Primary bone tumours of the spine

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Where am I from

Objective of spinal service

- An accessible and appropriate service for Patients with spinal conditions with potential for, or incipient spinal compromise with or without neurological involvement .

Reconstruction

- Tumour
  - Metastatic
  - Primary
- (Infection
  - Pyogenic
  - Tuberculous)
- (Trauma)

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Significant changes

- Improved Oncological Management
- Improved surgical options
- Roy-Camille
  -Pedicle Screws
- Harms Cages

Evolution of Metastatic Spinal Surgery - ROH

- 1977 – 91 Mainly Anterior
- 1992 – 1996 – Mainly Posterior
- 1997-2004 – Balanced Selection for better prognosis patients

Spinal Metastatic Management ROH

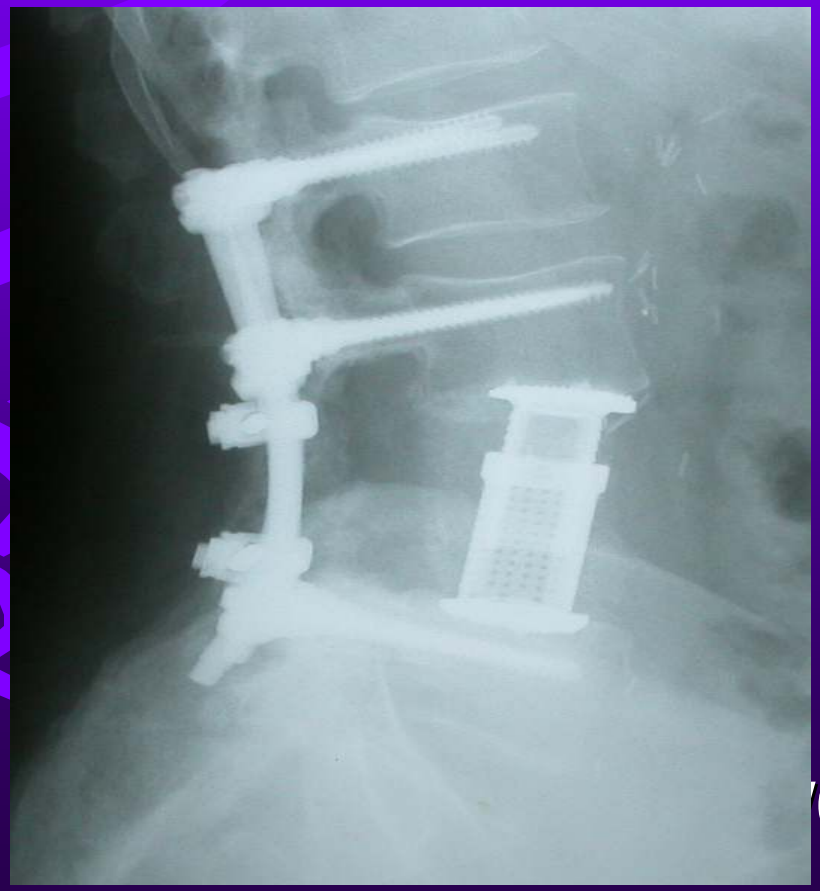
- 1977-91 – European Spine J 1995
- 1991- 96 –JBJS 1995 77B:261 (abs)
  JBJS 1998 80B:204(abs)
- Eur J Surg Oncol 1999 25:3(BASO Guidelines)
- **BOA Practice Guidelines Website 2002**
- 1996 – 2002 – JBJS 2002 84B :338 (abs)
- 2005 – BAUS Prostate Guidelines
- 2008 - NICE Guideline

Conclusion

- With the improved prognosis resulting from improved Oncology Rx some patients outliving the construct design
- Lower threshold for more radical resection for selected metastases particularly breast and renal

Extralesional Excision for Isolated UG Metastasis in L4 Body – 3 years ago

1ary yet to be found



Tokuhashi (Spine1990 15:1110) Tomita Scores (Spine 2001 26:298)

- Performance status (Karnofsky)
- Neurological Compromise
- No of vertebral metastasis

- Tomita
- Primary Site
- Extraspinal bone metastasis
- Visceral metastasis

All factors in both systems related significantly to outcome Grainger BritSpine 2002

Survival- after surgery for Breast Spinal Mets

- NO 30 Day mortality

Mean Survival

16.6/12 (2-99)

Literature – 11.8/12

- 5 year – 31%

Literature 1 year - 54%

Evidence based mandate to support application to Specialised Services Commissioners to develop appropriate service provision

Patchell ASCO 2002

LANCET 2005

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Spinal Bone Tumours

- Primary benign bone tumours 8% in spine or sacrum
- Of primary spinal tumours 20-40% benign

Presentation

- Pain Local +/- radicular
- Nocturnal - Osteoid osteoma/ osteoblastoma - 30-80%
- Scoliosis – with limited painful spinal movement .

  Imaging - lack of rotation or compensatory curves
- Neurology - variable

Investigation

- Probably Benign
- XRs - Standing AP and lateral
- MRI
- CT of spine
- Biopsy

- Probably malignant
- Also Staging CT
- Isotope Bone Scan
- Biopsy - avoiding spillage and with excisable track

Principles of Treatment - Curative

- Patient Factors
- Patient Comorbidity
- Patient Wishes

Principles of Treatment - Curative

- Tumour
- Location - more later
- Adjuvant sensitivity -

Removal

- Curettage
- Intralesional
- Extralesional
- With wide margins

Principles of Surgery - Curative

- Neural elements
- Leave intact as far as possible
- May require dural excision and repair in malignancy
- Root division
- Cord Division

- One S2 root may be sufficient for continence
- Literature 50%
- Both S2 roots and one S3 root - all continent

