TUBERCULOSIS OF THE SPINE

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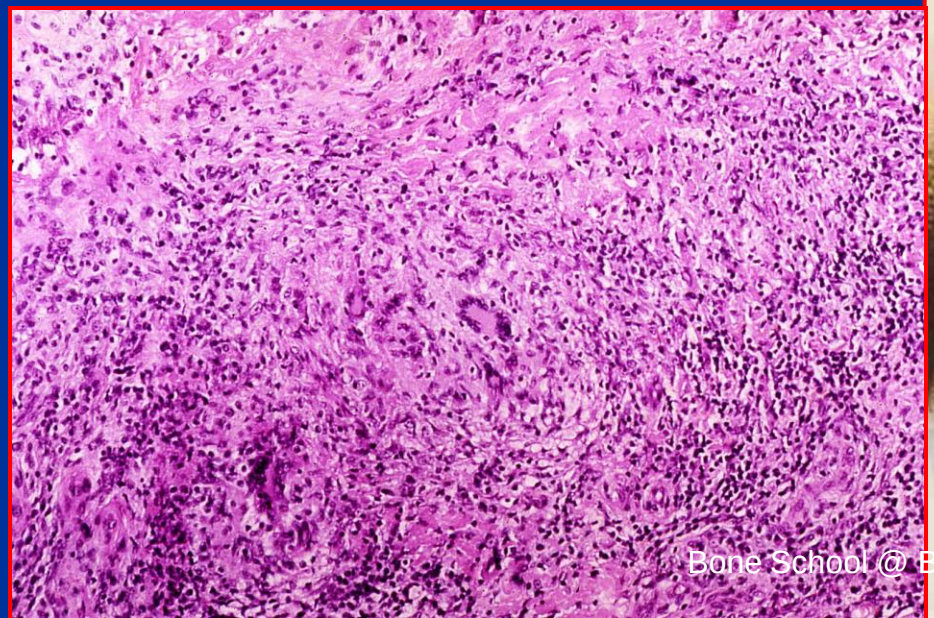
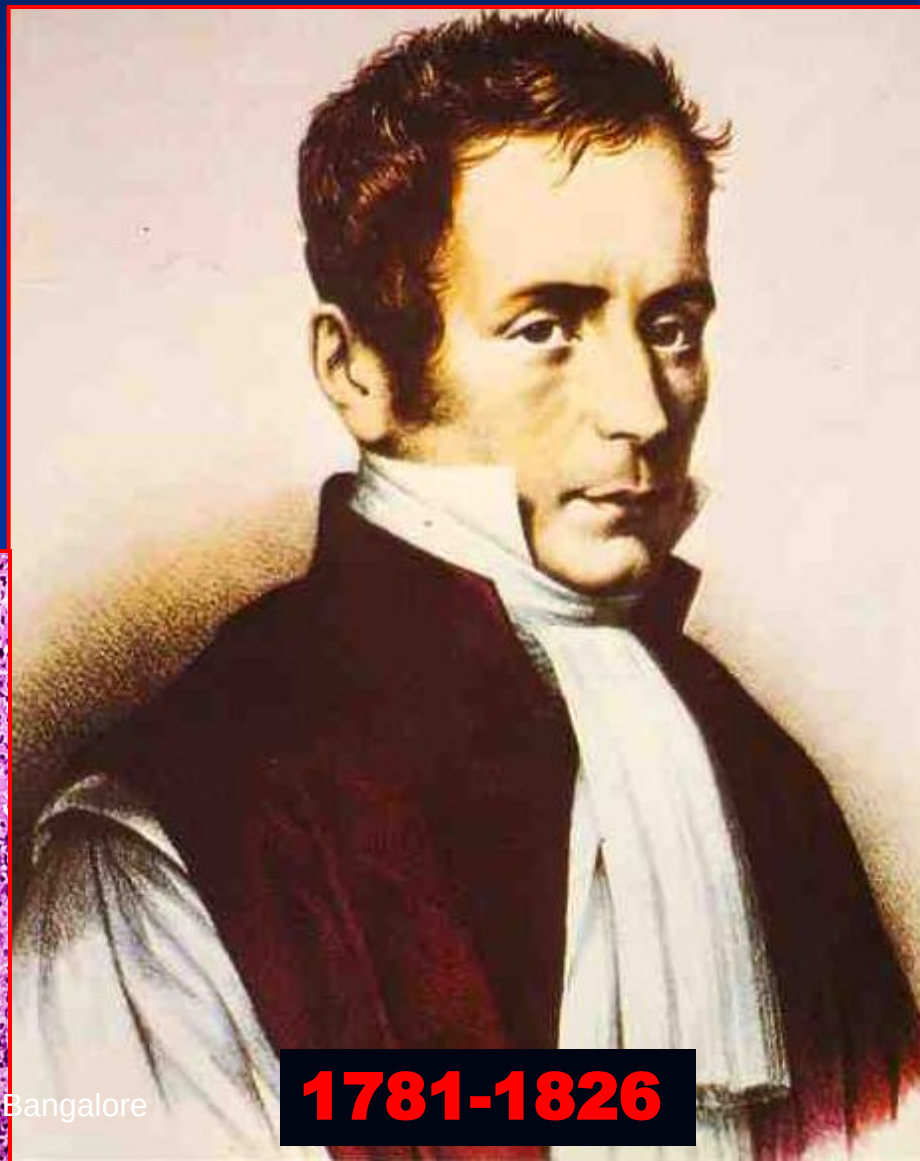
- Although spinal caries is now termed as **Pott's disease**, Pott did not describe the disease or its tuberculous nature ***Garrison***

- "The useless state of the lower limbs in consequence of a curvature of the spine" ***Percivall Pott, (1782)***

Rene Theophile Hyacinthe Laennec

Tubercle - A microscopic pathological lesion with a central necrosis surrounded by epitheloid cells, giant cells and round cells

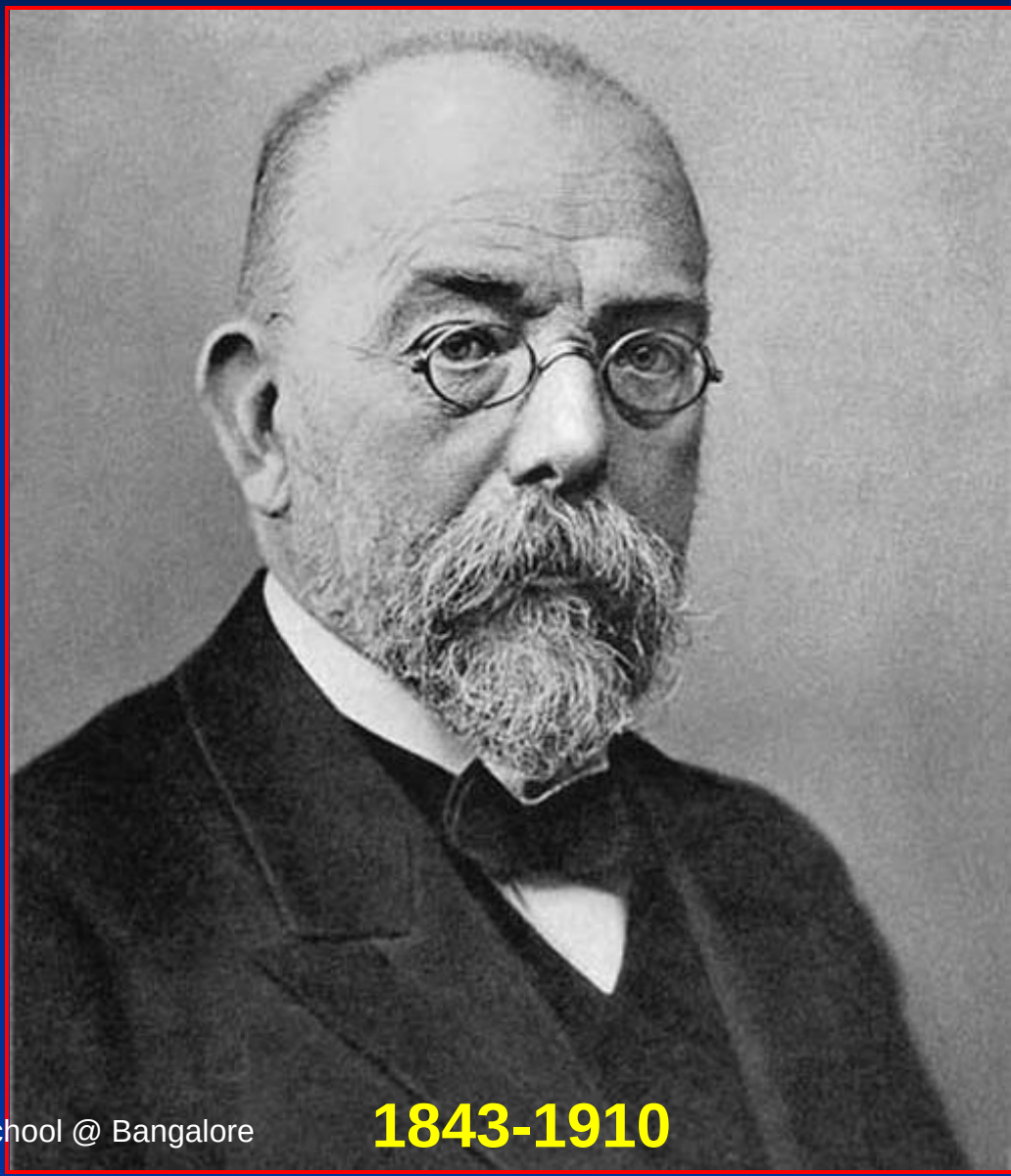




1781-1826

Robert Koch

- Identified the organism (1870)
- Acid fast – gram positive



1843-1910

Landmarks

- Identification of the mycobacterium as the causative agent (1870)
- Use of Bacille Calmette Guerin vaccination (Used first in 1921)
- Radiographic examination
- Availability of specific anti-tubercular drugs

Discovery of Anti Tubercular Drugs

- **Streptomycin - 1944**

  Discovered by Schatz, Bugie and Waksman

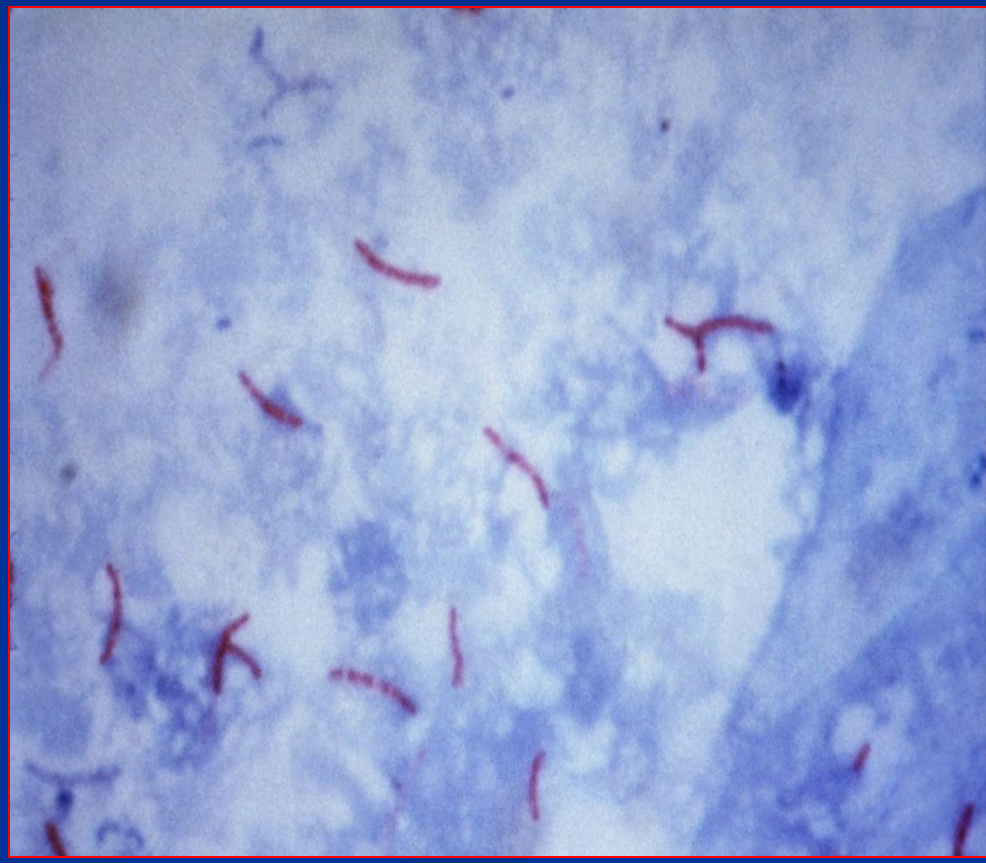
  Major milestone in treatment of tuberculosis

