PAEDIATRIC CARIES SPINE

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Tuberculosis – *as Old as Man himself.*

Egyptian Mummy

21st Century

The incidences of spinal tuberculosis in children as reported by MRC (British) are variable: 58% of all spine tuberculosis patients in Korea, 1/3 of patients in India, and 26% in Hong Kong.

- The overall occurrence of extra-pulmonary tuberculosis in children is unknown, however, it is quoted to be between 5% to l0% in children younger than 5 years, of which half of them occur in the spine. *World Health Organization. Global TB Control Report. 2010.*

Clinical Presentation

- Most common mode of presentation in a child less than 2 years: gibbus.
- 80% of patients with spinal involvement have detectable kyphosis at the time of presentation
- Constant crying child often regarded and treated as "colic".

Clinical Presentation

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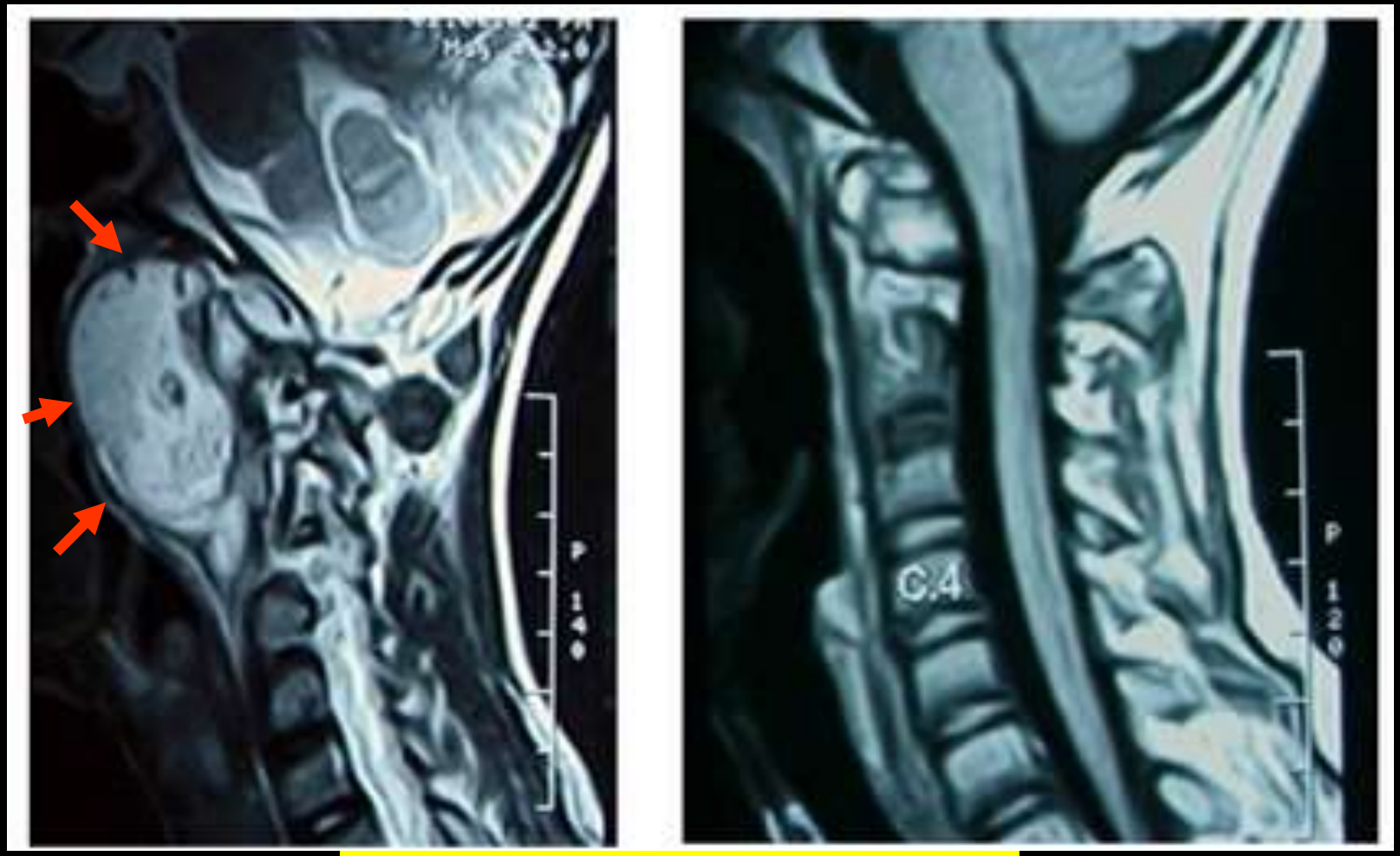
- 80% of patients with spinal involvement have detectable kyphosis at the time of presentation
- Constant crying child often regarded and treated as "colic".

- Under the age of four, backache in children should be regarded as pathological unless and until proved otherwise.
- Usually present with deformity or cold abscess
- Rarely present with neurology

Uncomplicated Spinal TB

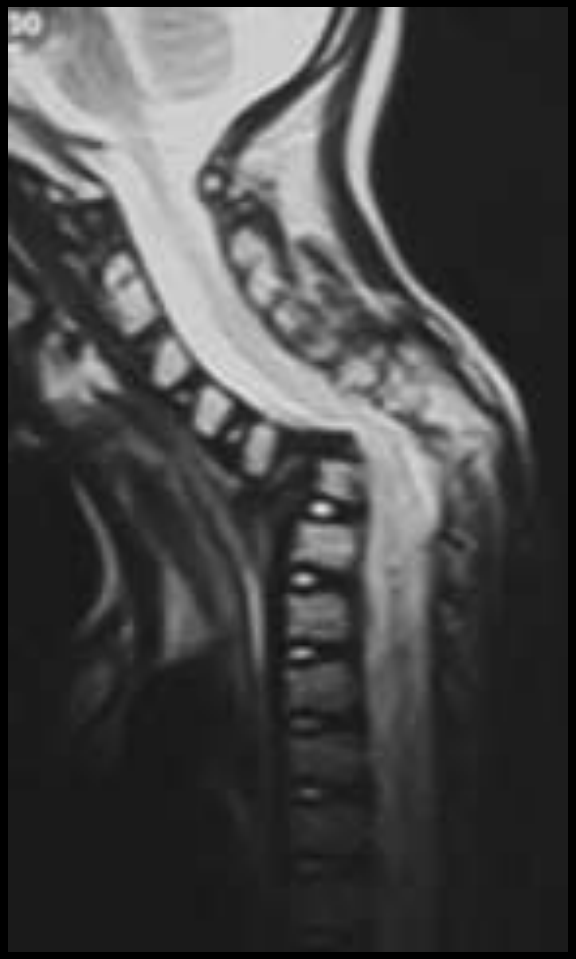
- **Is now mainly a ‘Medical Disease’!**

Resolution of abscess with drugs.



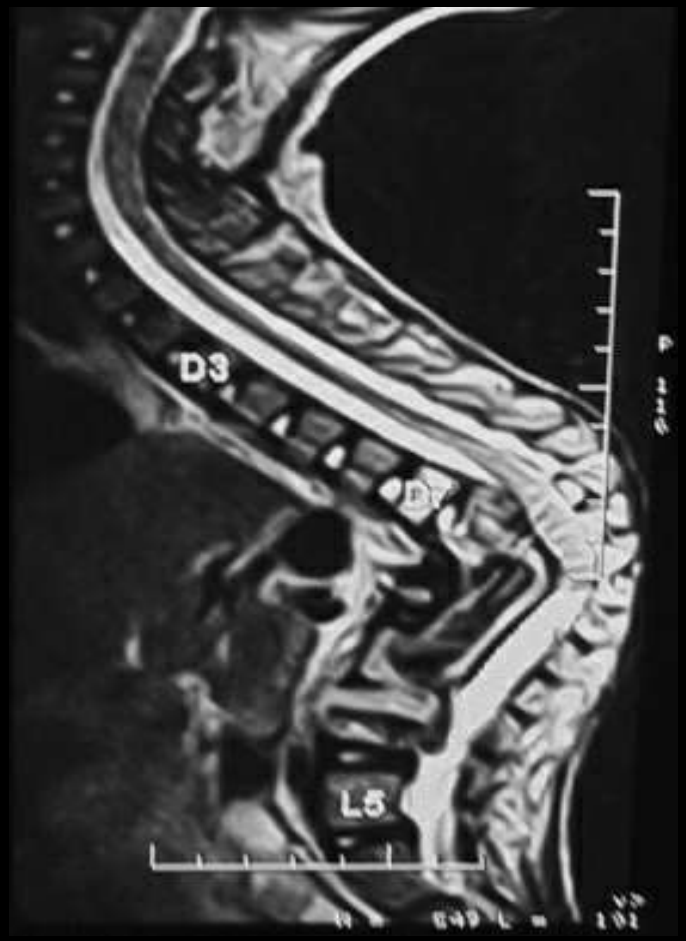
No Surgery.

