities (>100 degrees)
- ✓ Diagnosis is based on the clinical picture and typical changes in plain lateral radiographs
- ✓ During growth, brace treatment is recommended in mobile deformities of between 45 and 60 degrees

# Core Messages

- ✓ Rare spinal cord compression is the only absolute indication for operation
- ✓ Relative indications for surgery are kyphosis greater than 70 degrees, pain, and cosmetic impairment
- ✓ The results of operative treatment are satisfactory in the majority of cases regarding pain and cosmesis
- ✓ The risk of severe intra- and postoperative complications should be weighed carefully against the benefits

# Core Messages

**Severe wedging does not develop in the lordotic lumbar spine**

**Back pain is activity dependent**

**Back pain is related to curve size and location**

*Thank You*

Aknowledgment:

Material has been used from contributions of **V. Arlet** and **D.Schlenzka** to the Textbook "Spinal Disorders" by N.Boos and M. Aebi, Editors, Springer Publisher, 2008