  Has bacteriostatic and bactericidal activity

- **Pyrazinamide** – 1949
- **Isoniazid** – 1951
- **Rifampicin** – 1957
- **Ethambutol** – 1961

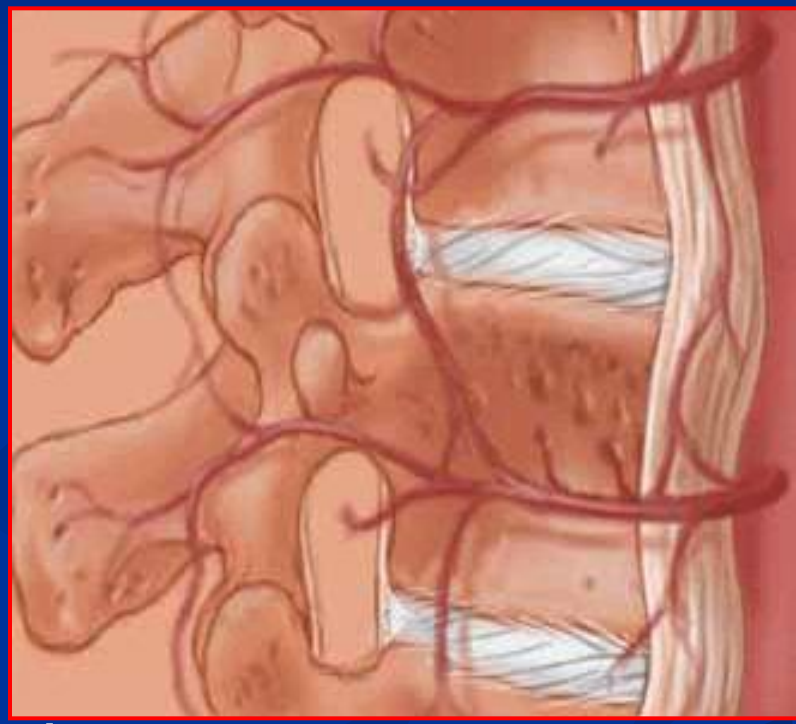
M. tuberculosis, M. africanus, M. bovis, M. avium

- Thin rod shaped, non-motile, no capsule
- Ziehl-Neelsen staining: Alcohol and acid fast
- Strict aerobe
- Culture takes 2- 4 weeks to grow (Lowenstein-Jensen medium)



Spinal Tuberculosis

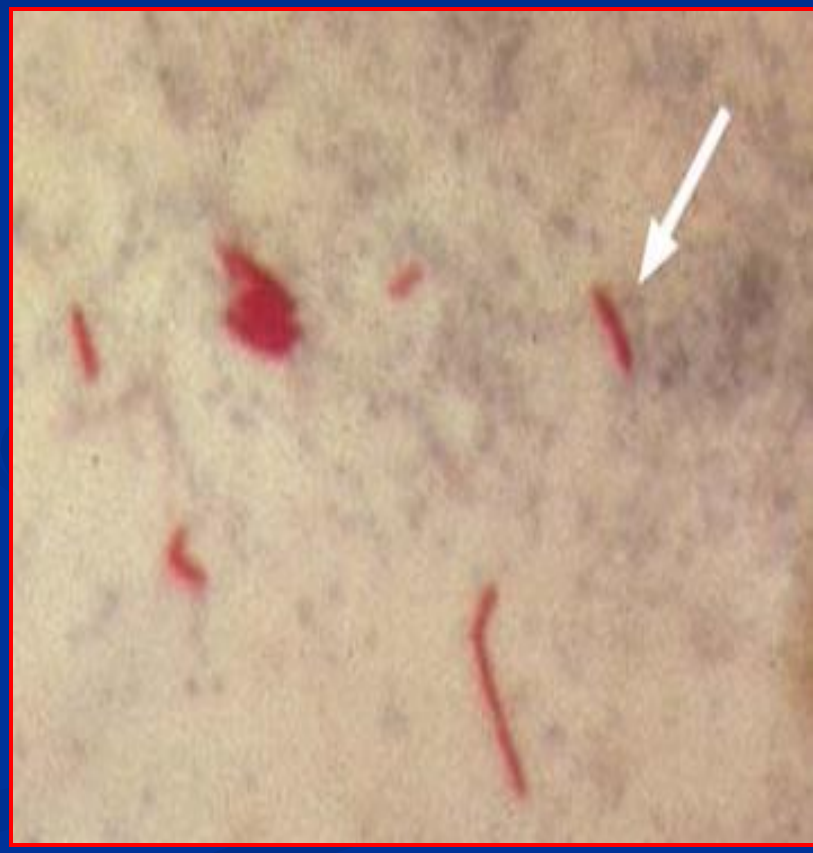
- Most common form of osteo-articular tuberculosis (around 50%)
- Always secondary
- Incidence of paraplegia (10 to 30%)
- Lymph nodes- direct spread
- Hematogenous- paradiscal lesion
- Batson's plexus- central type and skip lesion



Current Thoughts On Pott's Disease

Mycobacterium tuberculi

- Paucibacillary
- Immunocompromised
- Multi-drug resistance
- Extreme drug resistance
- Total drug resistance



Thinking About Pott's Disease

- Pathological lesion

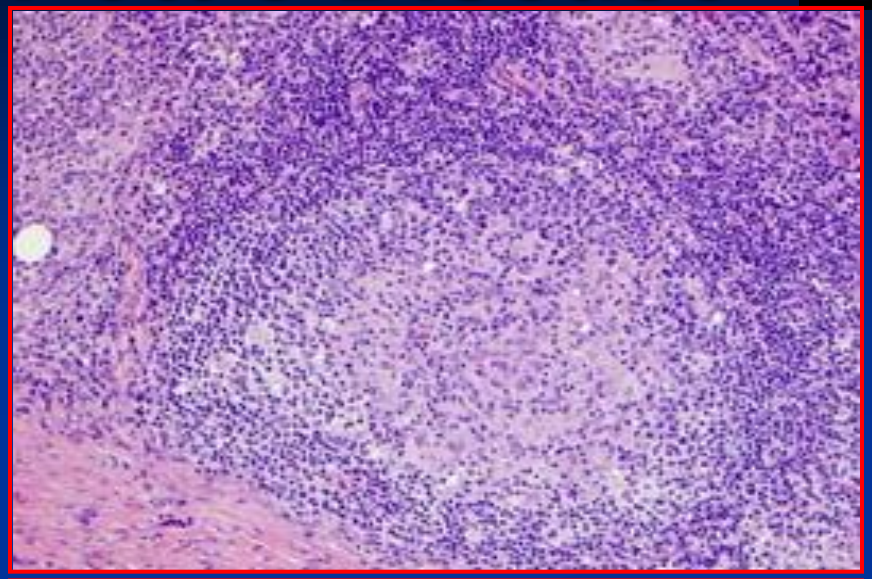
  "The Granuloma"

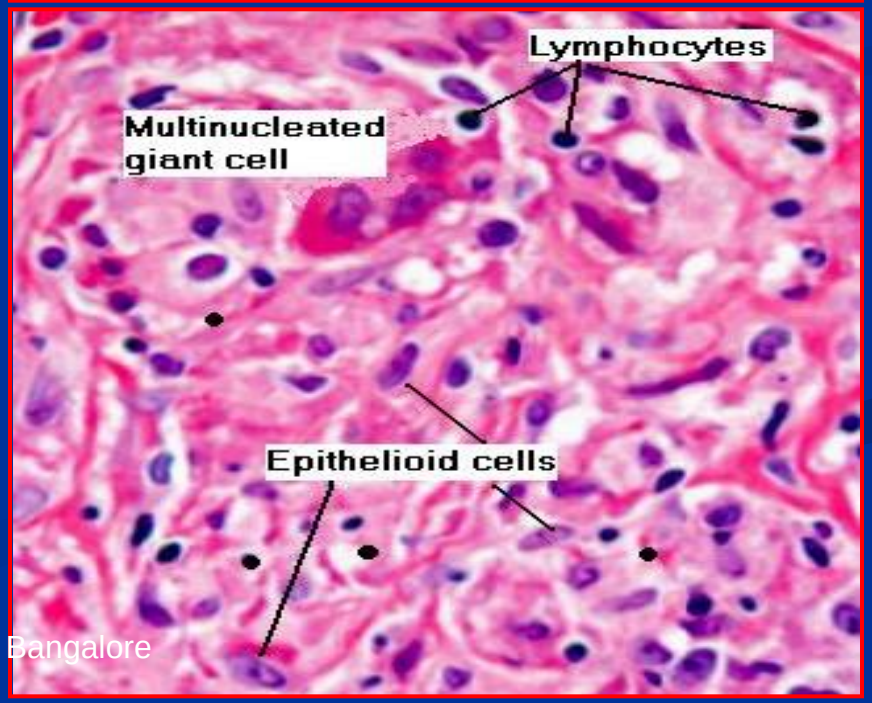
- Not found in 20 to 30%
- To be differentiated from

  Brucella spondylitis

  Mycotic spondylitis

  Tumorous conditions





Pathogenesis Of Spinal Tuberculosis

Five stages by Kumar KA (1988)

- Stage of Implantation
- Stage of early destruction
- Stage of advanced destruction and collapse
- Stage of neurological involvement
- Stage of residual deformity

Complications

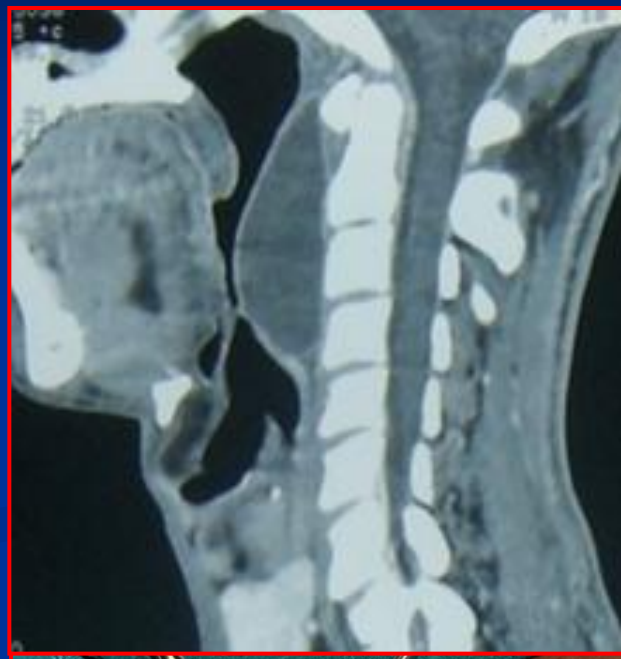
- Cold abscess and sinus
- Spinal deformity
- Pott's paraplegia

Cold Abscess

- Classic local signs of acute infection (calor and rubor) not evoked
- Pus accumulates beneath anterior longitudinal ligament and extends along paths of least resistance