Paralysis



Cardio-pulmonary deficit

Stature and Pain



Vicious Cycle

Volume 21(10), 15 May 1996, pp 1162-1167

Mechanical Modulation of Vertebral Body Growth: Implications for Scoliosis Progression
[Biomechanic]

Stokes, Ian A. F. PhD
MD

Is it always True?

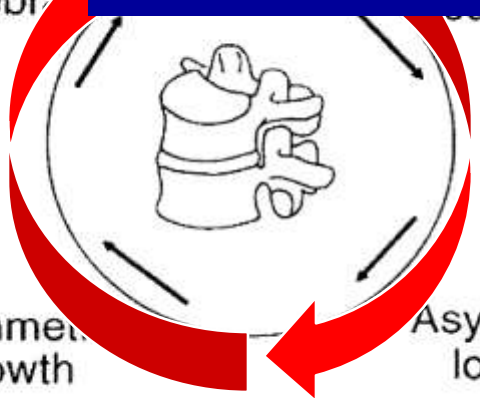


Figure 1. The concept of a "vicious cycle," whereby spinal curvature increases during growth because it leads to asymmetric loading of vertebrae, which in turn causes asymmetric growth and additional wedging of the vertebrae.

ys
aggravates deformity.

Deformity begets more deformity.

-Hippocrates

NATURAL HISTORY OF PROGRESSION OF DEFORMITY- 2 PHASES

Phase I or active phase:
Included the changes during the active stages of the disease.

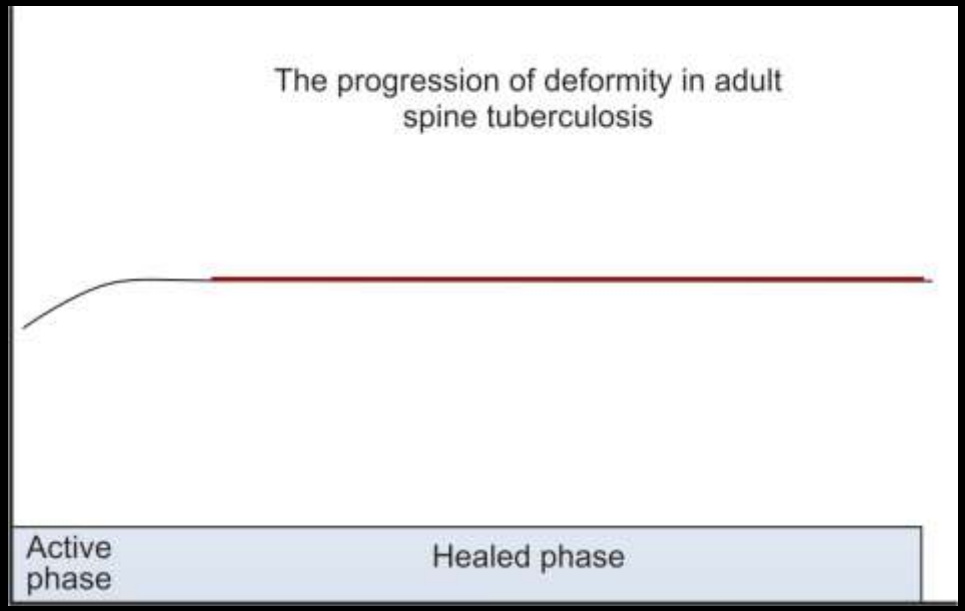
Phase II or healed phase:

Changes included progress in deformity that occurred even after the disease was cured.
There was a difference in the extent of progression of the deformity in both these phases between children and adults.

Phase I—Progression in Active Phase

ADULTS:

- ❑lesser deformity at presentation
- ❑lesser increase during Phase I
- ❑ no change after disease cure



The progression of deformity usually was less than 40° and restricted to the first 12 to 18 months when consolidation of the focus was complete

Phase I—Progression in Active Phase

CHILDREN:

- ❑ Higher deformity at presentation
- ❑ Greater tendency for collapse during the active phase
- ❑ Continued and variable progression even after the disease was cured and growth was completed

Why do children have increased susceptibility to develop Kyphosis?

- ❑increased severity of destruction at presentation,
- ❑ increased flexibility of the spine in children,
- ❑variable destruction of the growth plates interfering with future growth,
- ❑suppressive effect of the mechanical forces of kyphosis on the growth of the anterior half of the fusion mass and adjacent healthy vertebrae

Moon MS, Kim MJ. The effects of mechanical forces on vertebral growth. J West Pac Orthop Assoc. 1974;11:1Y16.

Phase 2—Progression in Healed Phase

THE JOURNAL OF BONE & JOINT SURGERY (BR)

The natural history of post-tubercular kyphosis in children

RADIOLOGICAL SIGNS WHICH PREDICT LATE INCREASE IN DEFORMITY

S. Rajasekaran

From the Tuberculosis Research Centre, Chennai and Ganga Medical Centre, Coimbatore, India

39 % deteriorated.

43% improved.

17% showed no Change.

Phase 2—Progression in Healed Phase

Five distinct types of progression :

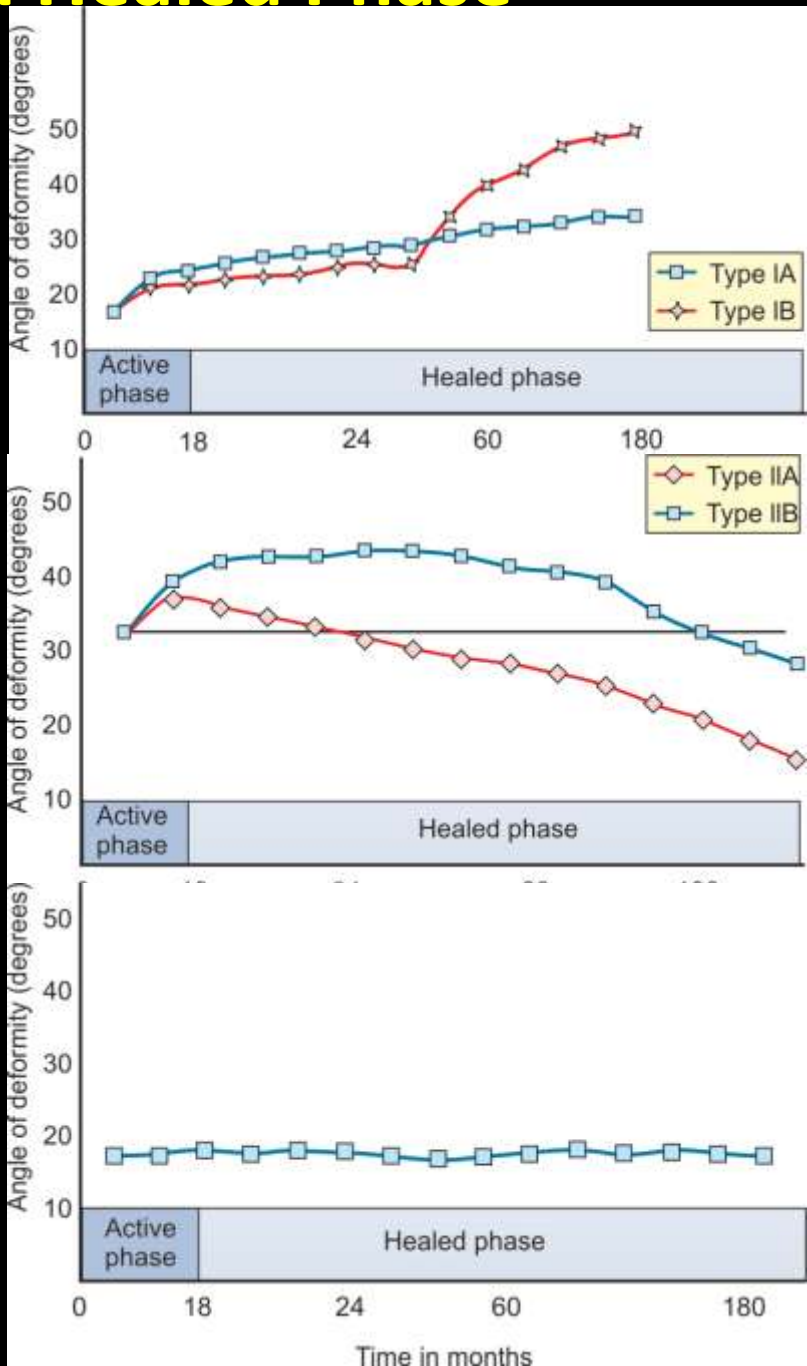
Type I progression :continued progression through the entire period of growth . This increase could occur continuously after Phase I (Type IA) or after 3 to 6 years once the disease was cured (Type IB)

Type II progression :beneficial effects during growth with a decrease in deformity after healing of the disease .

