

Epiphysiodesis and Growth Arrest in Scoliosis

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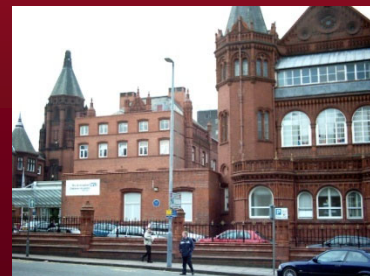
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Royal Orthopaedic Hospital

Birmingham Children's Hospital

Birmingham

England



History

MacLennan. BMJ 2: 864-866, 1922

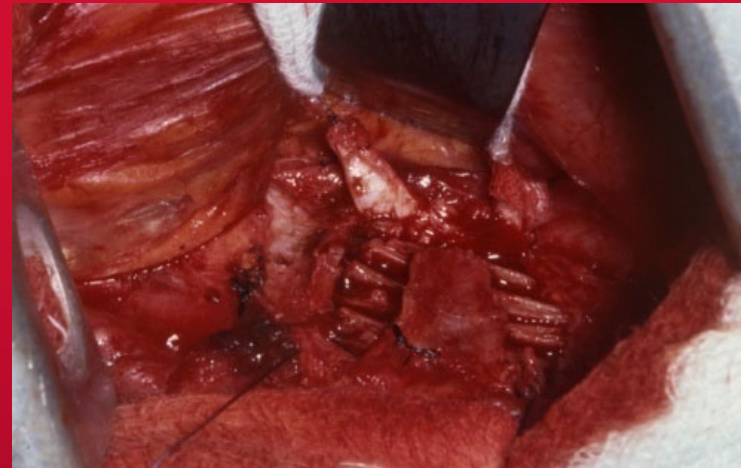
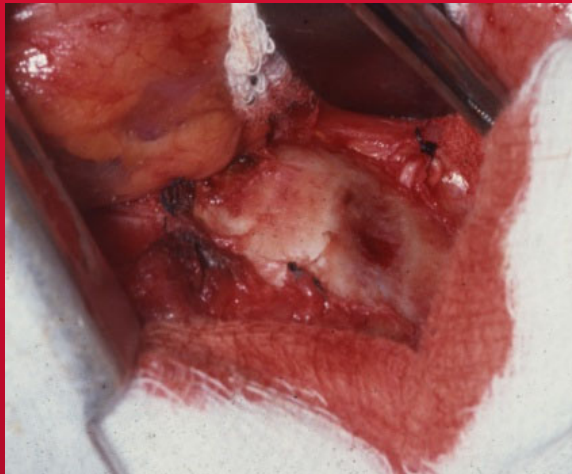
Haas. JBJS 21 963-968, 1939

Nachlas et al. JBJS 33A 24-34, 1951

Smith et al. JBJS 36A 342-348, 1954

Roaf. JBJS 45B 637-651, 1963

The Principle

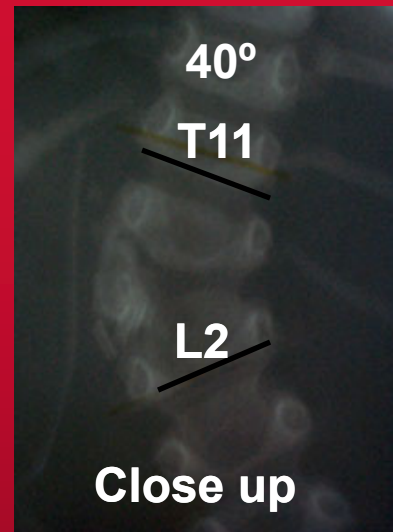
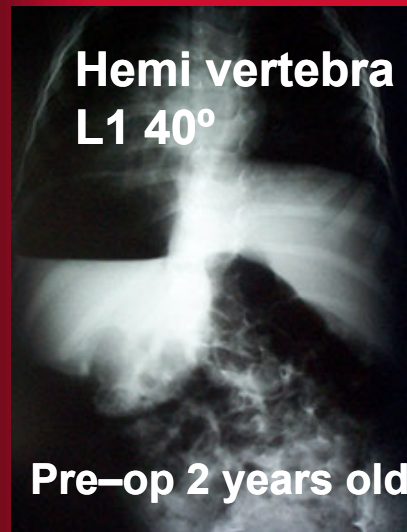


It is not possible to 'create' growth on the opposite side to a hemi vertebra and treatment must be directed towards preventing growth of it

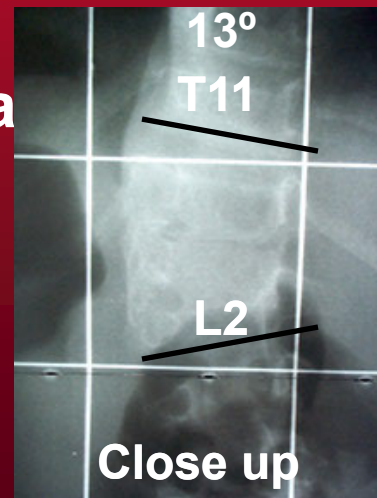
McMaster M J, David C V Hemi vertebra as cause of Scoliosis JBJS 1986; 68B: 588-595



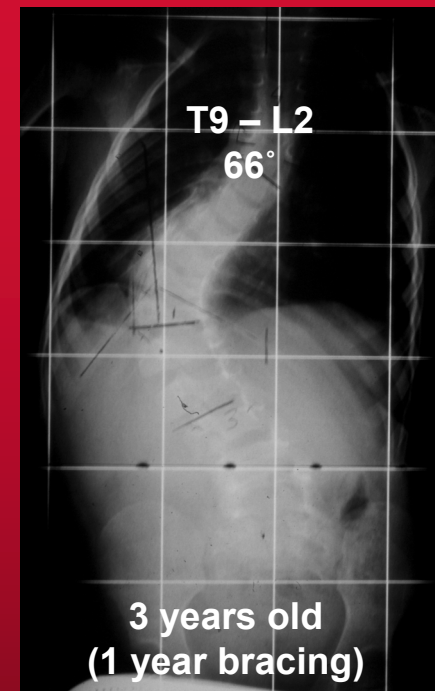
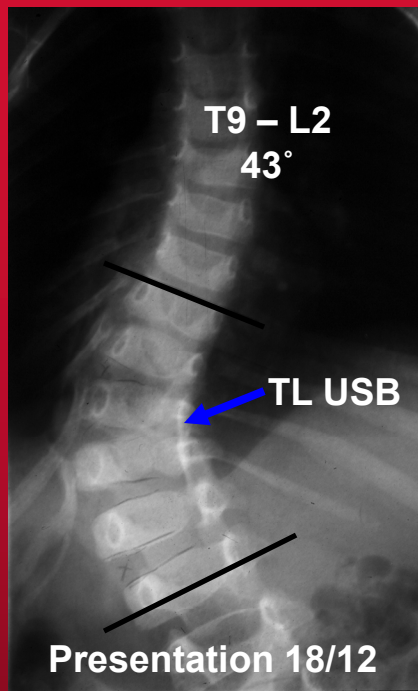
Growth Arrest - Congenital