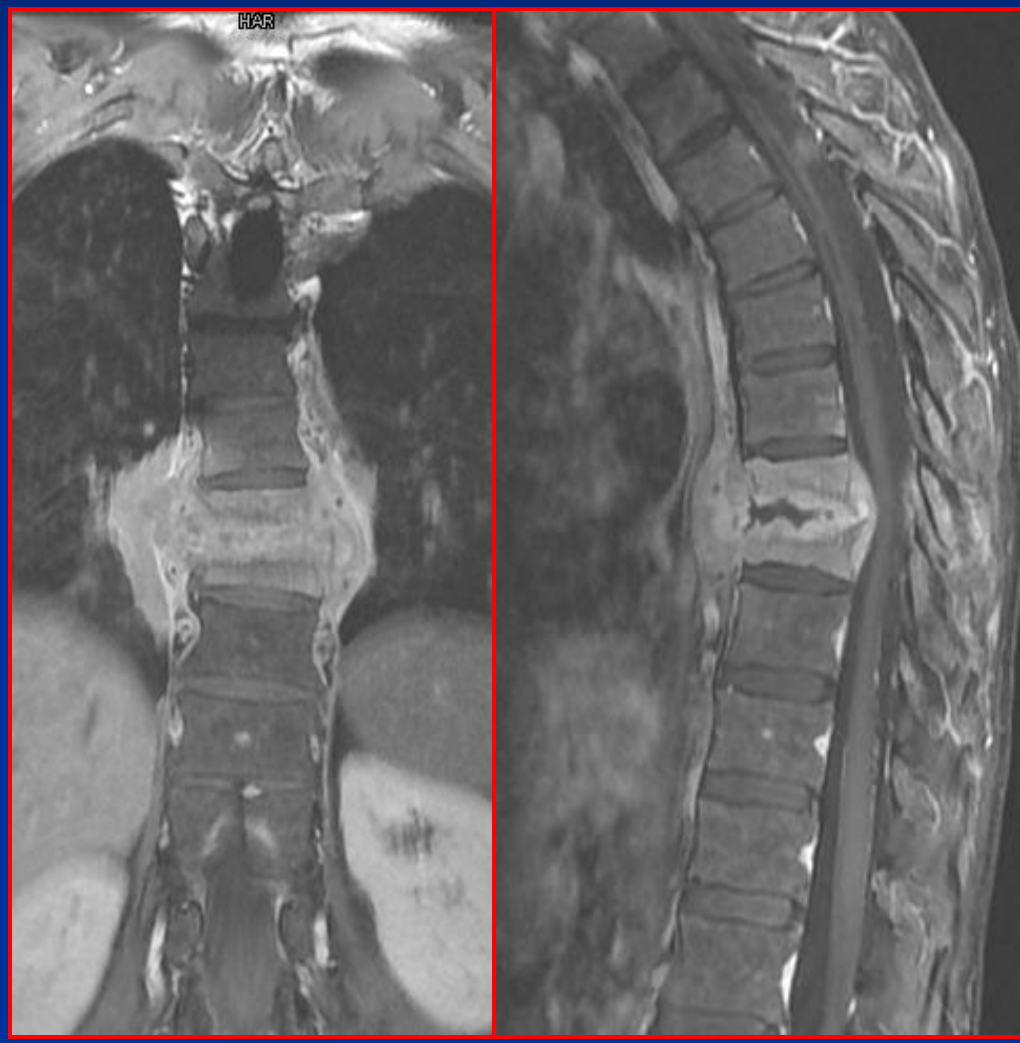
Cold Abscess - cervical spine

- Retropharyngeal abscess- dysphagia, difficult phonation
- Neck swelling- behind sternomastoid in posterior triangle of neck
- Mediastinum
- Axilla and cubital fossa (along vessel and nerve)
- Spinal canal



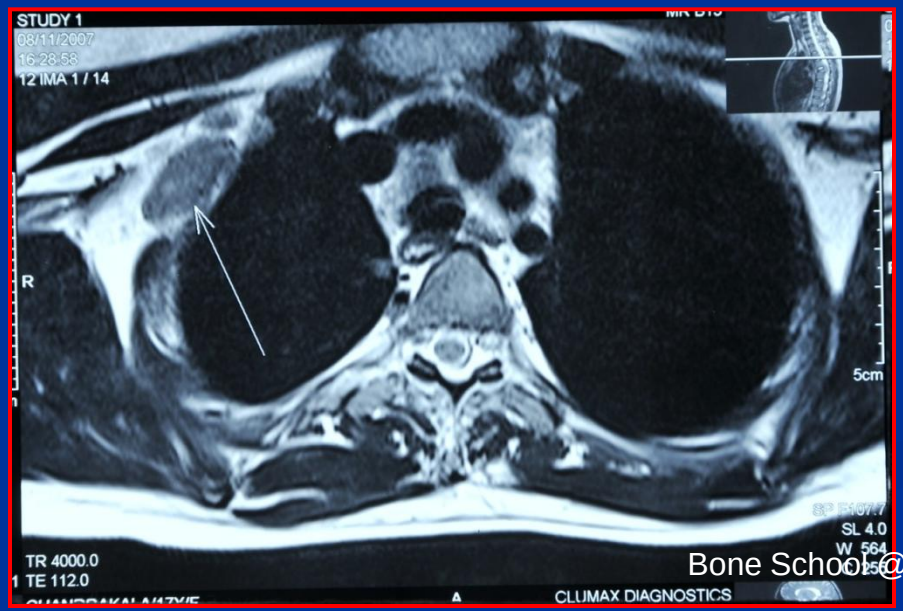
Cold Abscess - thoracic spine

- Prevertebral- posterior mediastinum
- Empyema- rupture into pleura
- Track along intercostal nerves



Cold Abscess - thoracic spine

- Extrapleural space- Spreads laterally
- Spinal canal- cord compression and paraplegia



Lower thoracic spine

- Track down through lateral arcuate ligament

⬇

Kidney bed

⬇

Anterior abdominal wall (via nerve planes)

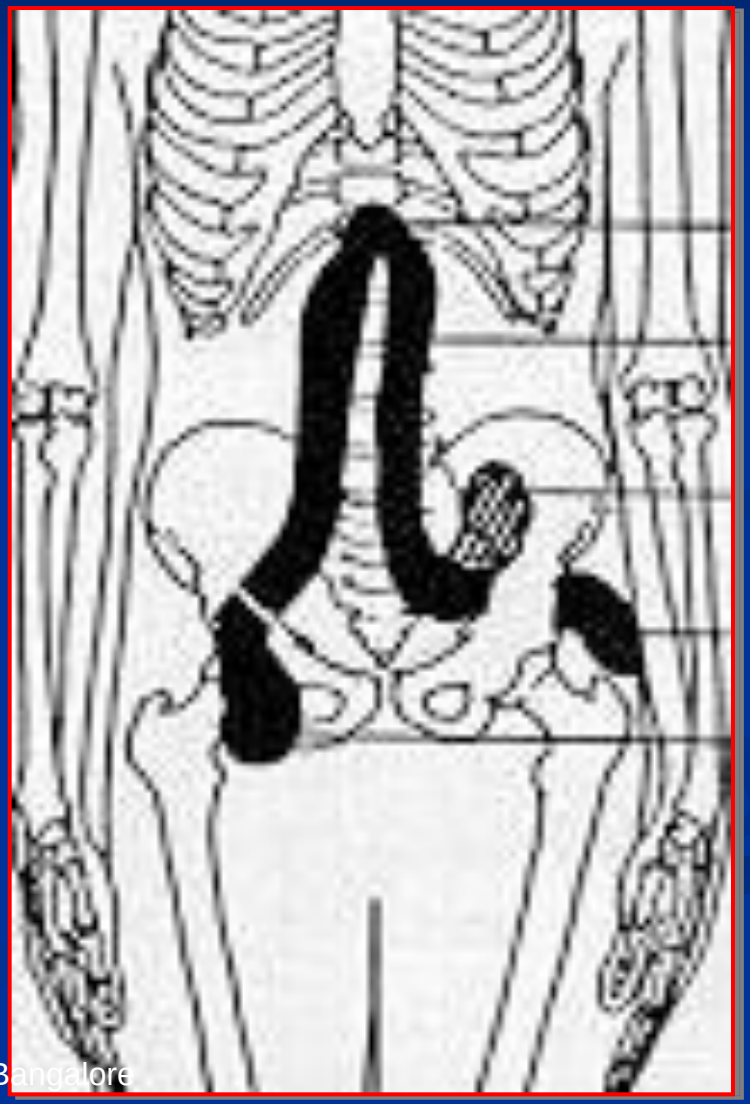
- Medial arcuate ligament

⬇

Psoas sheath

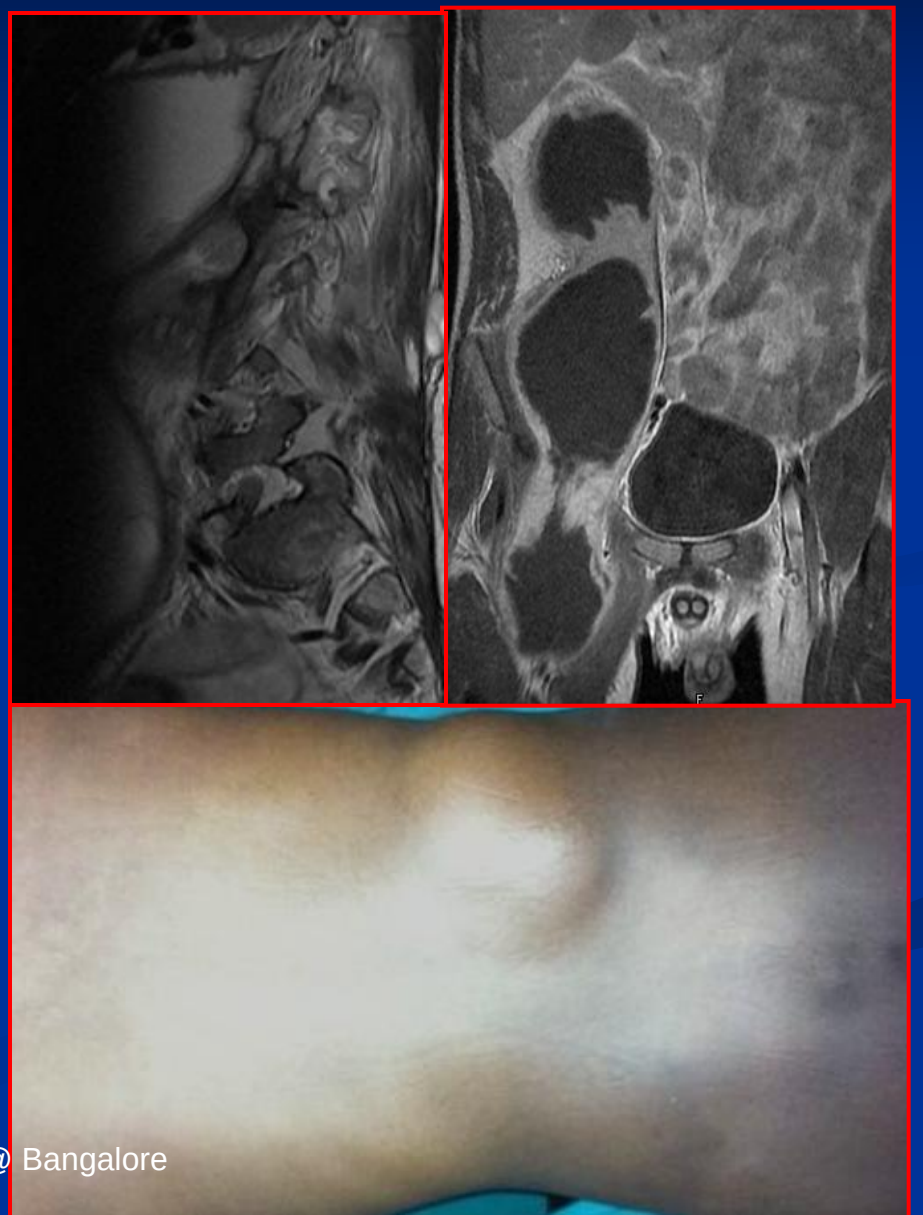
⬇

Thigh swelling



Lumbar spine- Psoas Abscess

- Psoas abscess can travel along sciatic nerve to pelvis, gluteal region, posterior aspect of thigh and popliteal region