This can occur immediately after Phase 1 (Type IIA) or after 3 to 6 years (Type IIB).

Type III progression: children who had a minimal disease with no major destruction of the vertebral bodies did not have any major change in the deformity during Phase I and Phase II

Children with Type IIA progression had the best outcome because they had a lesser increase during Phase I and a greater improvement during Phase II.

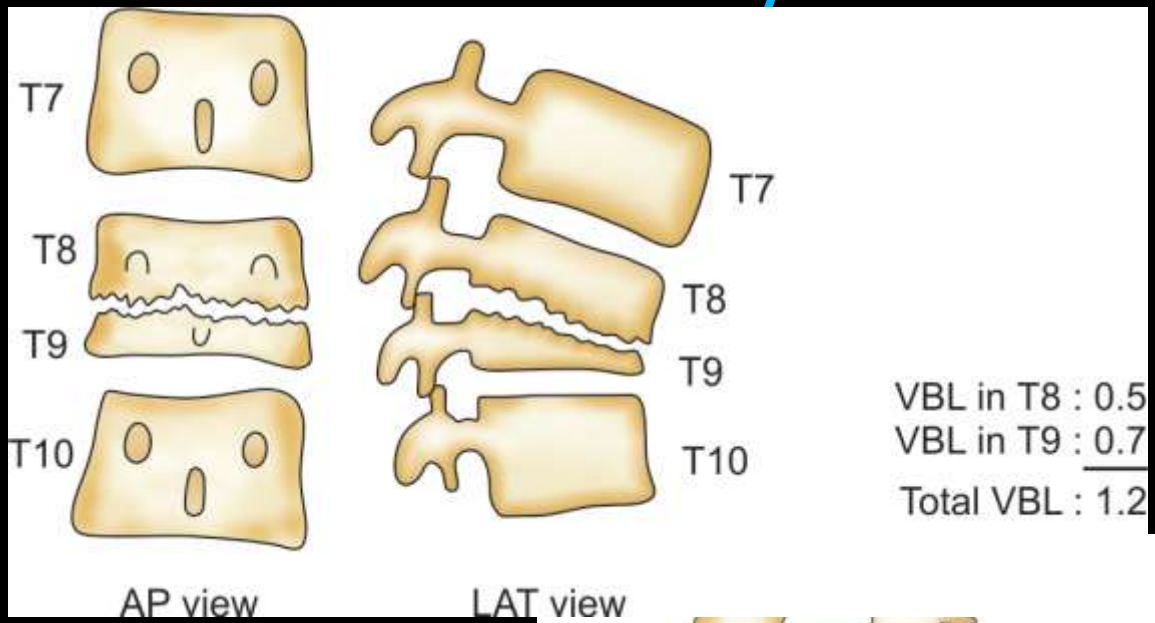


FACTORS INFLUENCING DEFORMITY

- Age
- Severity of involvement
- Level of lesion
- Presence of instability.

FACTORS INFLUENCING DEFORMITY

Severity of Involvement

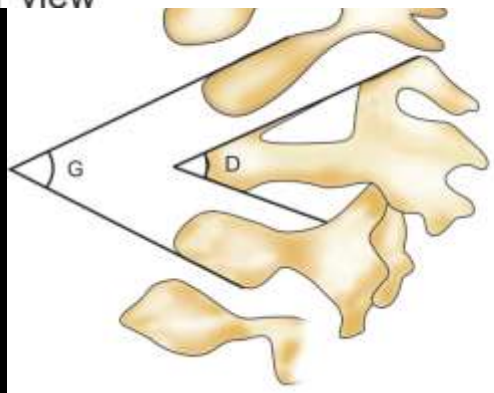


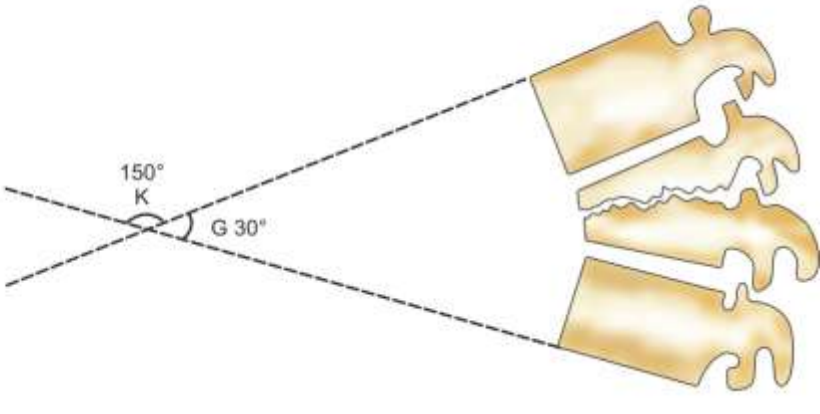
The vertebral body loss (VBL)

$Y = a + bX$

Y is the deformity at 5-year follow-up, X is the pretreatment VBL, and a and b are constant values of 5.5 and 30.5. #

- The angle of the deformity (D)
- The angle of the kyphosis (G)
- K angle (Konstams Angle)

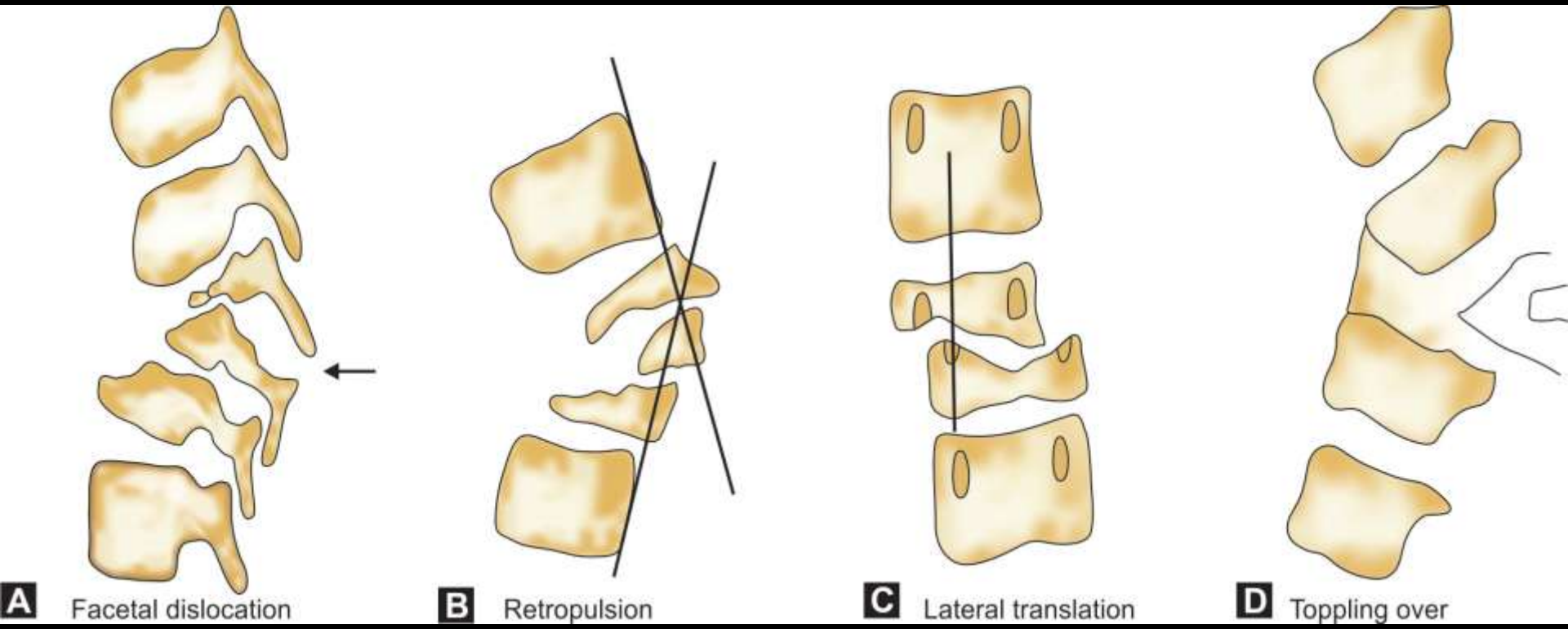




Rajasekaran S. A longitudinal study on the progress of deformity in children with spinal tuberculosis. PhD Thesis. Chennai, India, Tamil Nadu Dr MGR Medical University. 1999.