L1 hemi vertebra
Surgery age 2
7 year follow-up
Progressive
correction



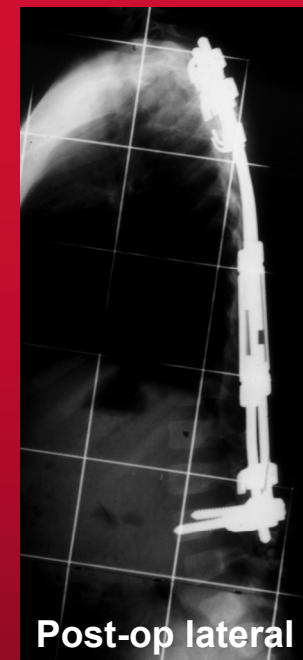
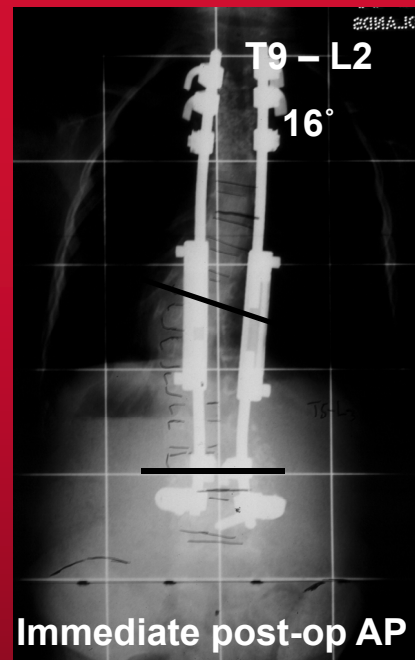
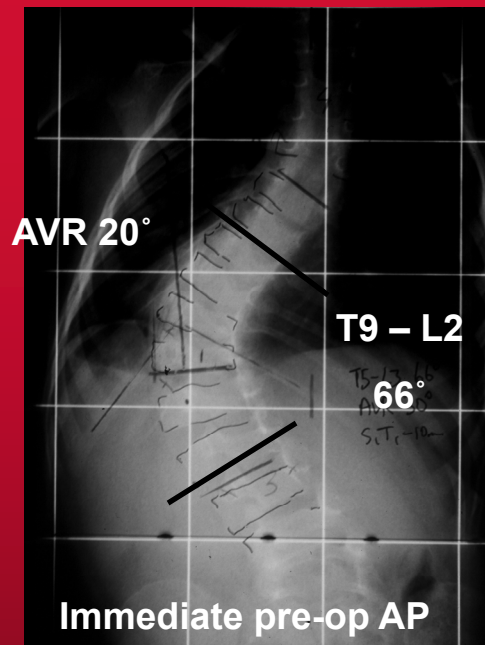
Growth Arrest - Congenital



BS 18 month old presented with 43° thoraco-lumbar curve due an Unsegmented bar at T11 – L1