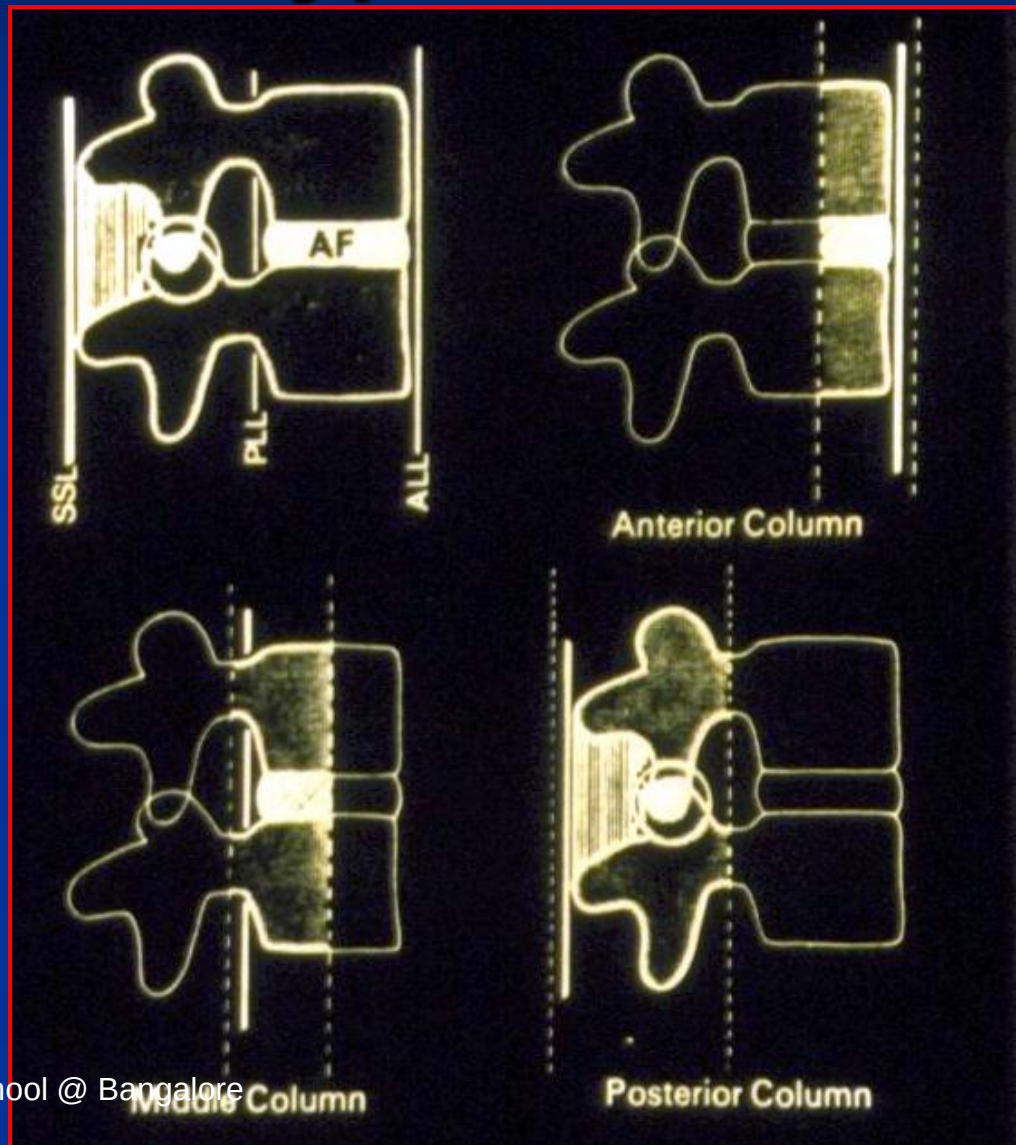


Infection And Progression Of Kyphosis

- Infection → Granulation Tissue → Destruction → Collapse → Kyphosis
- Infection → Osteopenia → Collapse → Kyphosis
- Infection → AVN → Collapse → Kyphosis

Mechanical Causes of Progression of Kyphosis

- Involvement of anterior and middle column produces progressive kyphosis
- Involvement of only the middle or the posterior column may not produce kyphosis
- Active continuous growth of the posterior column leads to progression



Clinico-Radiological Classification Kumar(1988)

Degree of bone destruction and deformity

STAGE I	Pre-destructive
STAGE II	Early-destructive
STAGE III	Mild angular kyphos
STAGE IV	Moderate angular kyphos
STAGE V	Severe kyphos

Pott's Paraplegia

- Paraplegia is the result of interference with the conductivity of the pyramidal tracts of the spinal cord and is most often associated with the tuberculosis of the dorsal spine (10 – 30 %)

- It can be early or late onset

Why paraplegia is common in dorsal spine?

1. Commonest site for tuberculosis
2. Thoracic kyphosis helps in squeezing the products into the canal
3. Cord : canal ratio is smaller
4. Spinal cord terminates below L1
5. Ant. Lon. Lig. Is loose in thoracic spine whereas in lumbar pus enters the psoas

Pott's Paraplegia

- **EARLY ONSET PARAPLEGIA**
  - Occurs when disease is active
  - Usually within 2 years of onset of the disease
  - Usually prognosis is good
- **LATE ONSET PARAPLEGIA**
  - Paraplegia of healed disease
  - Occurs 2 years after the onset of the disease
  - Has poor prognosis

Causes of early onset paraplegia

Seddon-1935

A) Inflammatory causes:

1. Abscess/ inflammatory tissue and caseating mass
2. Spinal tumor syndrome (circumscribed tuberculous mass)
3. Posterior spinal disease
4. Infective thrombosis

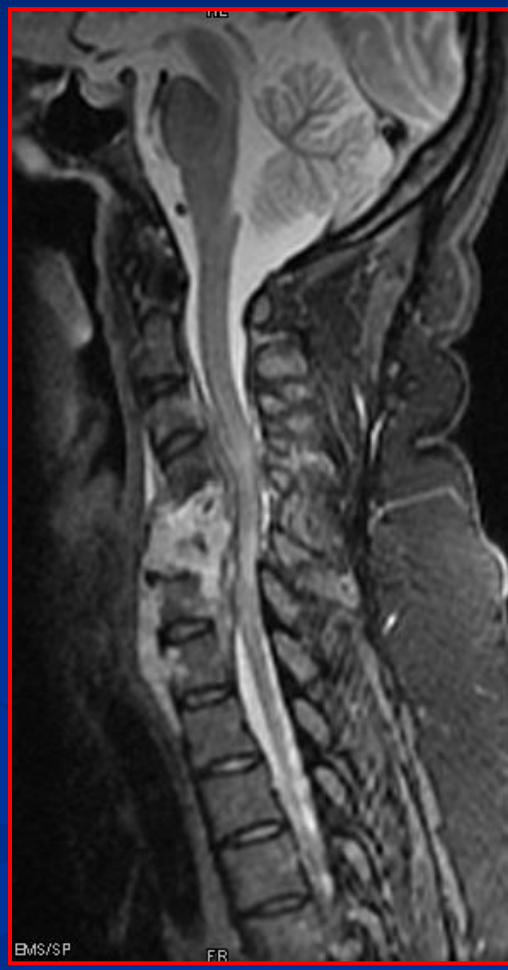
Causes of early onset paraplegia

Seddon-1935

B) Mechanical causes:

1. Pathological subluxation/ dislocation

2. Cord compression by sequestra/ loose fragments of bone/ granulation tissue/ debris/ disc



Causes of late onset paraplegia

Seddon-1935

A) Inflammatory causes:

Continued activity or reactivation

B) Mechanical causes:

1. Cord stretched over internal gibbus/ transverse ridge
2. Vascular and dural fibrosis

Causes of Paraplegia

Extrinsic causes

1) In active disease:

a) Abscess

b) Granulation tissue

c) Sequestered bone and disc

d) Pathological subluxation / dislocation

2) In healed disease

a) Transverse ridge / internal gibbus

b) Fibrosis of dura

Causes of Paraplegia

- **Intrinsic causes:**

1. Tubercular involvement of the dura/ meninges/ cord

- **Rare causes:**

1. Infective thrombosis of the cord
2. Spinal tumor syndrome

Thinking About Pott's Disease

Clinical Presentation

1) Pain (97%)
2) Fever (19%)
3) Tenderness and muscle spasm (88%)
4) Kyphosis (56%)
5) Cold abscess
6) Paraplegia (10 to 30%)

Deformity

- **Knuckle deformity**: Wedging of 1 or 2 adjacent vertebral bodies
- **Gibbus deformity**: wedge collapse of 2-3 vertebral bodies anteriorly
- **Round kyphus deformity**: wedging of more than 3 vertebrae

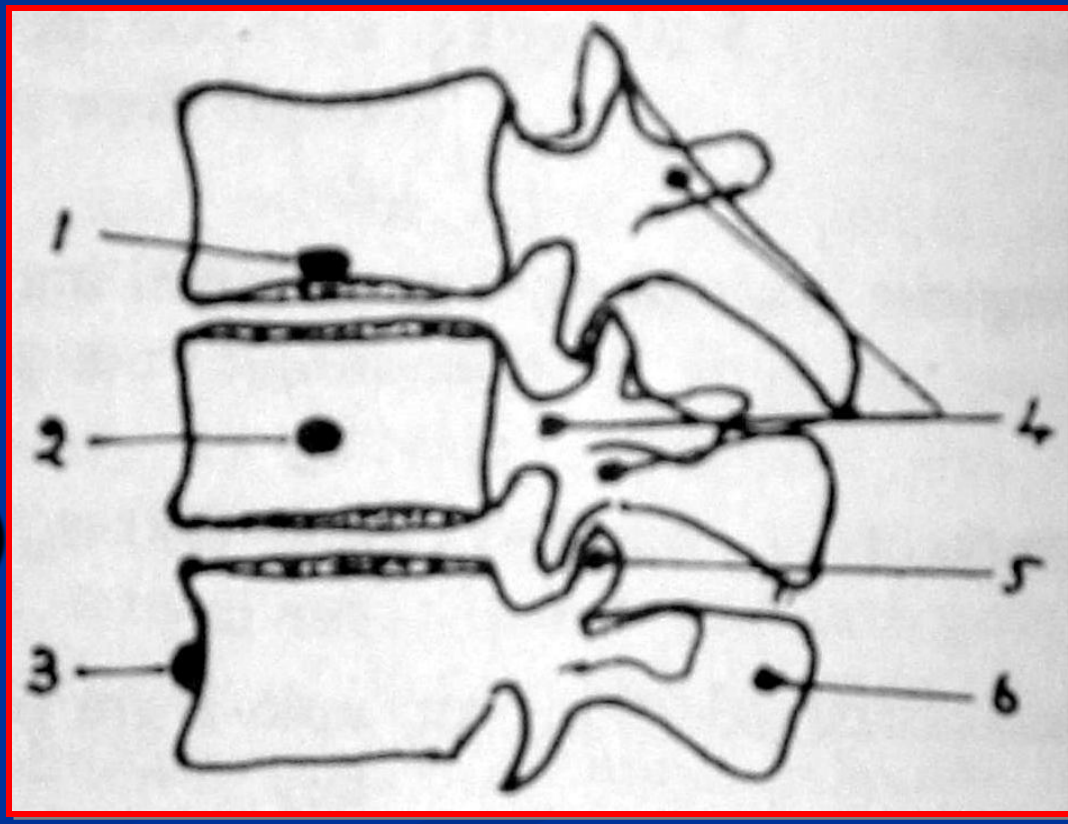
Pott's Paraplegia Classification - Kumar & Tuli

Stage		Clinical features
I	Negligible	Patient unaware of neural deficit, physician detects plantar extensor and/or ankle clonus.
II	Mild	Patient aware of deficit but manages to walk with support, clumsiness of gait.
III	Moderate	Paralysis in extension, sensory deficit less than 50%
IV	Severe	III + flexor spasm/ paralysis in flexion/ flaccid/ sensory deficit more than 50%/ sphincters involved.

Thinking About Pott's Disease

Conventional Radiological Presentation

- Paradiscal (54%)
- Central (19%)
- Anterior (4%)
- Appendicial (4%)
- Atlanto axial (1%)
- Normal (2%)
- Multiple (18%)



Even though, classical clinical and radiological features have been described in the literature, spinal tuberculosis does mimic other lesions