FACTORS INFLUENCING DEFORMITY

Presence of Instability - "Spine at risk" radiological signs.



Presence of more then 2 signs = a final deformity of over 60°.

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FACTORS INFLUENCING DEFORMITY

Level of Lesion

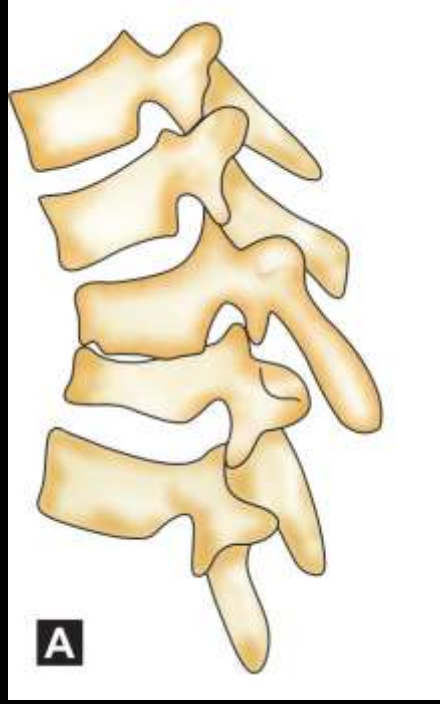
- Thoracic lesions : highest deformity at the time of presentation
- Thoracolumbar lesions: worst prognosis
- Lumbar lesions: best prognosis.
- The deformity angle per vertebral loss was 26.7° in the thoracic region compared with 27.6° in the thoracolumbar region and only 9.2° in the lumbar region #
- TELESCOPY Vs FLEXION COLLAPSE ##

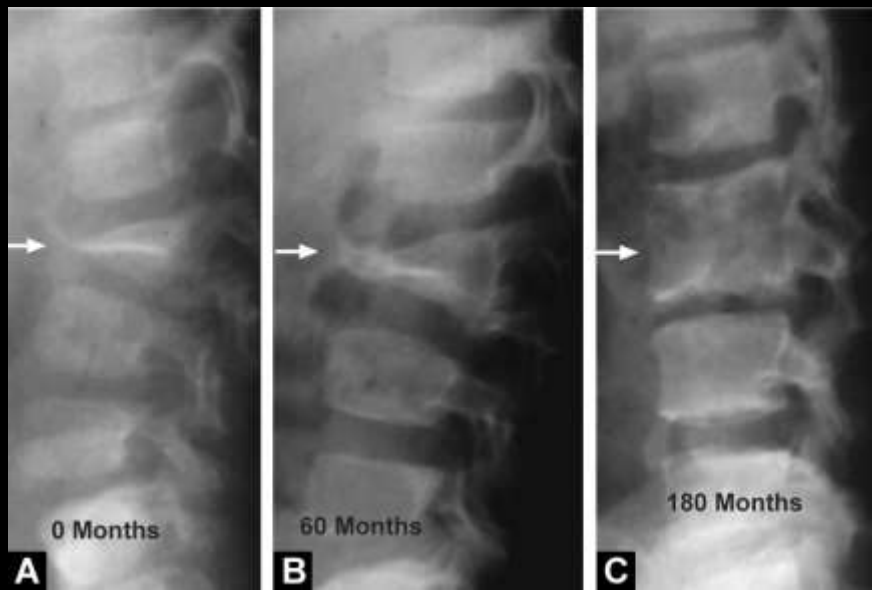
Rajasekaran S. A longitudinal study on the progress of deformity in children with spinal tuberculosis. PhD Thesis. Chennai, India, Tamil Nadu Dr MGR Medical University. 1999.

Puig Guri J. The formation and significance of vertebral ankylosis in tuberculous spines. J Bone Joint Surg Am. 1947;29:136-48.

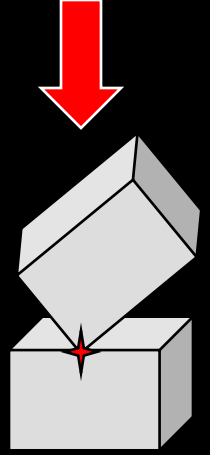
TYPES OF RESTABILIZATION
TYPE A

Contact of vertebral bodies	**Wide, between adjacent surfaces of vertebral bodies**
Approximate VBL	**< 0.75**
Status of facet joints	**Intact**
Expected final deformity	**Usually, spontaneous improvement. Even if it increases, it is <10°**

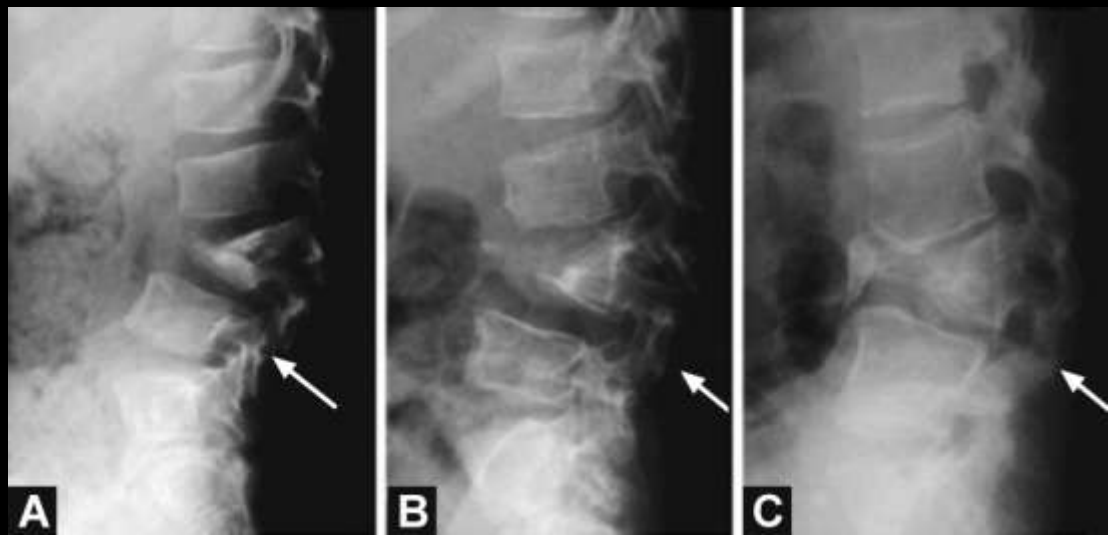




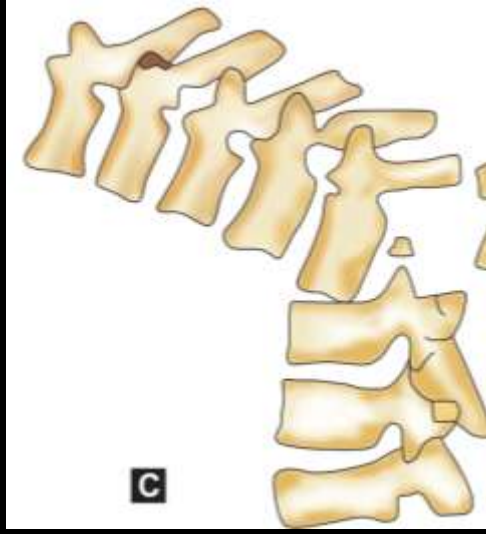
TYPES OF RESTABILIZATION
TYPE B



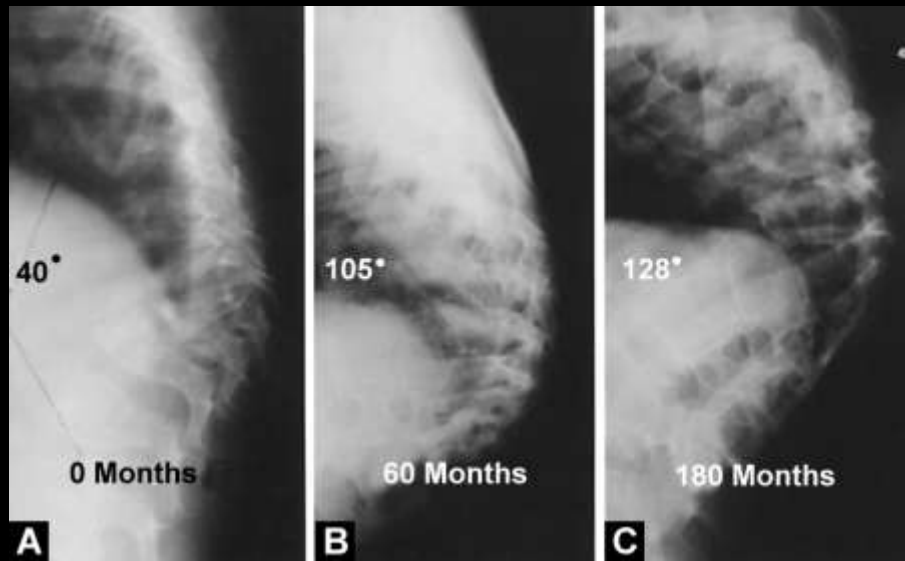
Contact of vertebral bodies	Point contact of anteroinferior part of superior vertebra and superior surface of inferior vertebra
Approximate VBL	0.75-1.5
Status of facet joints	Subluxation or single level (apex) dislocation
Expected final deformity	Less than 60°