Serial casting and bracing failed to control the curve

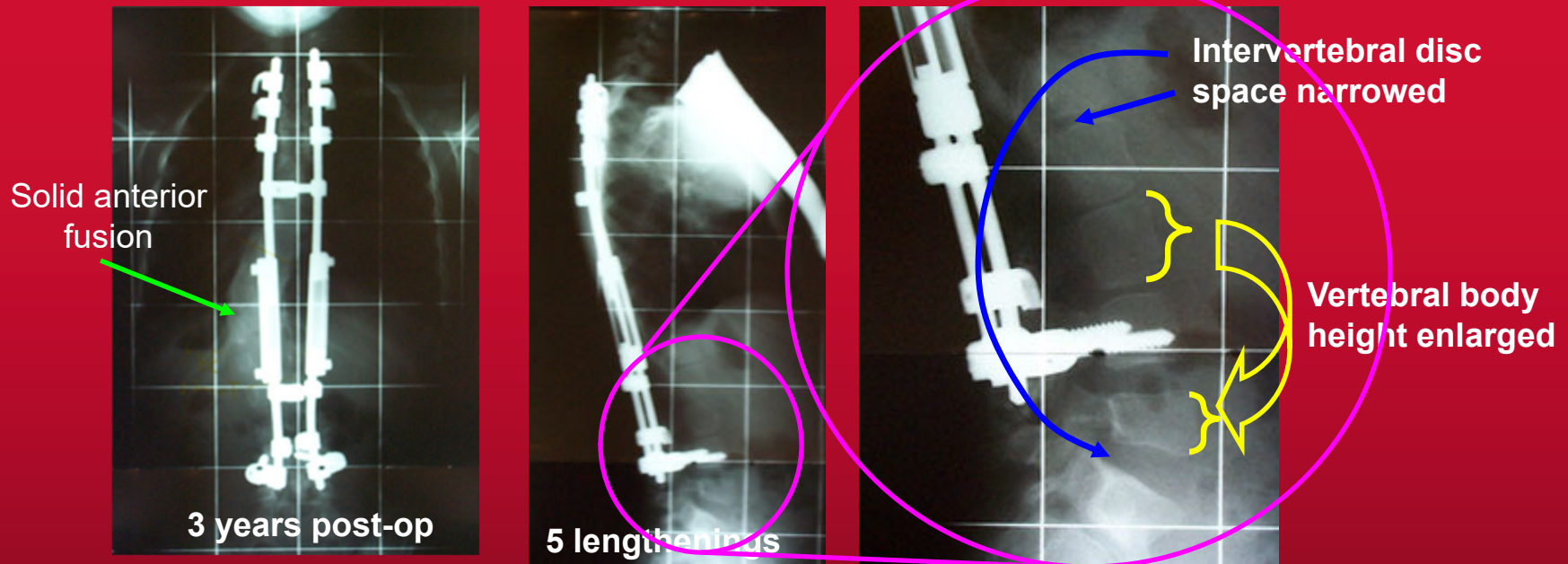
Growth Arrest - Congenital



**3 years old - anterior convex hemi-epiphysiodesis
to match the concave T11 – L1 Unsegmented Bar**

Posterior Paediatric ISOLA T2 – L3

Growth Arrest Congenital



**After 3 years (5 lengthenings /
implant changes) with no
complications**

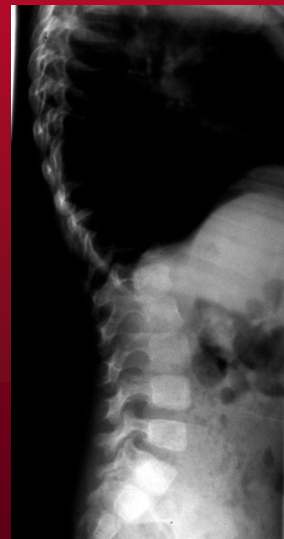
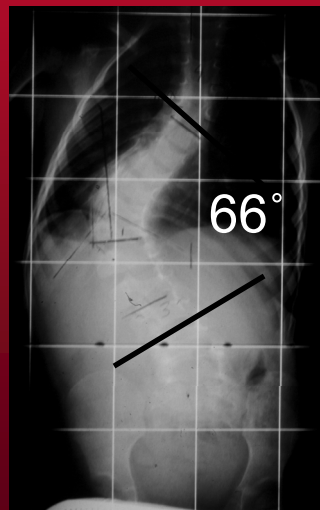
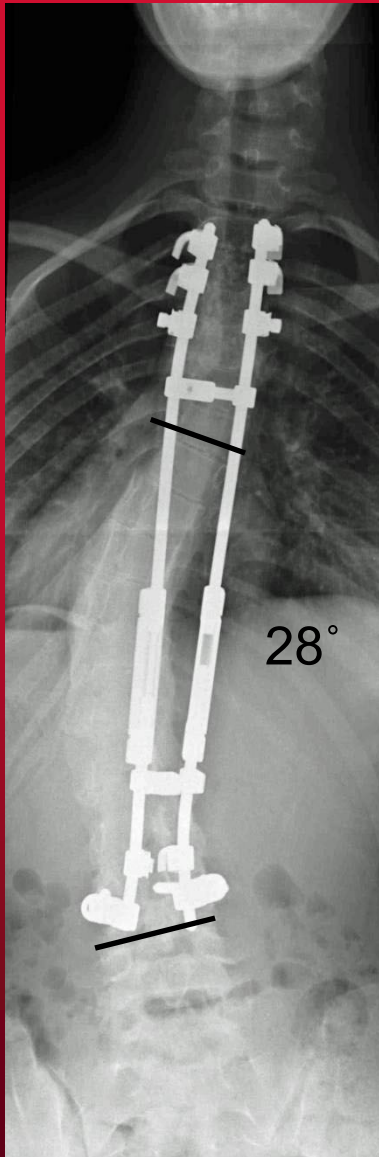
Growth Arrest - Congenital

Age 14 (11 yrs post op)

1 yrs post menarchial

12cm T1 / S1 height gain

Active in sports



Site

Upper Thoracic

Lower Thoracic

Thoracolumbar

Lumbar (L/S)

$L > T$

Roaf R JBJS (B) 1963; 45: 637 - 651

$L > TL > LT > UT$

Marks DS, Thompson AG et al Eur Spine J 1995; 4(5): 296 – 301

$UT + TL > L$ for Complex pattern

Walhout RJ Eur Spine J 2002; 11: 543 – 549

No site effect

Yazici M et al JPO 2004; 24 (6): 658 - 666



Type of anomaly and length of curve

Type of Anomaly

Hemi vertebra

Thompson AG, Marks DS et al Spine 1995 20; 12: 1380 -1385

Complex

Marks DS et al European Spine Journal 1995; 4; 296 - 301

Unsegmented Bar

Keller PM et al Spine 1994; 19: 1933 - 1939

USB + Hemi

King A G et al Spine 1992; 17: S291 - 294

Length of curve

5 segments or less

Kieffer J, Dubousset J Eur Spine Journal 1994; 3: 120 – 125

Winter RB et al JPO 1988; 8: 633 - 638

More than 5 segments (25% - 38% success)

Uzumcugil A, Yazici M et al JPO 2004 24; 6: 658 - 666

Andrew T, Piggott H JBJS (B) 1985; 67: 193 - 197

Age & Sagittal Plane

Age

‘Younger age’ better

Roaf R JBJS (B) 1963; 45: 637 - 651

3.5 – 5 years optimal

Thompson AG et al Spine 1995 20; 12: 1380 -1385

Marks DS et al Eur Spine J 1995: 4; 296 – 301

Kieffer J et al Eur Spine J 1994; 3: 120 -125

Over 5 increased - fusion effect

Yazici M et al JPO 2004 24; 6: 658 -666

Kyphosis / Lordosis

No effect

Dubosset J et al JPO 1993; 1: 123 – 130

Kieffer J et al Eur Spine J 1994; 3: 120 -125

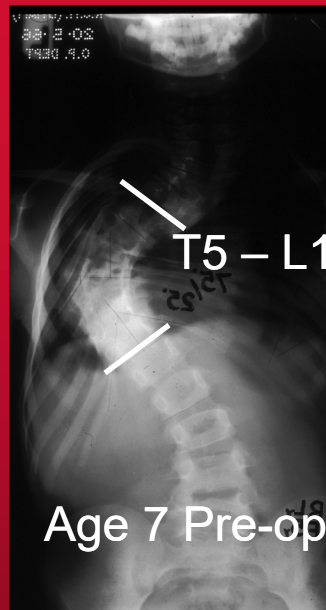
Yazici M et al JPO 2004 24; 6: 658 - 666