Can be

MISSED, MISTAKEN or MISDIAGNOSED

The Missed Lesions

X- Ray

CT

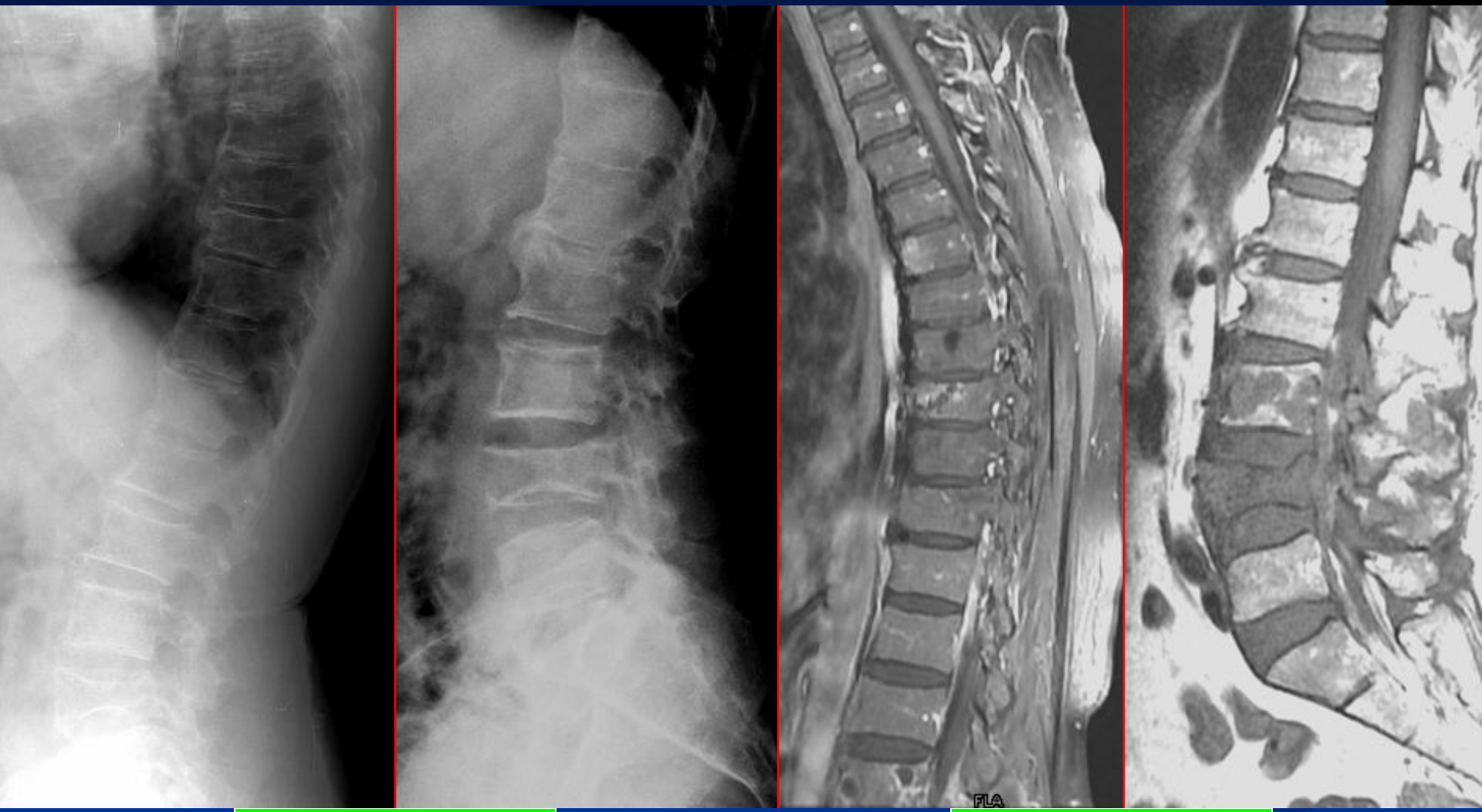
MRI

The Mistaken Lesion

X- Ray | CT | MRI

DIAGNOSIS : NON-HODGKINS LYMPHOMA

The Misdiagnosed Lesion



X- Ray

MRI

DIAGNOSIS: TUBERCULOSIS

Current Trends In Imaging

ROLE OF CT SCAN

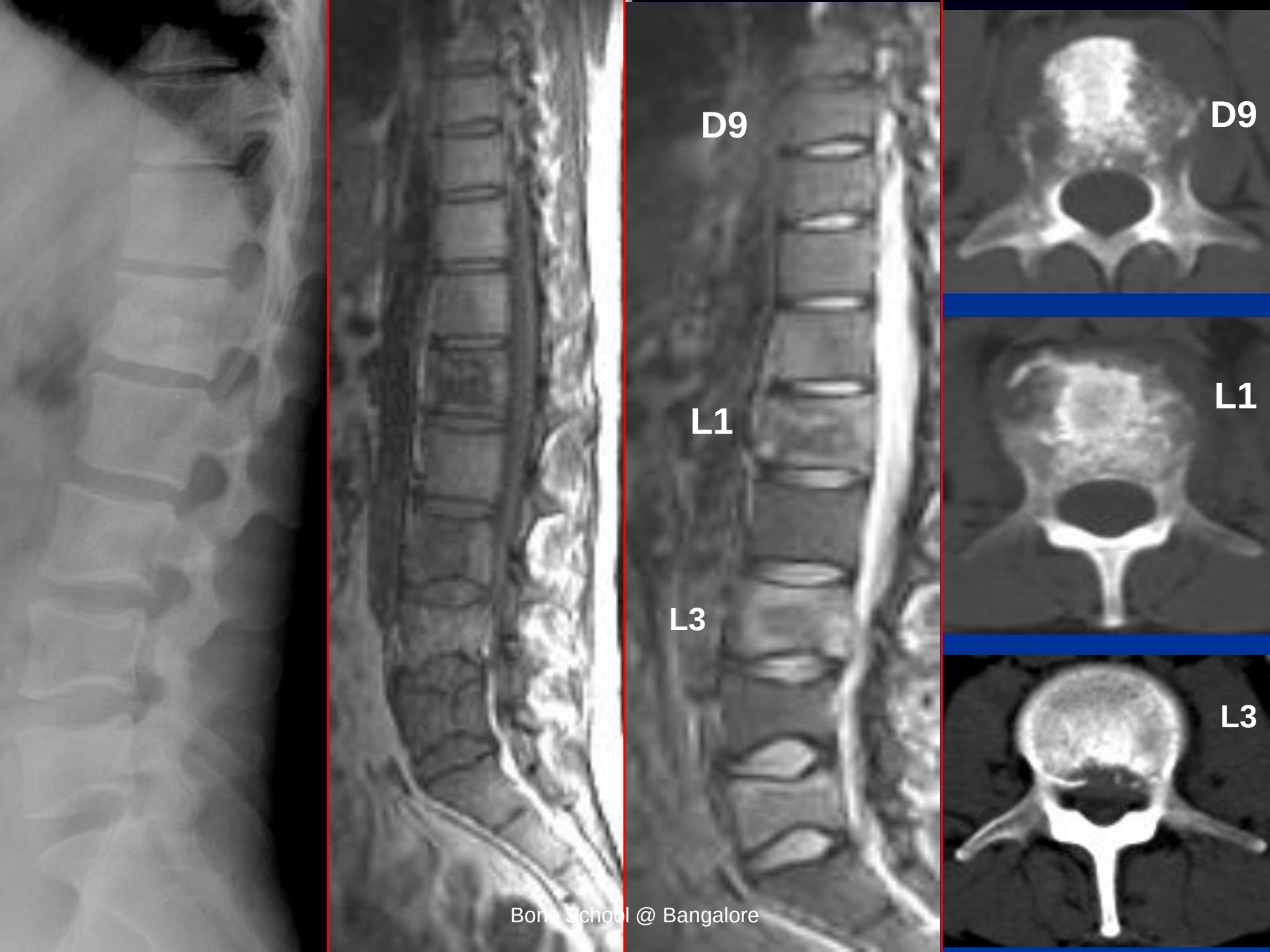
- **CT IMAGING** shows focus of

- Bone Infection
- Early Erosions
- Level Of Lesion
- Amount Of Bone Destruction
- Posterior Element Lesions

Current Trends In Imaging

ROLE OF MRI SCAN

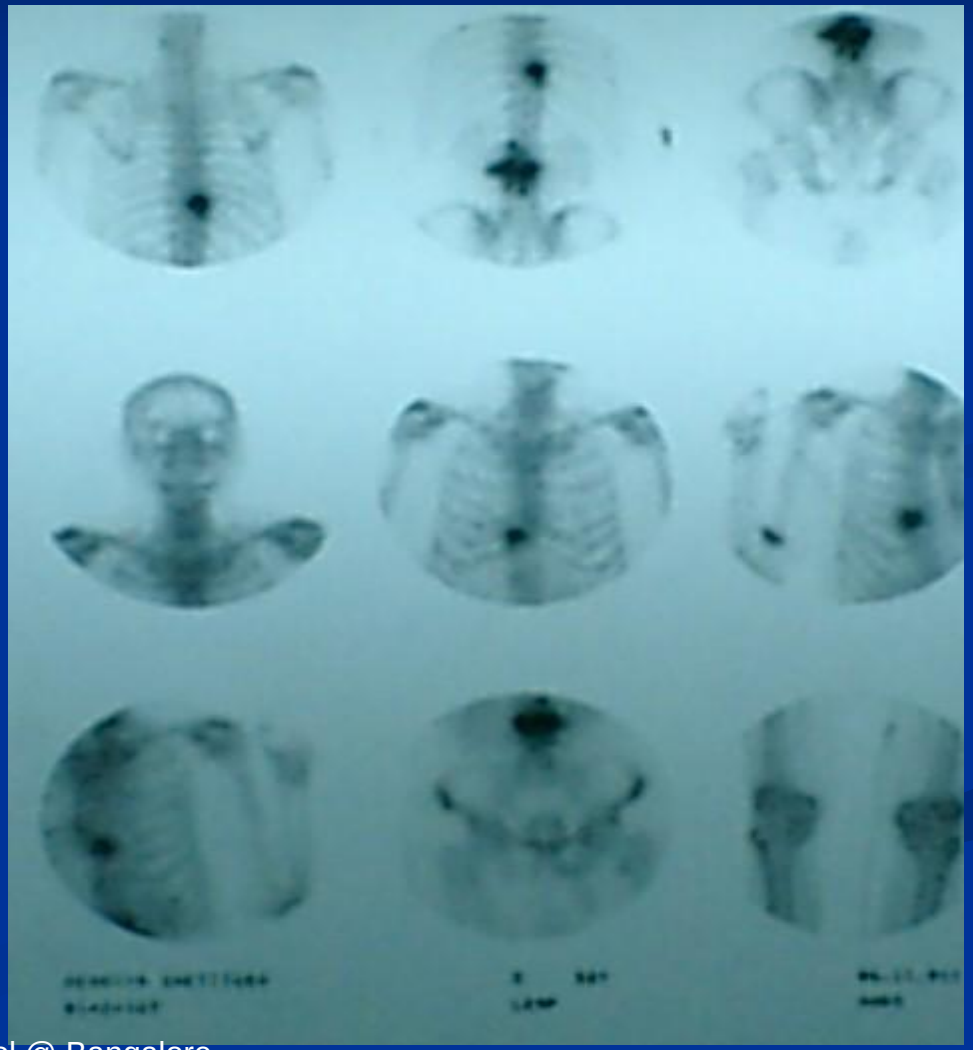
- **MR IMAGING IDENTIFIES**
  - Cord compression / changes
  - Soft tissue shadows and intraosseus abscesses
  - Skip lesions
  - Sub ligamentous spread of infection and epidural extension
  - The Imaging **Method Of Choice**



Current Trends In Imaging

ROLE OF BONE SCAN

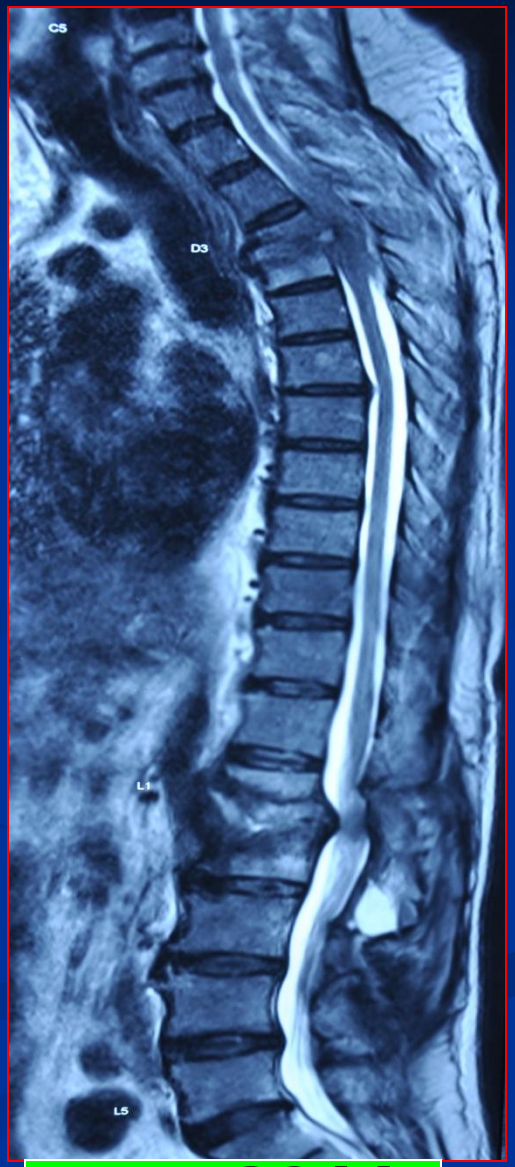
- Helps in detection of early lesions when radiologically normal
- Helpful in diagnosing skip lesions/ involvement of other bones
- 95% sensitivity



Advantage of Bone Scan

Jan 2011

Feb 2011



May 2011

The Sero-immunological and Biochemical Investigations

- **POLYMERASE CHAIN REACTION**

  - Simple and widely used
  - Highly sensitive but less specific

- **ROLE OF IgM AND OTHERS**

  - Low specificity and sensitivity
  - Of low predictive value in spinal TB and other extra-pulmonary diseases