TYPES OF RESTABILIZATION
TYPE C



Contact of vertebral bodies	By 90° sagittal rotation of superior vertebrae, with its anterior surface contacting the superior surface of inferior vertebra
Approximate VBL	>1.5
Status of facet joints	Dislocation of two or more facets
Expected final deformity	Can be more than 100°, Buckling collapse

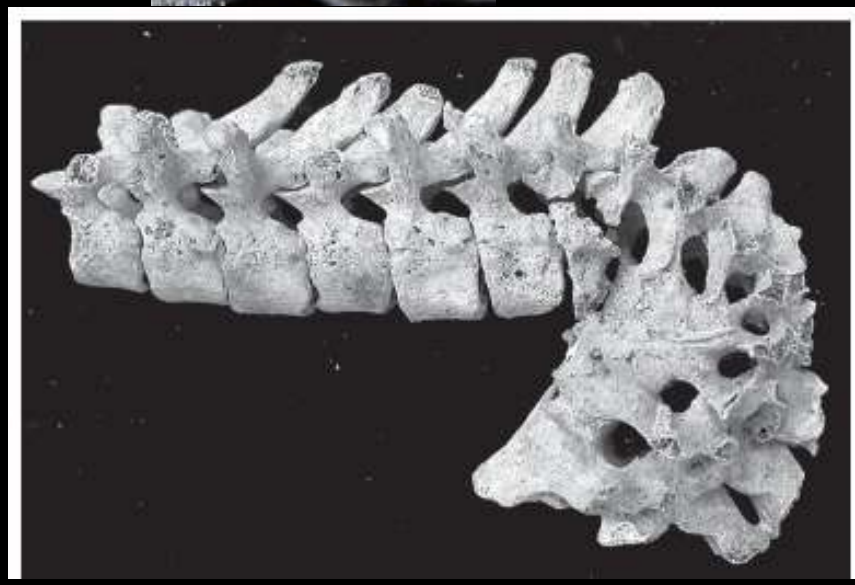


CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 460, pp. 86–92

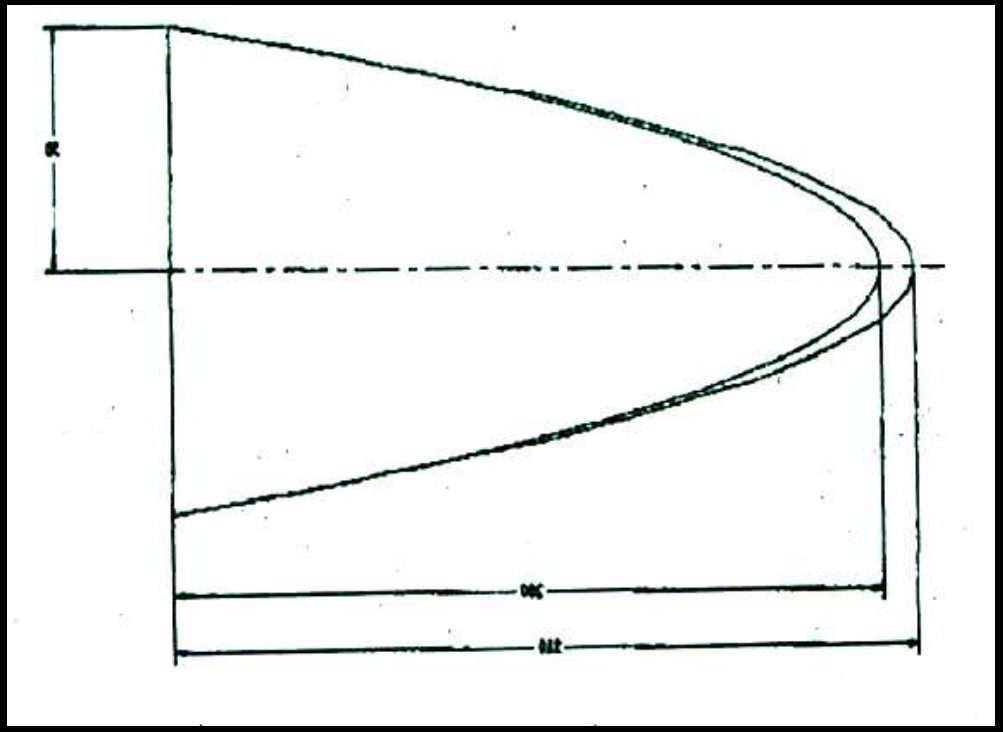
Buckling Collapse of the Spine in Childhood Spinal Tuberculosis

S. Rajasekaran, PhD

Horizontalisation of the vertebral segments.



Accelerated Growth due to Absence of Normal Compressive forces.



If ‘y’ is lengthened by 1 cm , each arm of the parabola is lengthened by 1.9 cms. In effect, the spinal cord will be stretched by 3.8 cms.

Hueter C. *Die Formentenwickelung am Skelet des Menschilchen Thorax.* Leipzig: F.C.W. Voge; 1865.

Von Volkmann R. *Chirurgische Erfahrungen uber Knochenverbiegungen and Knockenwachsthum.* Berlin: G. Reimer; 1862.

Linear negative relationship between Stress and Growth.