Contraindicated

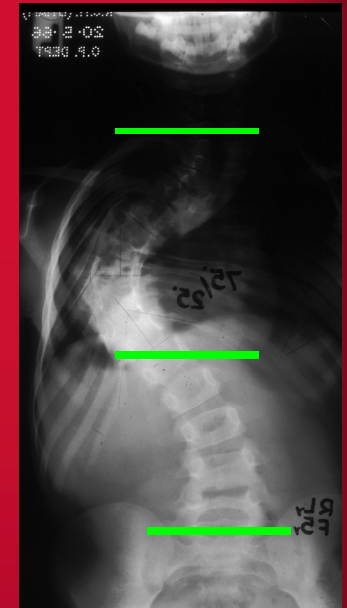
Andrews T, Piggott H JBJS (B) 1985; 67: 193 – 197

Winter RB et al JPO 1988; 8: 633 – 638

Growth Arrest - IIS



Significant loss of thoracic height



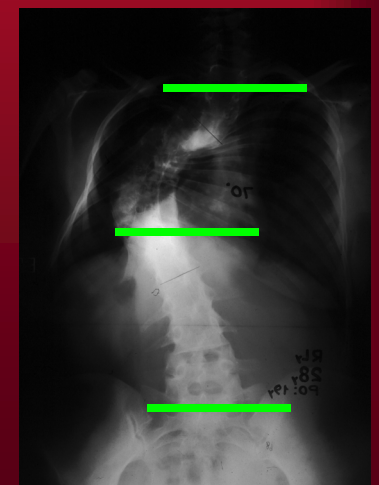
Thoracic height
50% age 7 and 40 %
Age 21 (normal 66%)

Solid anterior and posterior growth arrest in the IIS spine failed to prevent progression

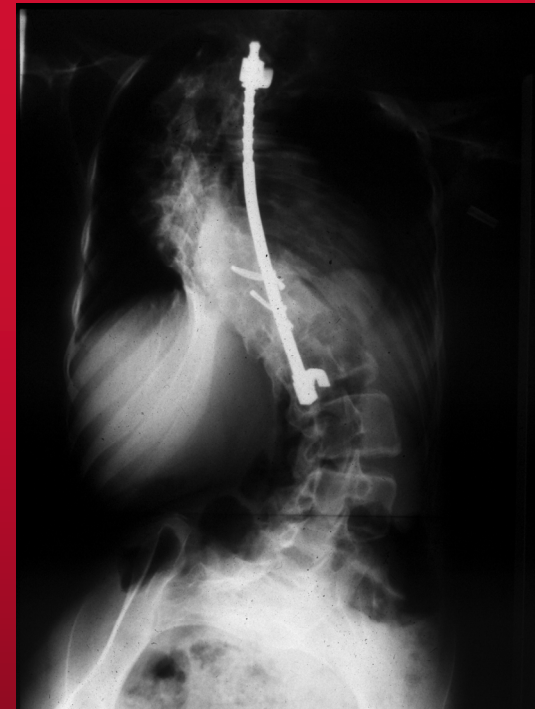
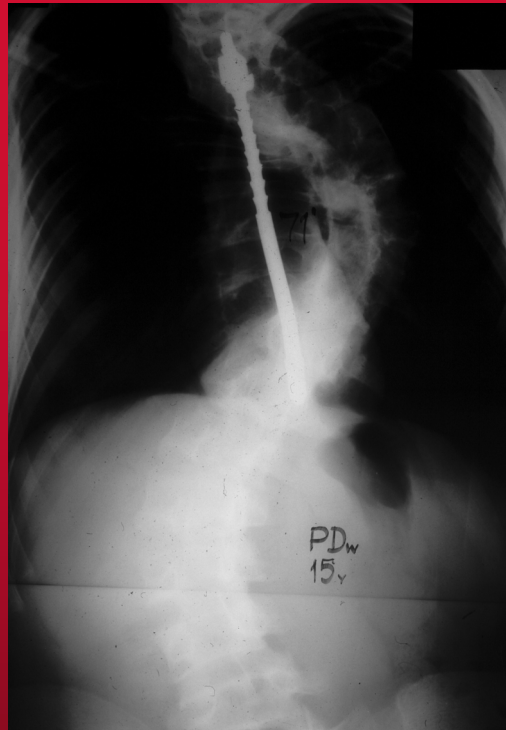
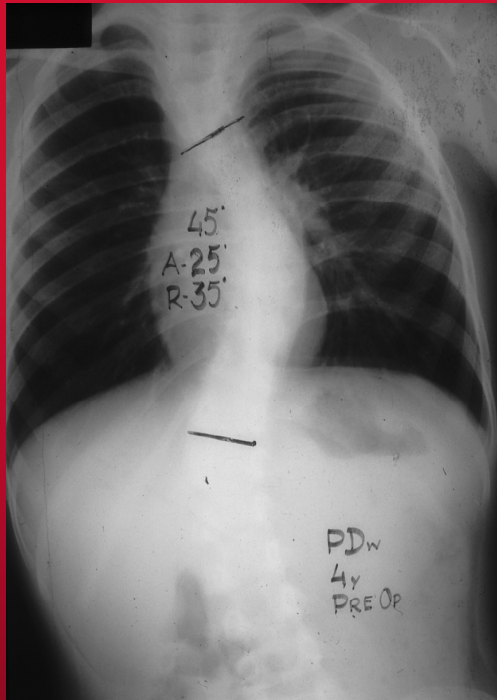
22 patients followed to maturity following Growth Arrest for IIS

D S Marks et al Spine 1996; 21 (16): 1884 - 1888

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Growth Arrest - IIS



Addition of a subcutaneous Harrington rod slowed but did not arrest curve progression