EVOLUTION OF TREATMENT OF POTT'S DISEASE

1. Pre-chemotherapy Era

- Era of inactivity
- Era of controversial surgeries

2. Post- Chemotherapy Era

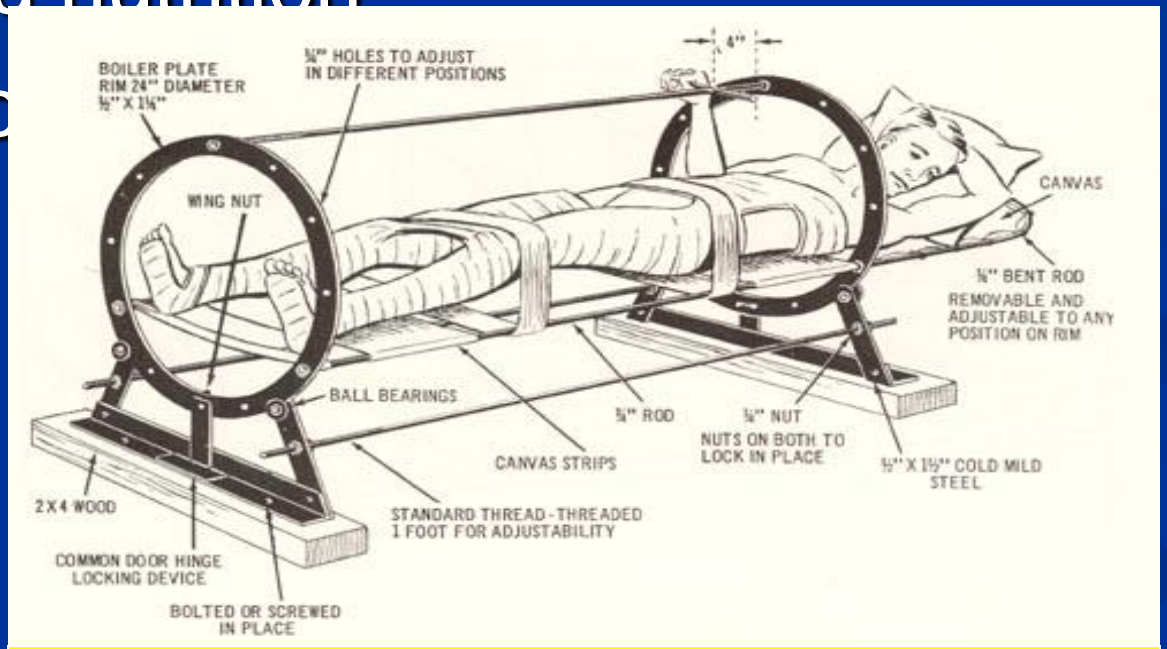
- Era of limited surgeries
- Era of radical surgeries

3. Current Trends In Operative Management

- Era of instrumentation

Era of Inactivity

- Prolonged recumbence in bed
- Good nutrition
- Expo



REST

TOTAL, COMPLETE AND UNINTERRUPTED

HUGH OWEN THOMAS

Anti Tubercular Drugs

- Specific anti-tuberculous drugs have revolutionized the outcome of spinal tuberculosis which is now considered to be curable

- It has to be realized that surgical treatment cannot replace chemotherapy

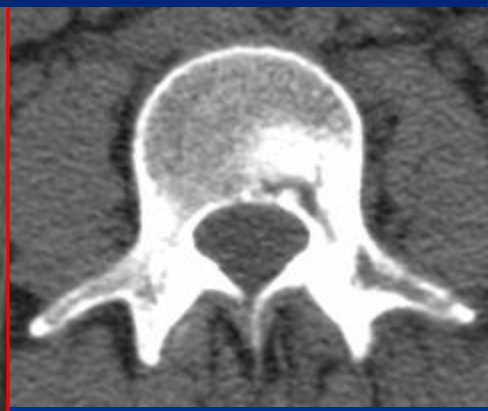
Anti Tubercular Drugs

- One in 20 new cases of tuberculosis is considered to be multidrug-resistant
- Therefore, in spinal tuberculosis, 3 months of intensive chemotherapy with 4 drugs followed by 12-15 months of maintenance therapy with two drugs is necessary

The Role of Empirical Treatment

- Always an attempt should be made to prove the diagnosis before therapy is initiated
- However, young patients with classical clinico-radiological features and high ESR may be empirically started on ATT
- If empirical therapy is initiated, meticulous monitoring to ensure sustained improvement is necessary

Empirical Treatment



Pre Chemo

- Febrile
- Pain
- ESR 84 **mm/hr**

3 weeks Post Chemo

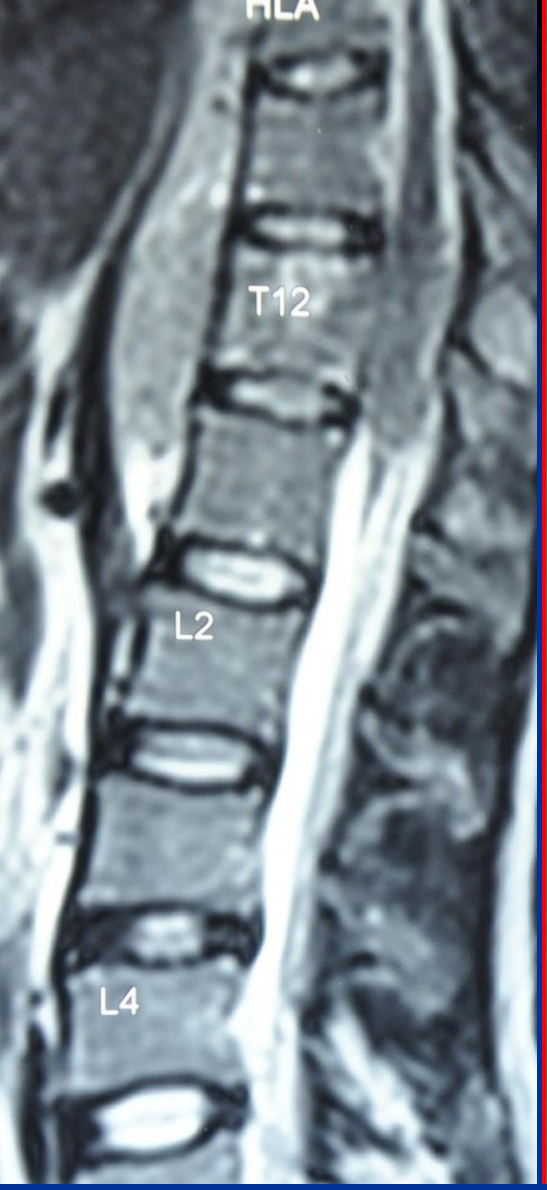
- Afebrile
- Pain ↓
- ESR 18 **mm/hr**

Controversial Surgeries

LAMINECTOMY

- Is **CONTRAINDICATED** in spinal tuberculosis because the disease is present anteriorly and by doing a posterior decompression, the spine becomes completely unstable

- It is only indicated in cases of posterior element disease and spinal tumour syndrome