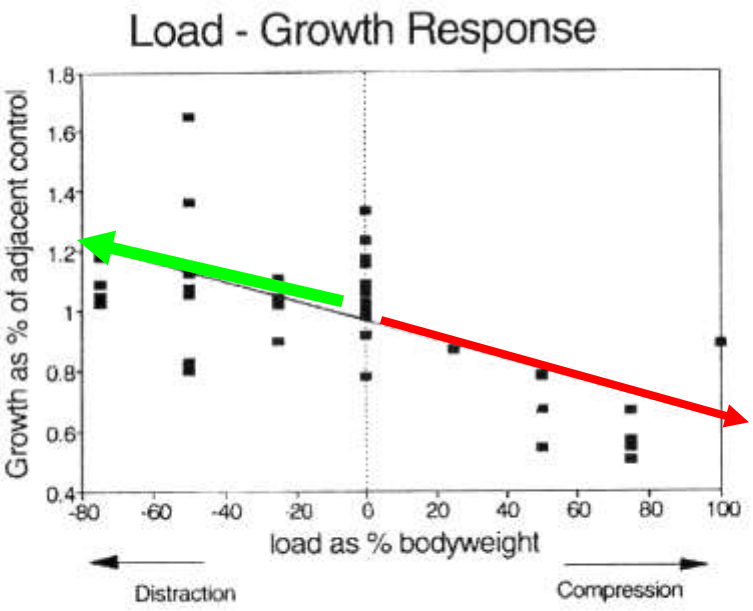
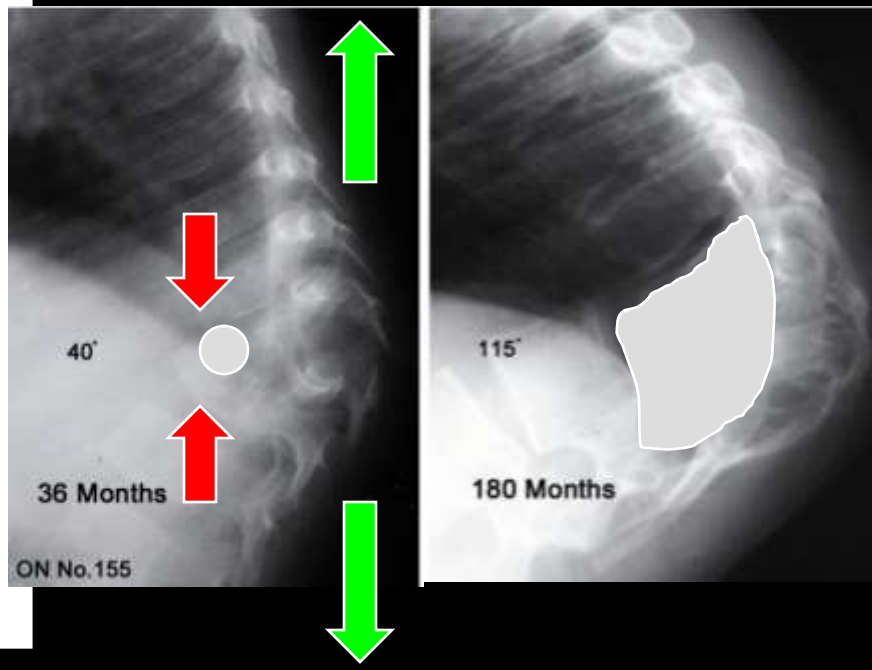
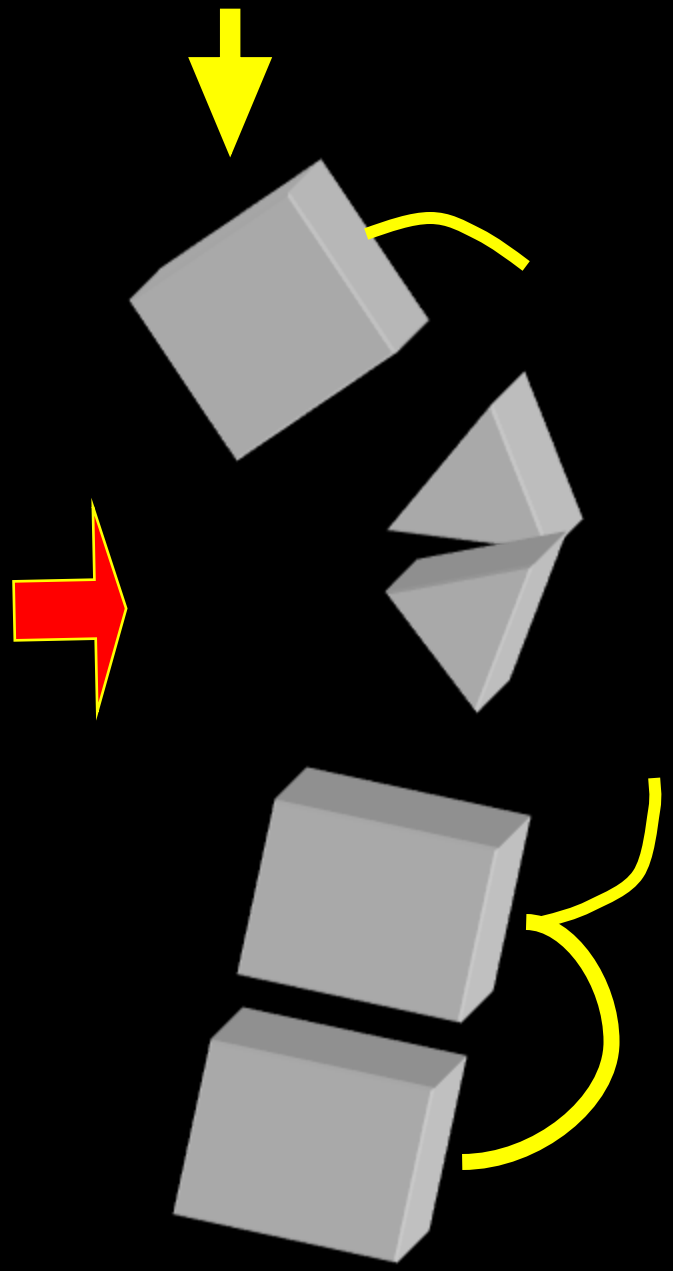


Figure 7. The load-growth response curve for loaded vertebrae as a function of the applied load. The load was expressed as a percentage of the animal's bodyweight. The regression line has a statistically significant R^2 value of 0.44.





Euler's Laws of 'Slender Columns'

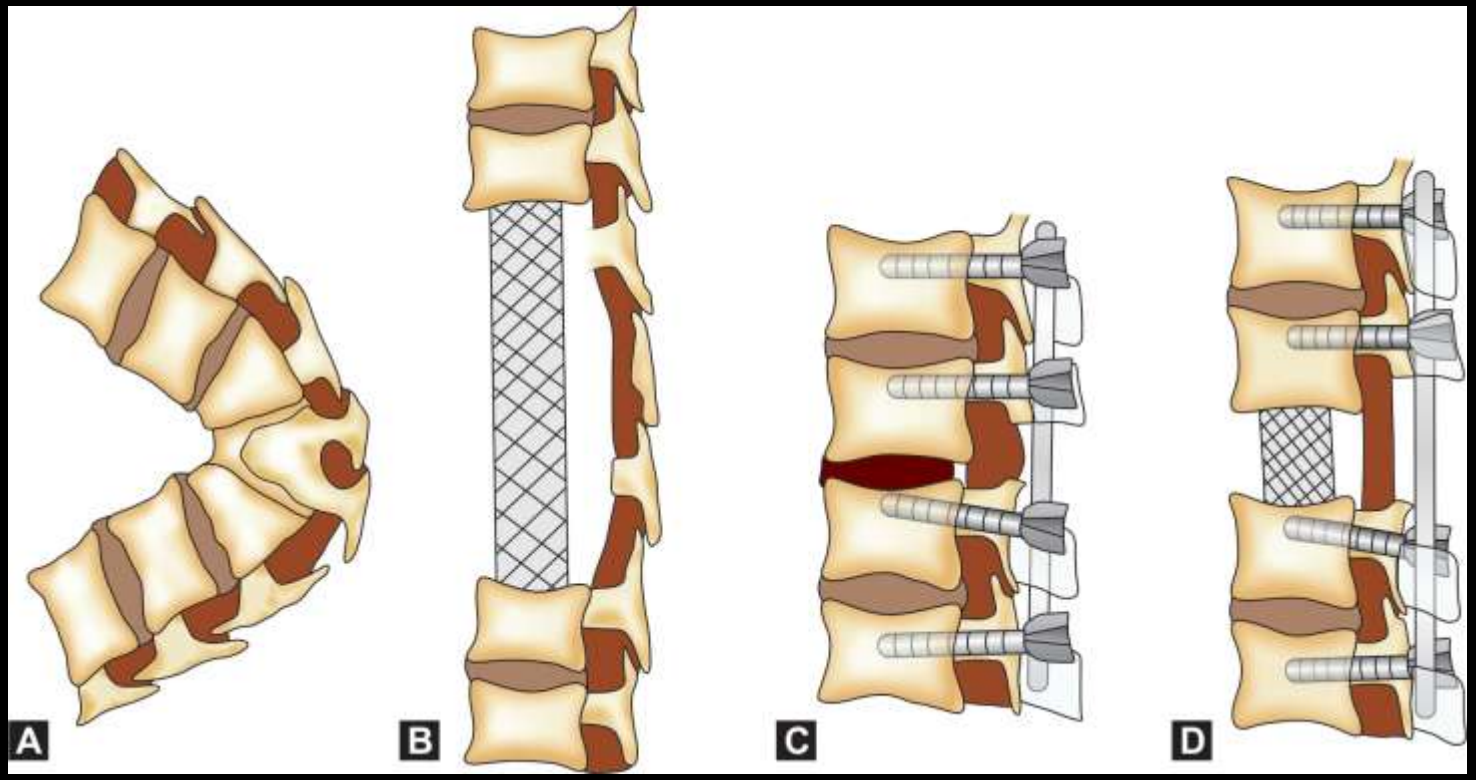
At 30 degrees of kyphosis, 80% of vertical forces are converted to translational forces.