D S Marks et al Spine 1996: 21 (16): 1884 - 1888

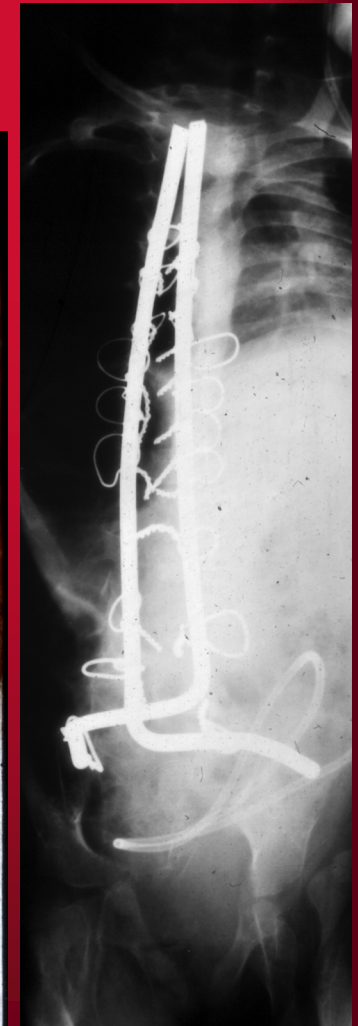
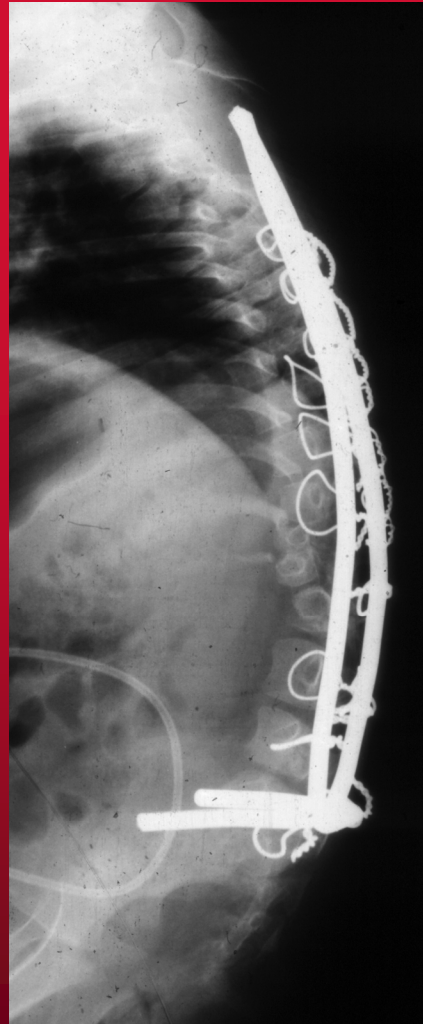
Luque Trolley

Luque Trolley alone did not prevent progression but addition of convex epiphysiodesis results in curve resolution in some patients

Pratt et al Luque trolley and convex epiphysiodesis in the management of infantile and juvenile idiopathic scoliosis Spine 24: 1538 – 1547, 1999

Segmental Spinal Instrumentation without fusion in immature patients was not effective in controlling spinal deformity

Mardjetcko SM et al The luque Trolley revisited. Review of nine cases requiring revision Spine 1992 May;17(5): 582-9