Pre-laminectomy MRI

Post-laminectomy CT

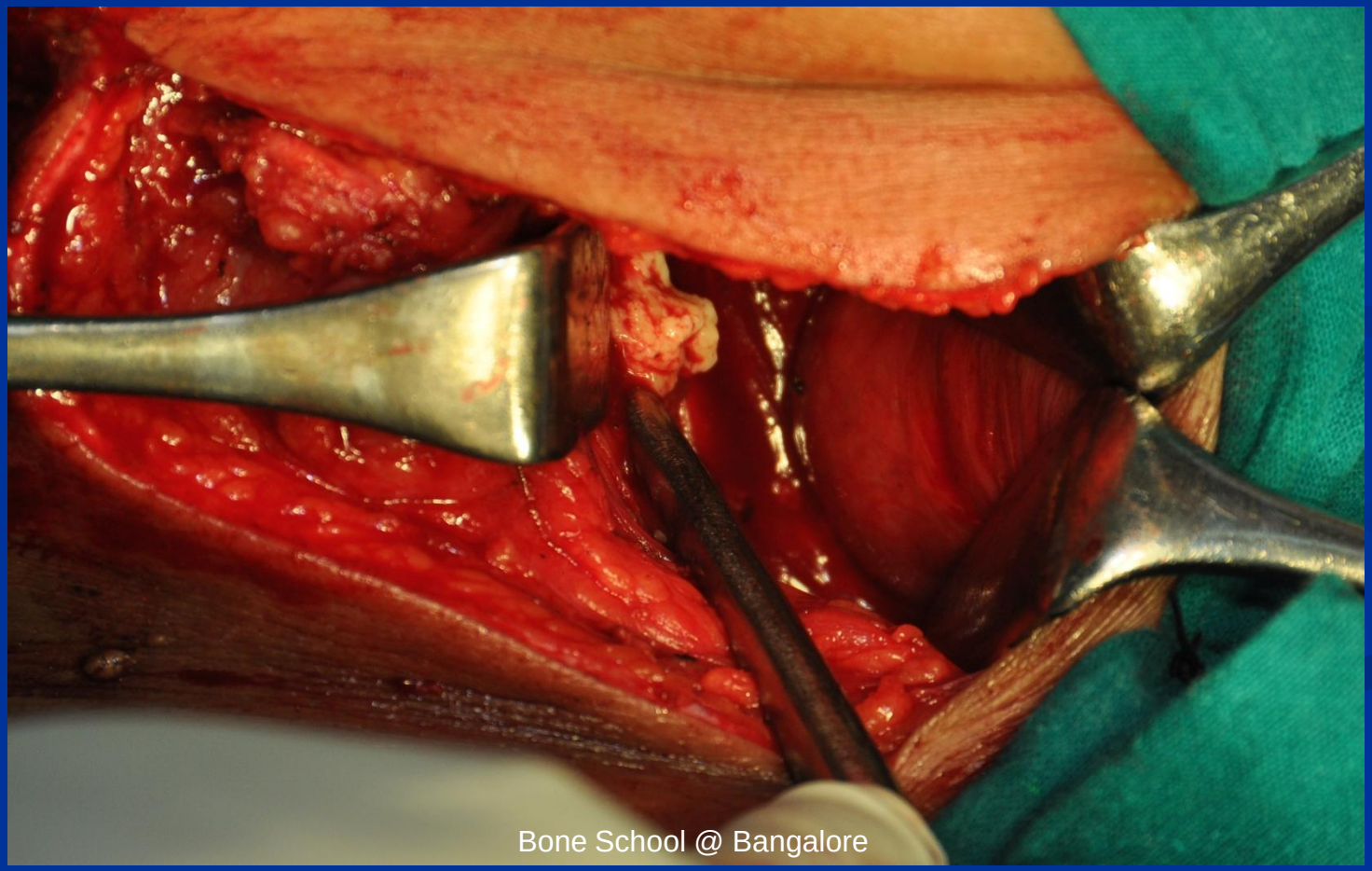
Post-laminectomy MRI

Limited Surgeries In Tuberculosis of Spine

- DRAINAGE OF COLD ABSCESS
- COSTO-TRANSVERSECTOMY
- LUMBAR TRANSVERSECTOMY

Limited Surgeries In Tuberculosis of Spine

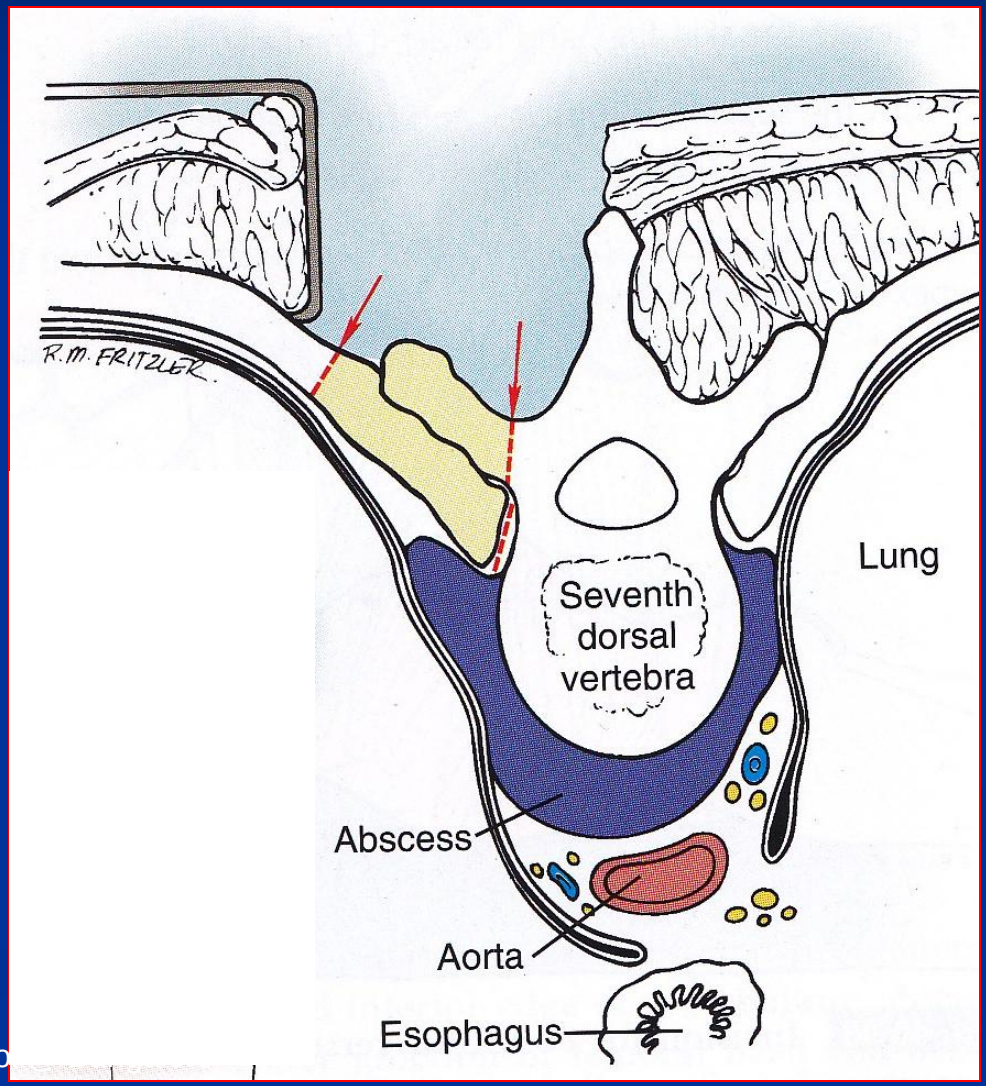
DRAINAGE OF COLD ABSCESS



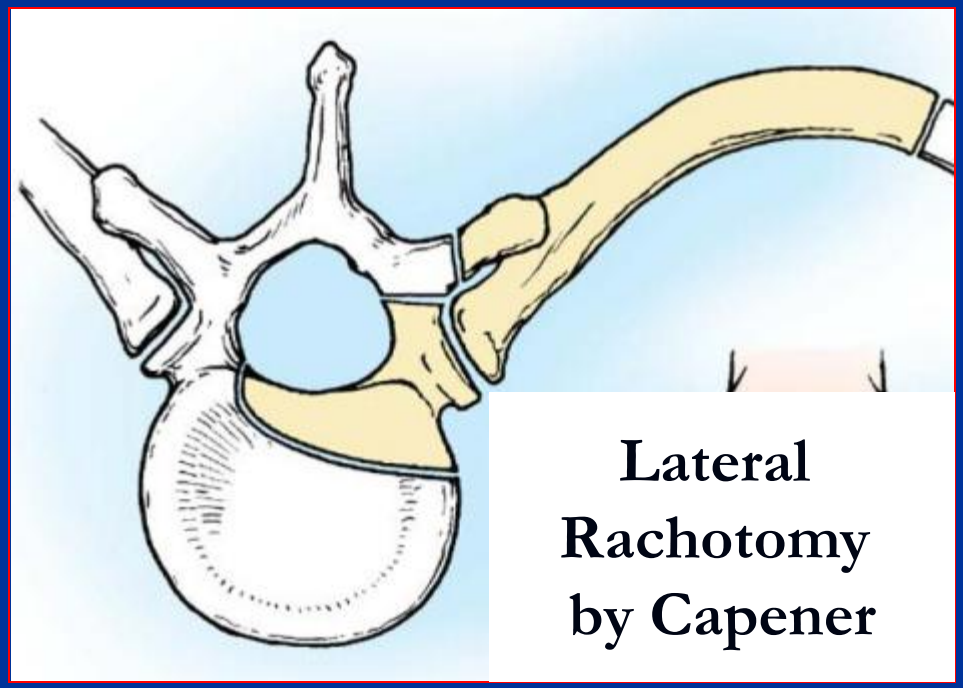
Limited Surgeries In Tuberculosis of Spine

- **COSTO-TRANSVERSECTOMY**

Excision of portion of a rib and the articulating transverse process



Conventional Limited Surgeries



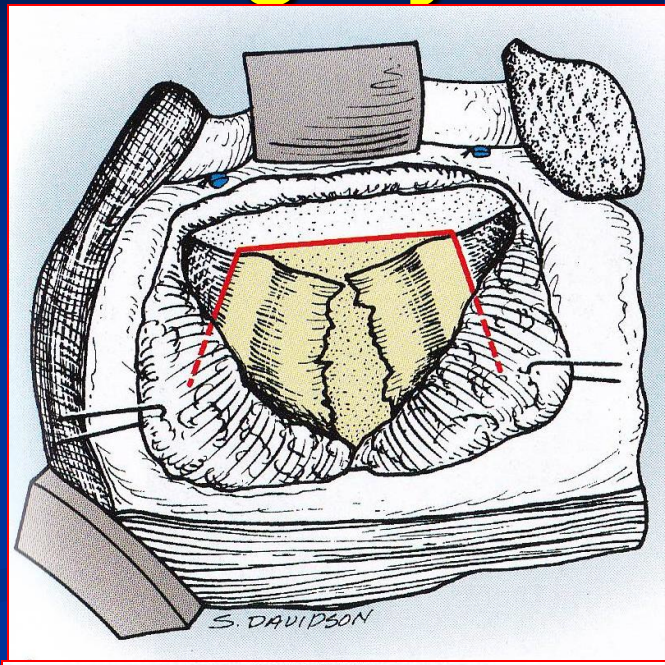
- **ANTERO-LATERAL DECOMPRESSION**

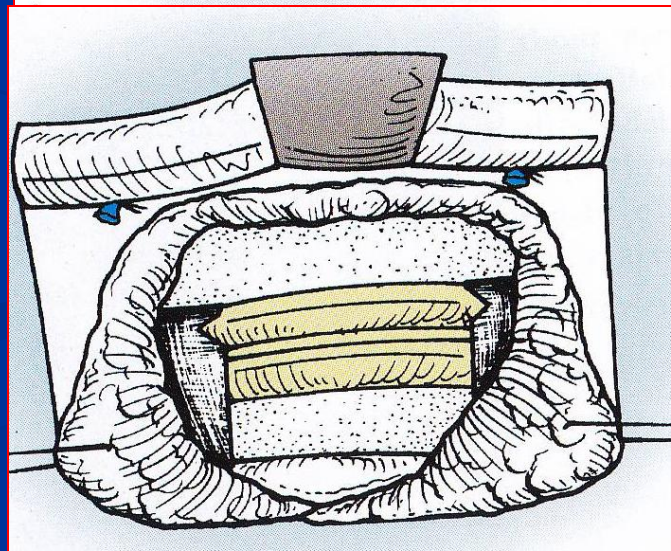
First described by Capener (1933).

Only operation in which decompression of the cord is performed by removing the actual cause of compression

Conventional Radical Surgery

- **Hodgson et al.(1960)**
  Developed the concept of radical excision of the diseased vertebral bodies and their replacement by bone grafts in all cases of spinal tuberculosis





Conventional Indications for Surgery

Griffith and Seddon

Absolute Indications

Relative Indications

Rare Indications

Absolute Indications

- Paraplegia during conservative treatment
- Paraplegia worsening during treatment
- Complete motor loss for 1 month despite conservative treatment
- Paraplegia with uncontrolled spasticity
- Severe and rapid onset paraplegia
- Severe flaccid paraplegia/ sensory loss

Relative indications

1. Recurrent paraplegia
2. Paraplegia in elderly
3. Painful and spastic paraplegia
4. Paraplegia with complications (UTI)

Rare indications

1. Posterior element disease
2. Spinal tumor syndrome
3. Severe cervical lesion $\overline{c}$ paraplegia
4. Cauda equinopathy

Conventional Treatment: Tuli

- Anti tubercular drugs are the most important therapeutic measure
- ATT must be continued for about 18 months(must include Isoniazide)
- Patients with early disease can achieve full clinical healing
- Indications of surgery are mainly for complications than for the disease control

The Middle Path Regimen of Tuli – Surgical Indications

- No neurological recovery after 4 weeks of ATT
- Development of neurological deficit during the course of chemotherapy
- Recurrence of neurological deficit after initial improvement
- Worsening of neurological deficit while on chemotherapy
- Advanced case of neurological involvement

BRITISH MEDICAL RESEARCH COUNCIL

When appropriate facilities and expertise are available radical surgeries have definite advantage over non-operative treatment

J Bone Joint Surg 60 (B), 61 (B) 64 (B) and 67 (B)

However long term follow up of radical surgeries showed considerable loss of correction and failure of the bone graft leading to progression of kyphosis

Parthasarathy et al, Rajashekaran et al, Sundararaj et al and Moon et al

Current Trends In The Surgical Management of Spinal Tuberculosis

Aims

- Correction of kyphosis
- Early fusion
- Prevention of progression of kyphosis
- Prevention of late onset paraplegia

Current Trends In The Surgical Management of Spinal Tuberculosis

Debridement, anterior instrumentation and fusion

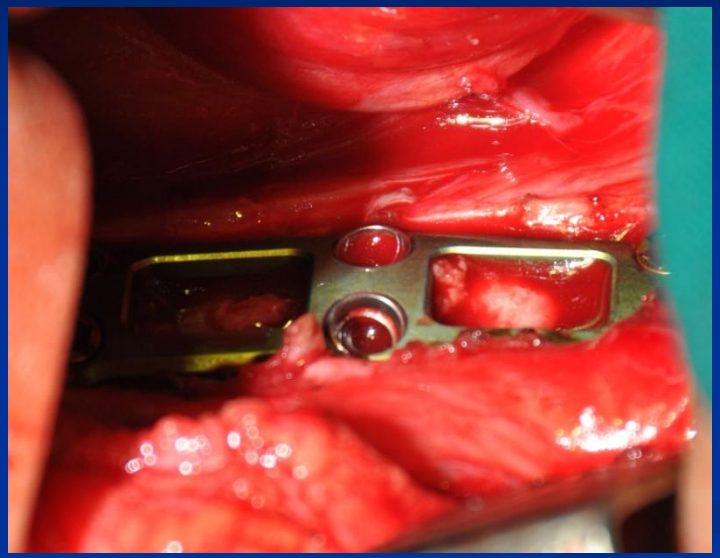
Anterior debridement and anterior column reconstruction with **bone grafting or CAGE**

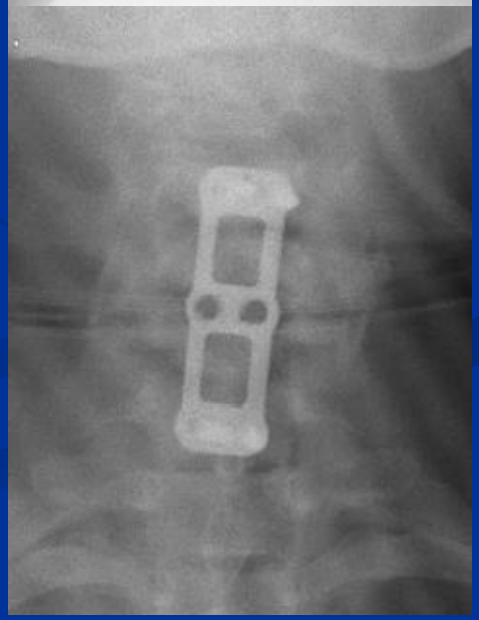
Debridement, posterior instrumentation and fusion