Death of a Column

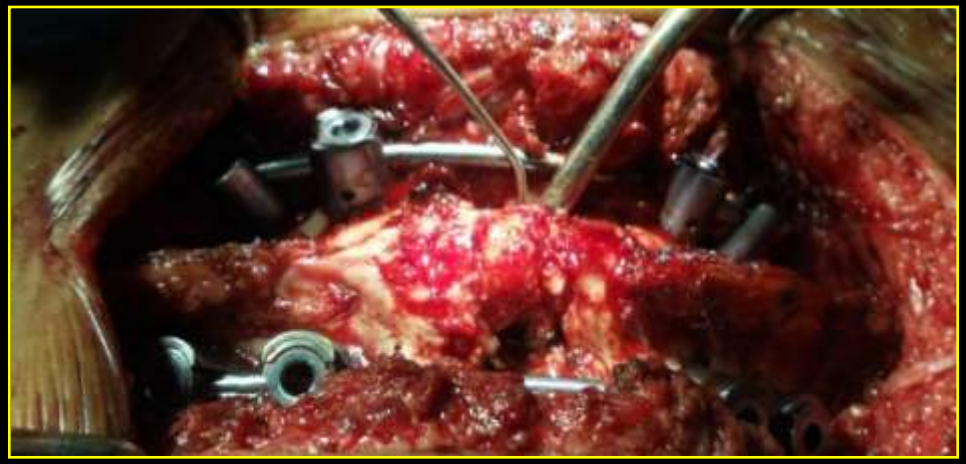
Management

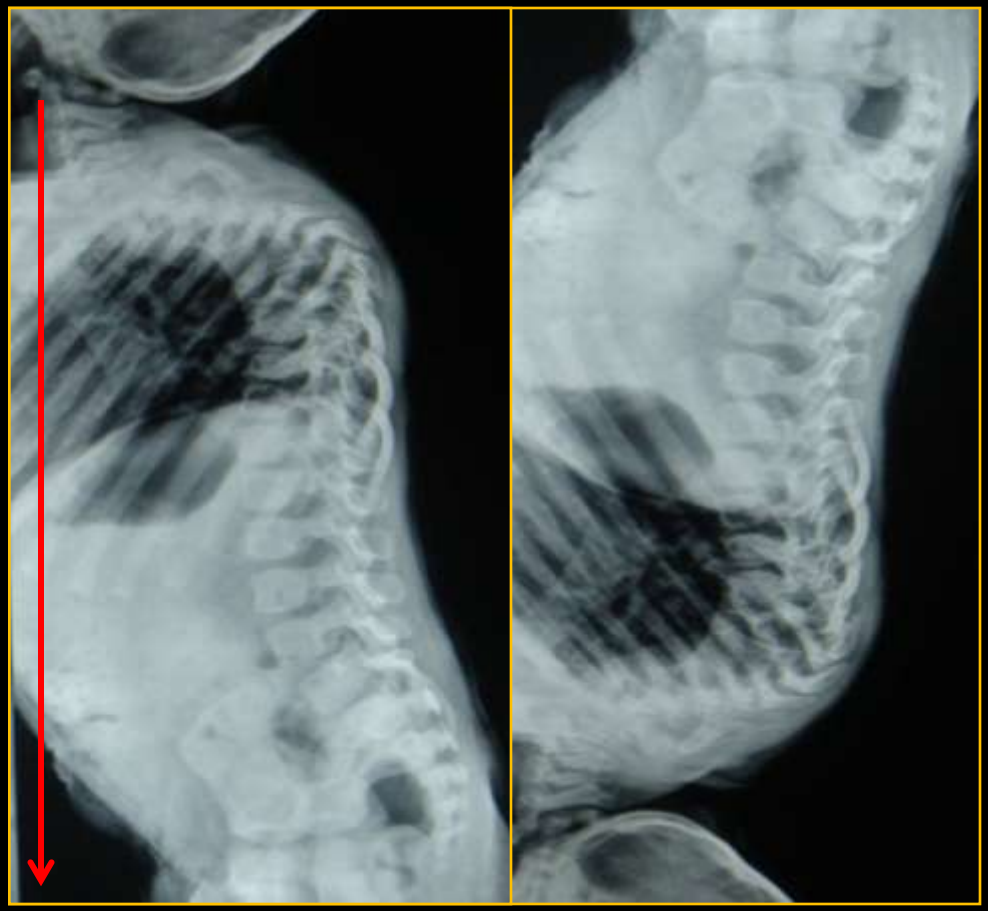
- Medical Treatment – dosage according to body weight.
- Surgery to prevent deformity
- Surgery to correct deformity
- Rarely surgery for neurodeficit

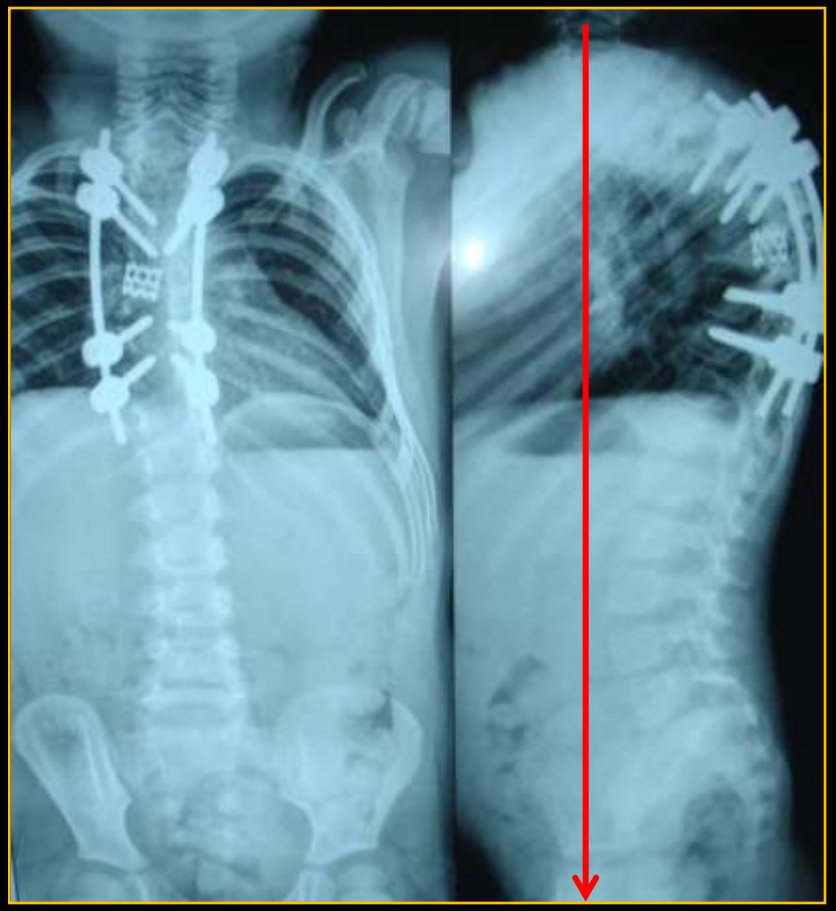
Do not forget MDR TB !


A
B
C
D

VCR







CASE NO 1





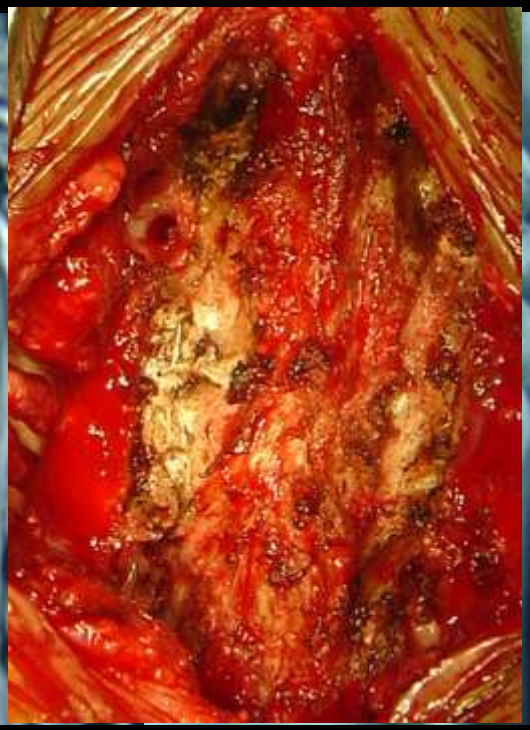

13 F
Neck pain 3m
Pre vert abscess+ erosion
C3,D3, D10-11
Abscess drainage—no microbial growth---started ATD---No improvement---progression of lesio
—Put on Halo—Initially did well---worsened after 3 months---s/o myelopathy---
-post TPF+B---grew MDR TB---second-line drugs X 2yrs---lesion healed---haloremoved
after 6 months—nw 5 yr FU –doing well—lesion healed—no progression of deformity