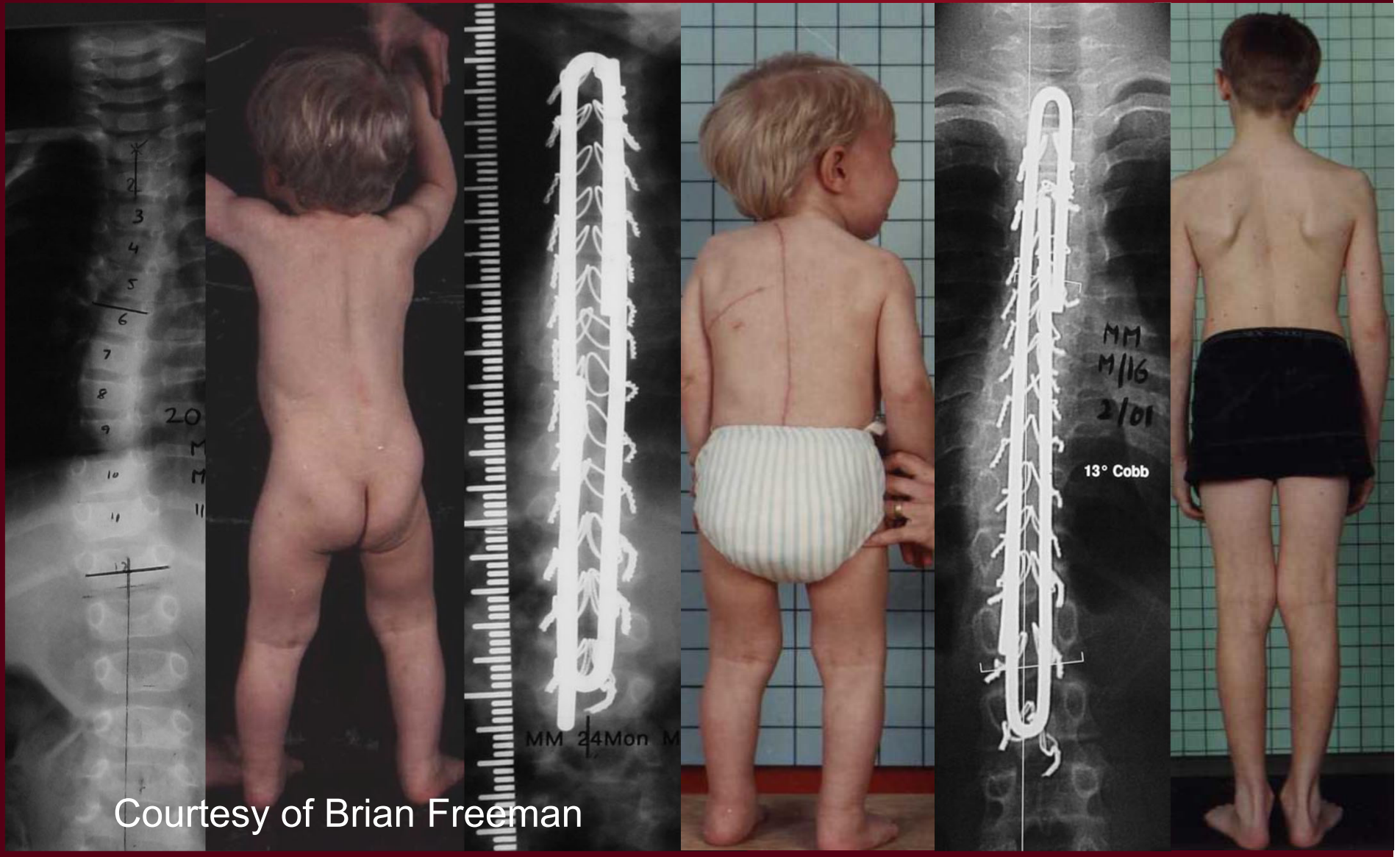


Certain cases did *not* require definitive fusion

1 yr

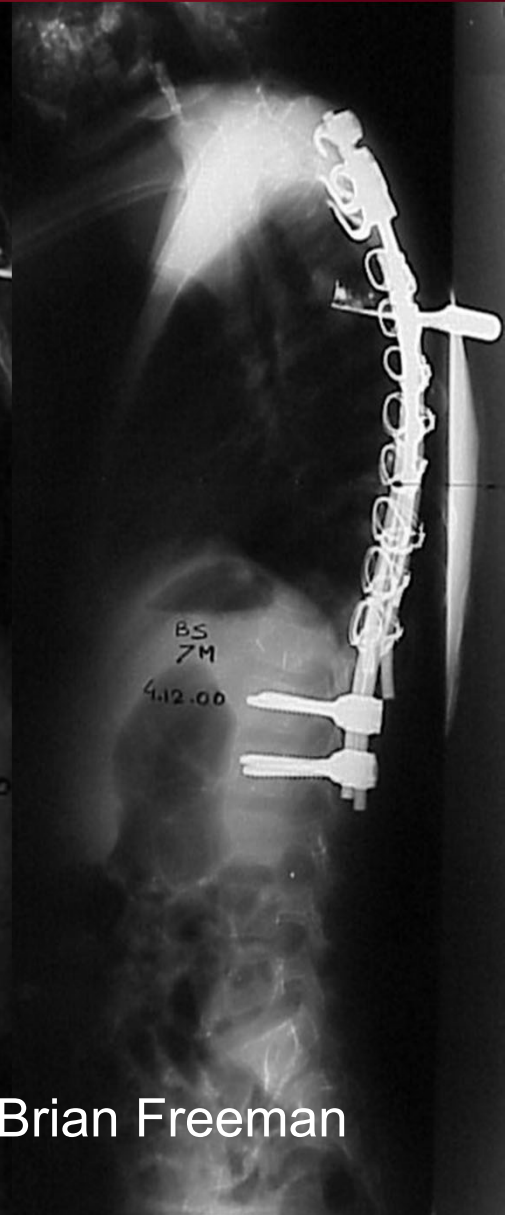
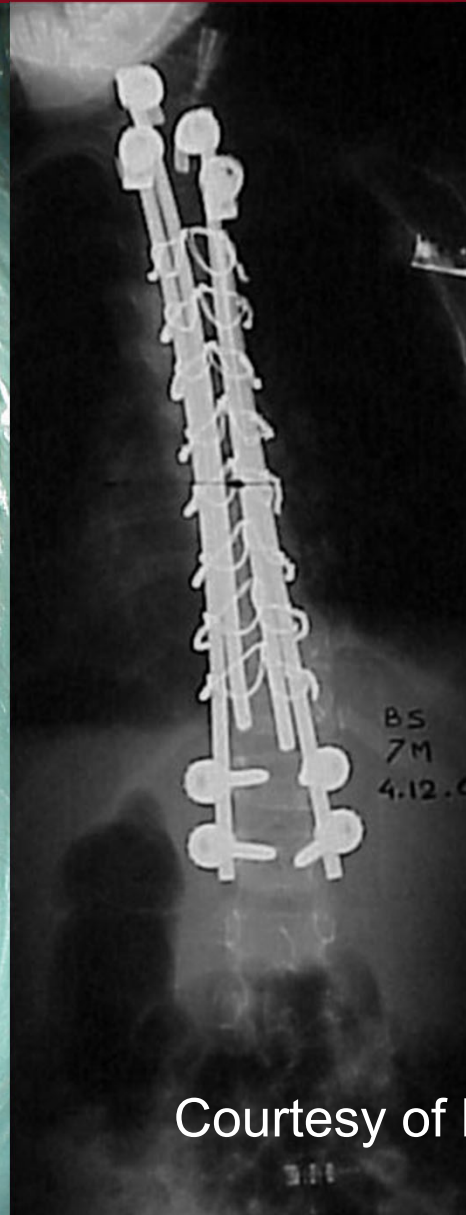
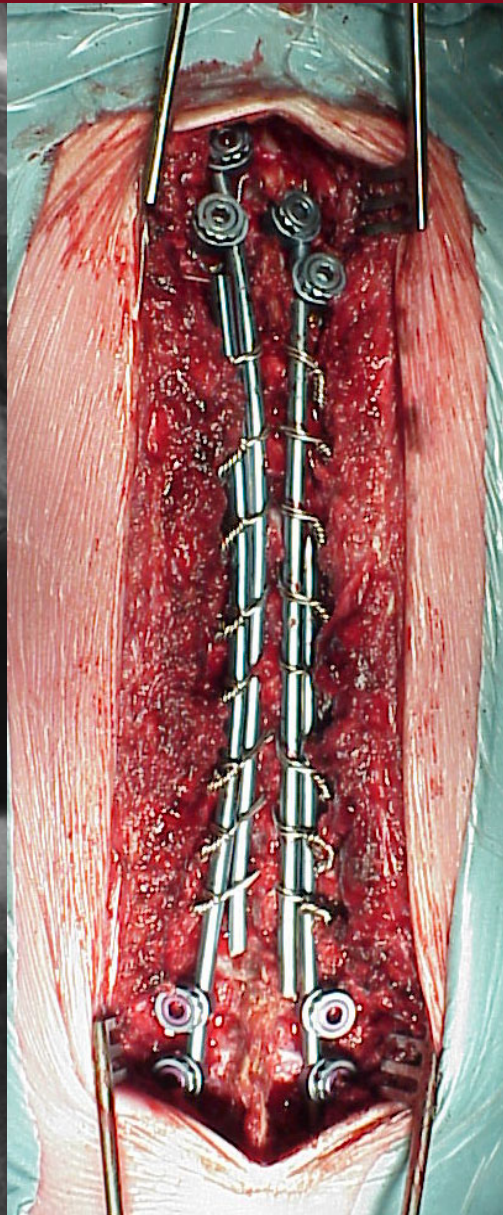
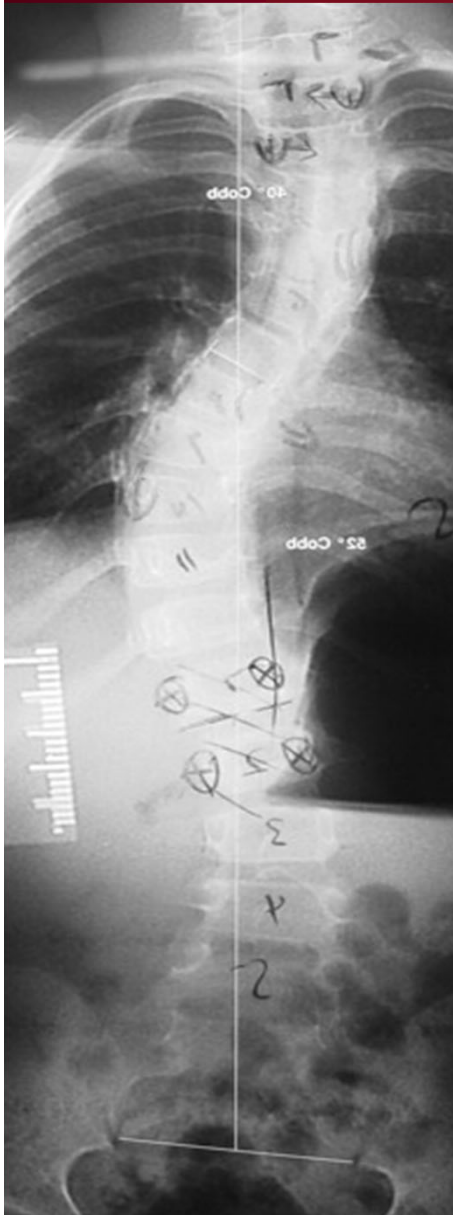
2 yrs