Anterior Debridement And Reconstruction

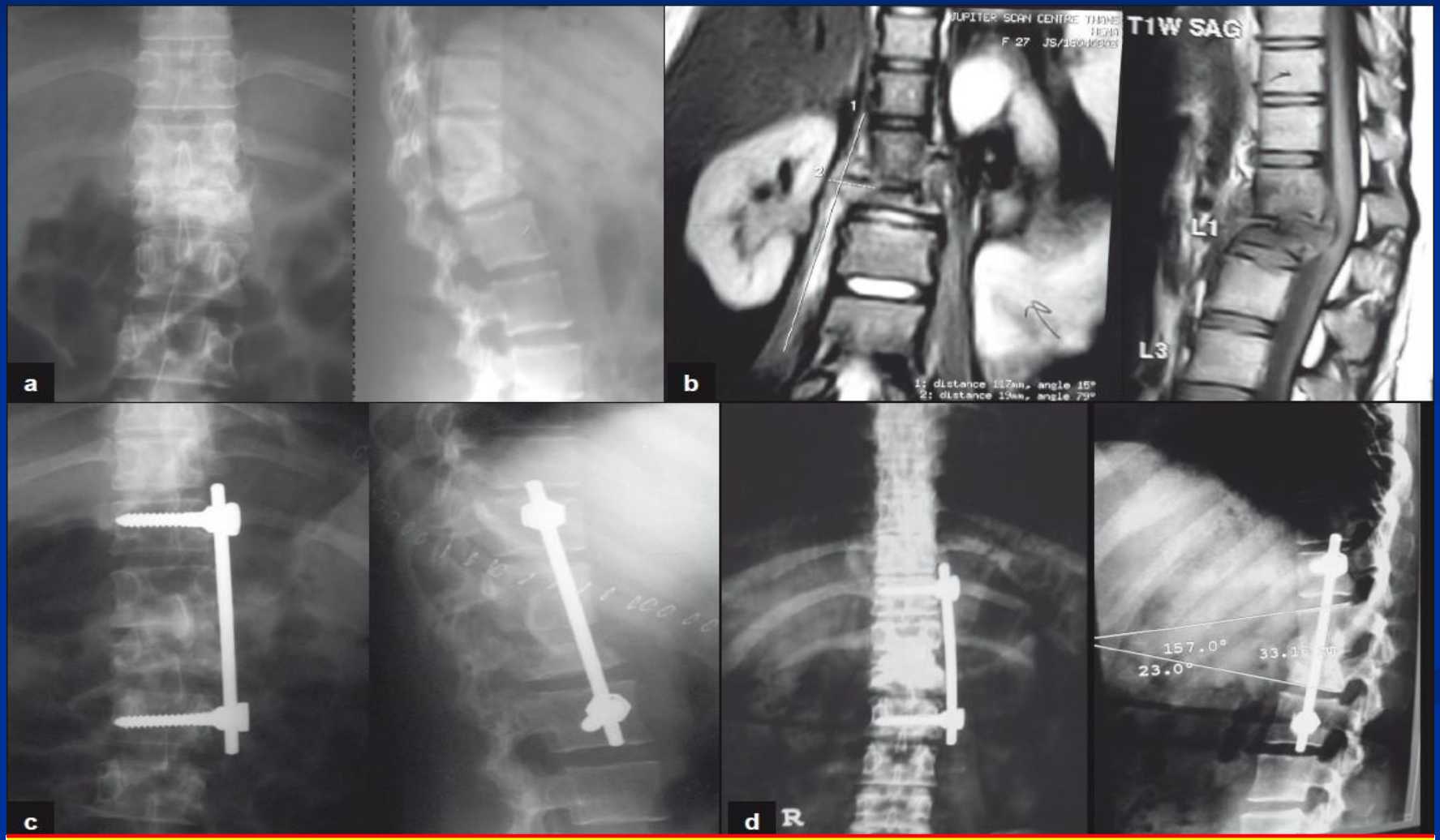
- Helps in neurological recovery and produces early fusion
- However, achieves only limited correction of kyphosis and may not be able to prevent progression

Anterior Debridement And Reconstruction





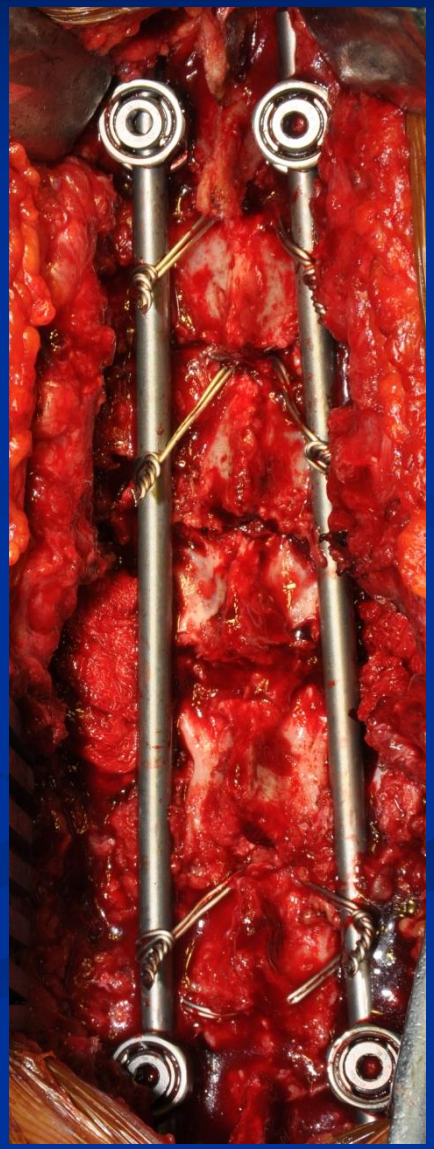
Anterior Radical Debridement And Anterior Instrumentation



Benli I T et al. Eur Spine J 2003

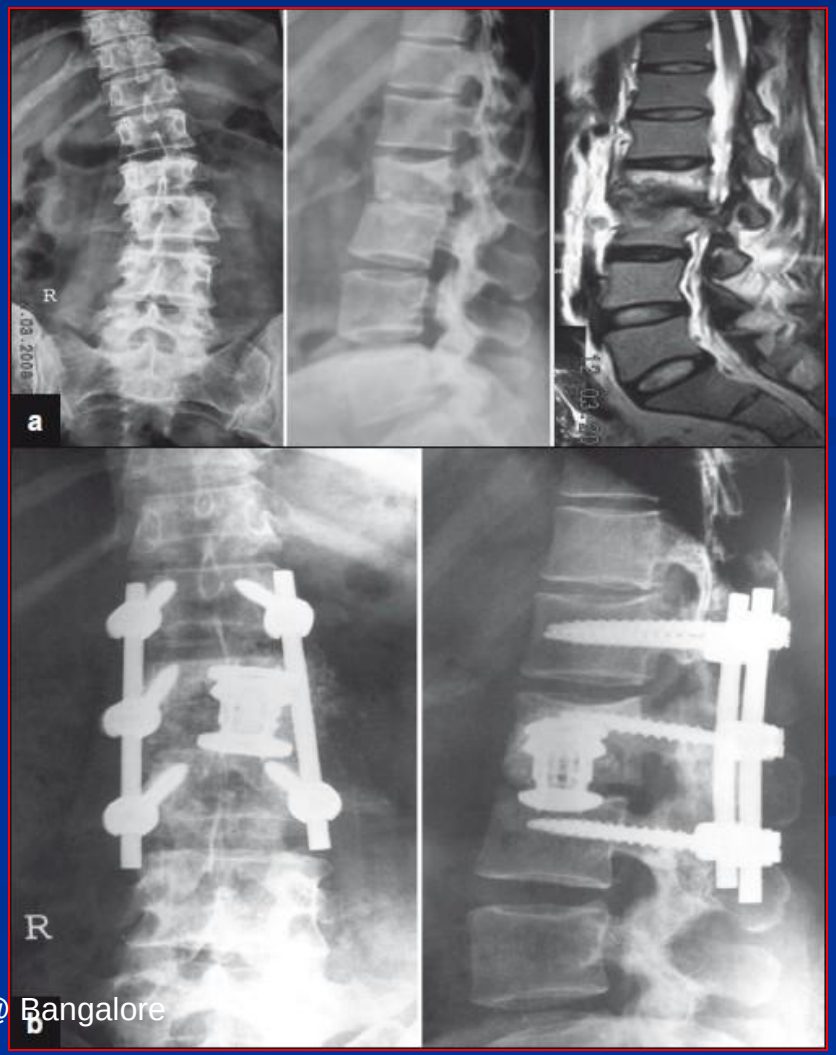
Role of Posterior Instrumentation And Fusion

- Aggressive correction of kyphosis achieved
- Prevents recurrence of kyphosis
- Not beneficial without anterior debridement and fusion



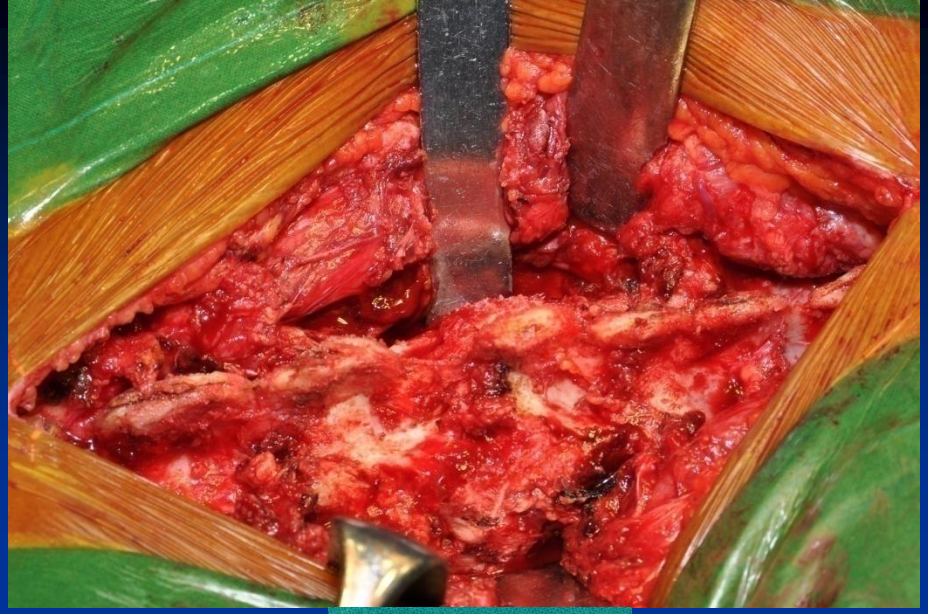
Combined Anterior Decompression And Bone Grafting / CAGE With Posterior Instrumentation And Fusion

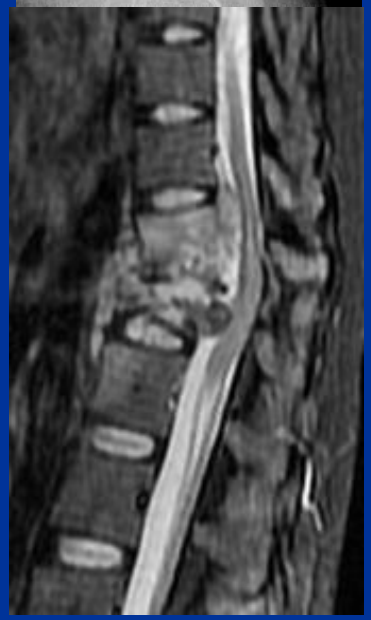
- Single stage through two approaches- Combined anterior and posterior
- Single posterior approach

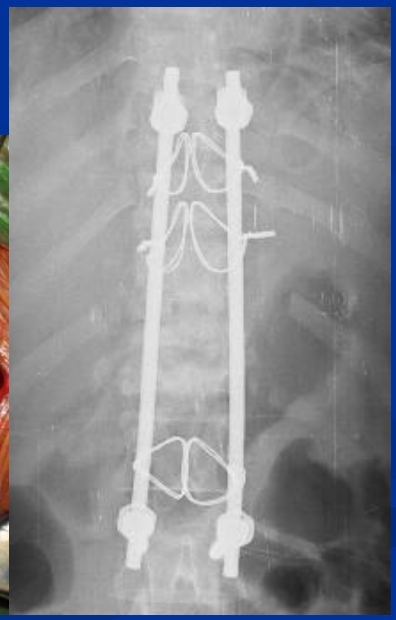


Combined Anterior Decompression And Bone Grafting / CAGE With Posterior Instrumentation And Fusion

- **LIMITATIONS**
  - Needs appropriate facilities and expertise
  - Intensive anaesthetic and postoperative care
  - Secondary infection and implant failure







COMBINED ANTERIOR DECOMPRESSION AND BONE GRAFTING WITH POSTERIOR INSTRUMENTATION AND FUSION (Posterior approach)

Conclusion

- Early diagnosis and treatment prevent complications
- Threat of MDR-TB
- Intensive chemotherapy and monitoring
- PCR / CT / MRI / Bone scan help in early diagnosis
- More aggressive and radical surgeries are advocated:
  - To correct and prevent progression of kyphosis
  - To achieve better healing and
  - To lessen the chance of late onset paraplegia


Thank You
Bone School @ Bangalore