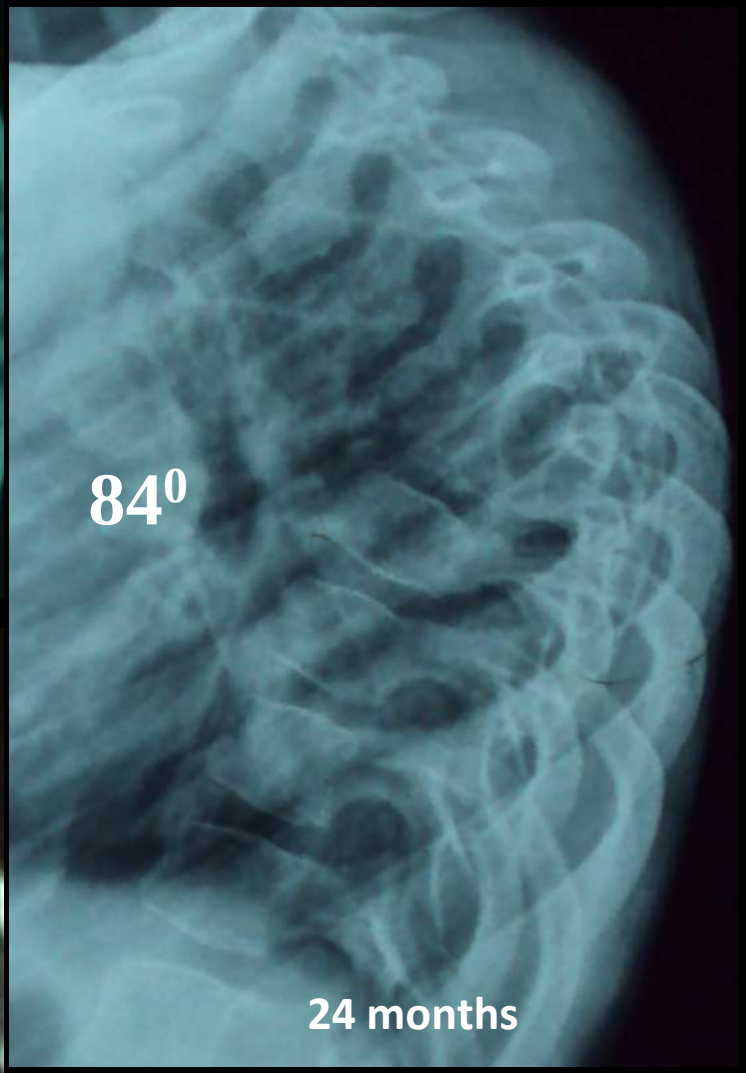
CASE NO 2



3/F – pain parapresis

Posterior TPF + TPD

Implant Removal



Waited for 2 years to complete the healing

FUSION MASS BENDS WITH GROWTH !!!



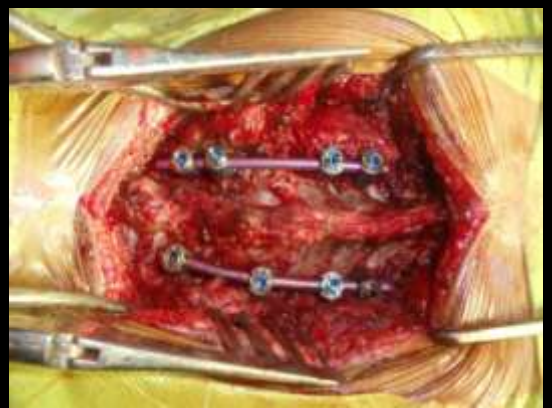


CASE NO 3

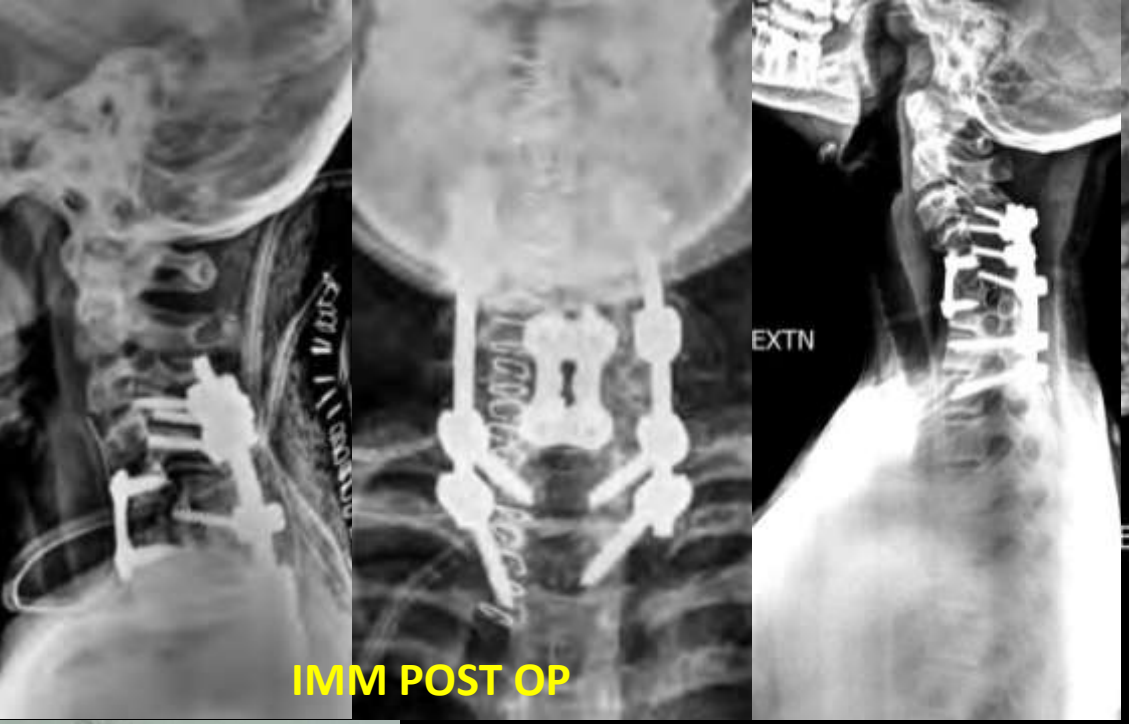
PRE TRACTION

POST TRACTION

9 yr / F
Neck pain and deformity
Intact Neurology



STAGE 1:C6,C7 corpectomy (anterior 2/3) ; partial C5
and T1 debridement and anterior column reconstruction
By iliac crest bone grafting and ant cervical plate
STAGE 2: Posterior cervical stabilisation C3,4;T1,2 with lateral mass screws
and rods.

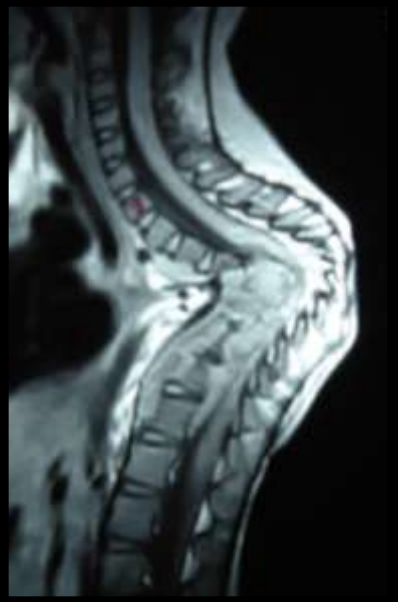


IMM POST OP

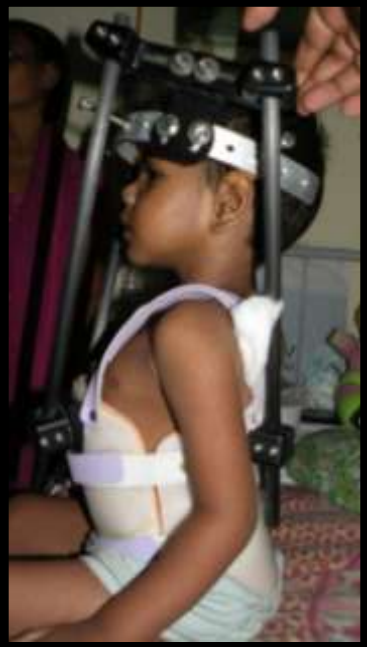
2 YRS FU

EXTENSION OF FUSION

CASE NO 4







12-05-2015

SUMMARY

- Prevention of deformity in tuberculosis should be the prime aim in the treatment of spinal tuberculosis as availability of potent antituberculous drugs has made uncomplicated tuberculosis a medical disease.
- The severity of deformity in spinal tuberculosis depends on the extent of vertebral destruction, level of lesion and age of the patient with more severe deformities seen in children and in lesions involving the thoracolumbar spine.
- In children deformity may continue to progress during growth even after the disease is cured and they should be followed up till the completion of growth.
- The presence of two or more “spine at risk” radiological signs or “pretreatment” deformities of 30° are harbingers of severe late collapse especially in children.
- Surgical procedures performed in the active stage to prevent deformity are simpler and have less morbidity compared to surgical correction of established deformities.


THANK YOU FOR PATIENT HEARING