16 yrs



Courtesy of Brian Freeman

Current type of construct



Courtesy of Brian Freeman

Luque Trolley

- **Convex Epiphysiodesis and Luque Trolley provided satisfactory Treatment for Early Onset Idiopathic Scoliosis allowing 42% growth**
- **Definitive Spinal Fusion was required in 56%**
- **Predictors for Definitive Spinal Fusion related to:**
 - 1. Pre-operative RVAD (56°)**
 - 2. Type of construct (L > U)**
- **Evolution 'L' → 'U' → 'over U' → 'Hybrid'**

Freeman B J, Sengupta D K, Mehdian S H, Grevitt M P, Webb JK: Presented to BSS meeting Leeds April 2003

Conclusion - Congenital

Safe procedure

Better at young age 2 – 3 yrs ideal but before 5 preferably

Small curves (ideal $<30^\circ$) but up to 50°

Correction of 3° - 5° per annum

Less than 5 segments

Hemi $>$ Complex $>$ USB $>$ USB + Hemi

Site (TL & L $>$ T)

No significant Kyphosis / lordosis

Conclusion – IIS (Non-Congenital)

Not “stand alone”

Nilsonne U Acta Orthop Scand 1969; 40: 237 - 45

Marks DS, Thompson AG et al Spine 1996. 21; 16: 1884 - 1888

Future -

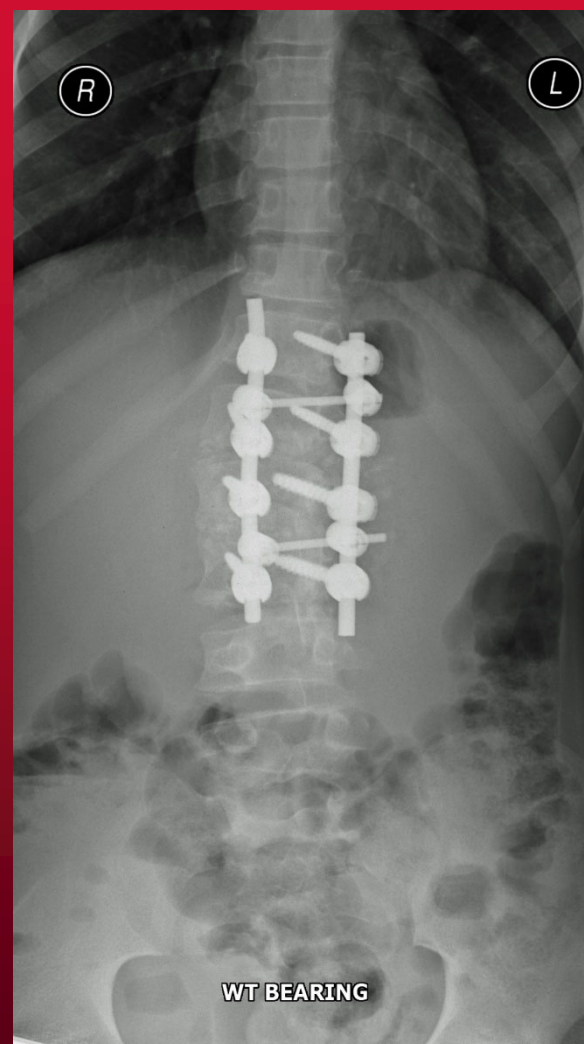
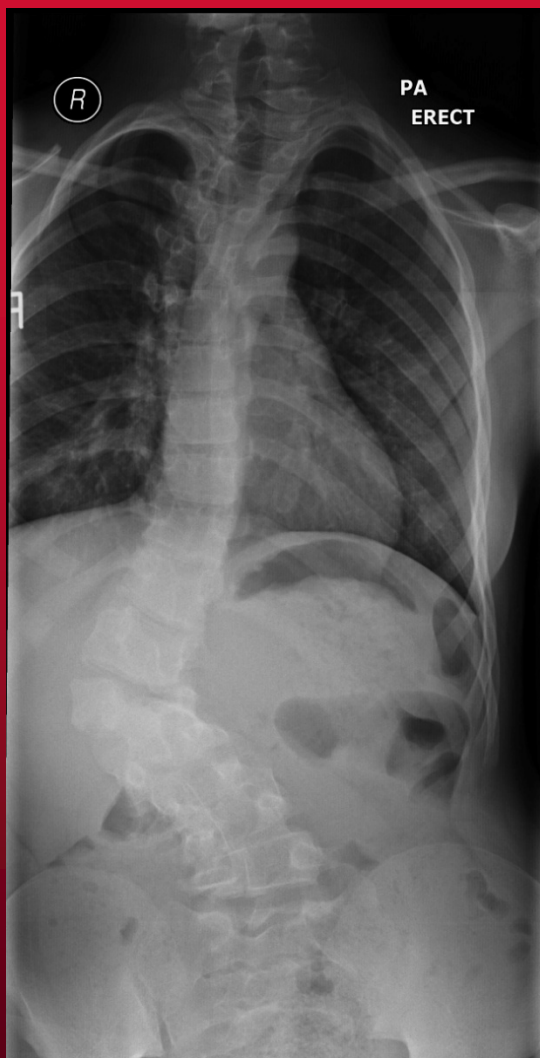
As adjunct to non – fusion techniques

Luque Trolley

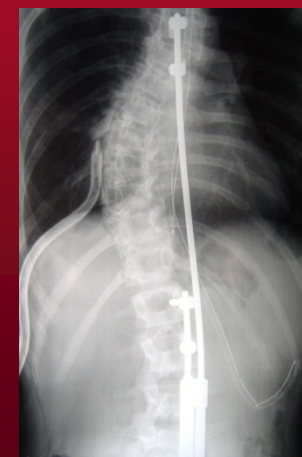
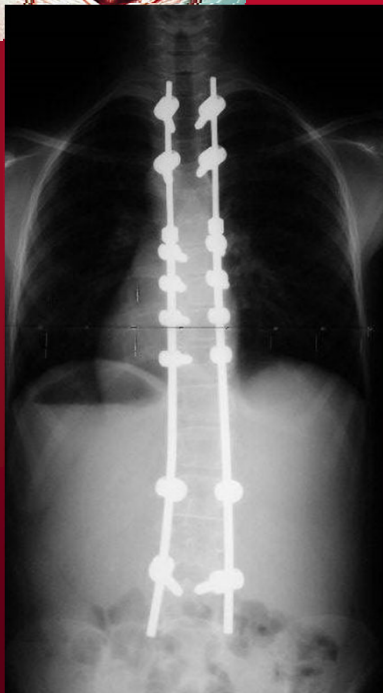
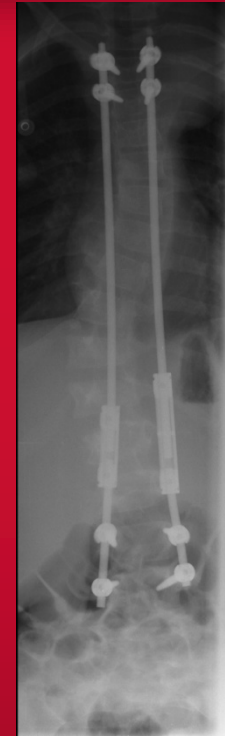
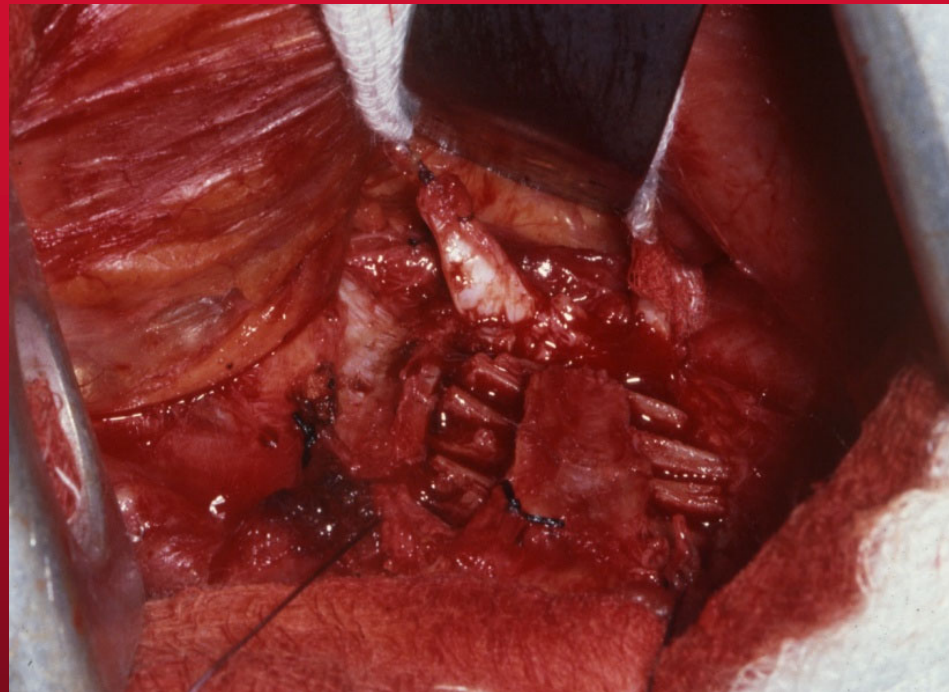
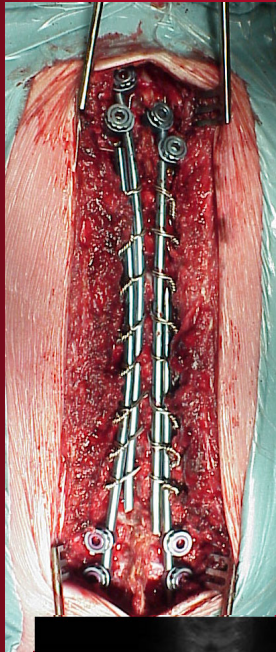
Shilla

Growing rods

New Tricks ?



‘Growth Arrest +’



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**Darn it!! Just as
you get the hang of
these Growing Rod
things – someone
goes and invents
a smaller digital
one!!**