Principles of Surgery - Curative

- Structural
- Posterior complex - spinous process and ligaments and Flavum – 25%
- Posterior vertebral wall and disc – 25%
- Left and right pars / facet complex – 25 % each
- After > 50% resection => Instrumentation and Fusion

Principles of surgery - Curative

- Structural - the immature spine
- Caveat

  Areas of kyphosis

  CTJ , Midthoracic spine
- Consider Instrumentation and Fusion
- Caveat Scoliosis -> Structural
- Peripubertal patients
- If deformity present for > 15-18/12
- Larger deformities

Principles of Surgery - Vascular lesions

- Embolise
- Haemangiomas
- ABCs
- Osteoblastoma
- GCTs

Adjuvant Modalities - Radiation

- Benign
- Single course over 6-8/52
- ABC - <30Gy
- Haemangioma - 30-40 GY

- ?Malignant
- GCT (not Osteoblastoma) if unresectable
- Risk of later sarcomatous transformation

Adjuvant therapy - Chemo

- Osteosarcoma
- Ewings Sarcoma
- (Myeloma
- Lymphoma)

Primary Spinal Tumours of Osseoligamentous Origin

- "Benign" locally Aggressive
- Osteoid Osteoma
- Osteoblastoma
- Aneurysmal Bone Cyst.
- Osteoclastoma(GCT)
- Haemangioma
- **Intra/extralesional excision**

- Malignant
- Chordoma
- Chondrosarcoma
- Osteosarcoma
- Ewings
- Odditi - sarcoma
- **Extralesional excision**

Radiological Features

- Age
- Location- Level
  - Anterior/Posterior
  - Central /Eccentric
- Mineralisng - Young
  Osteoblastoma/ Osteosarcoma >80%
- Mineralising - Old -
  Chondrosarcoma - Most
  Chordoma - 25%

Age

- **Young**
- ABC
- Ewings
- Osteoblastoma
- Osteoid Osteoma
- Eosinophilic Granuloma
- Osteosarcoma

- **Middleage +**
- Chordoma
- Chondrosarcoma
- Pagets Sarcoma

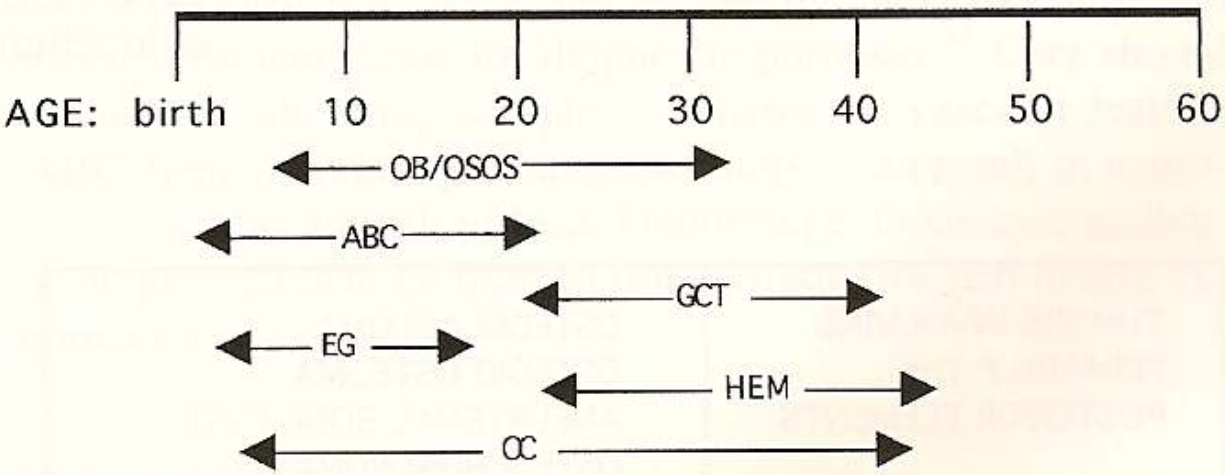
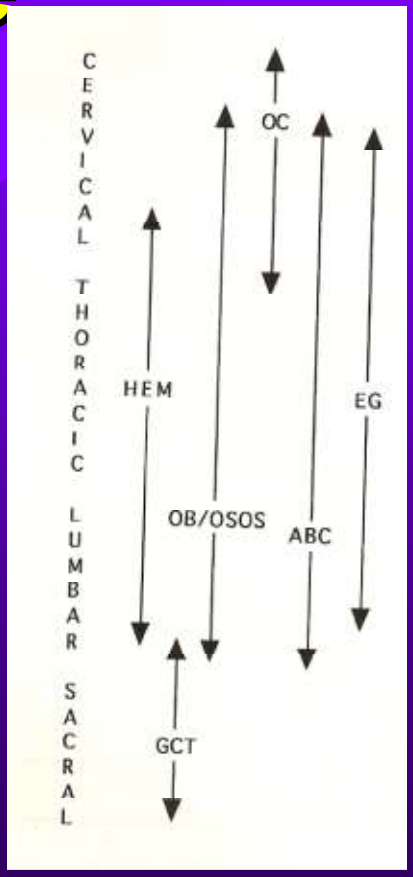


FIG. 105-1. Age distribution of common benign spinal tumors. *OB/OSOS,* osteoblastoma, osteoid osteoma; *ABC,* aneurysmal bone cyst; *GCT,* giant cell tumor; *EC,* eosinophilic granuloma; *HEM,* hemangioma; *OC,* osteochondroma.

Site of benign bone tumours of spine

TUMOR (by histologic type)	CTL SPINE (percent)	SACRUM (percent)
GCT	11.4	61.4
OSTEOID OSTEOMA	17.7	5.3
OSTEOBLASTOMA	14.9	7.0
HEMANGIOMA	14.2	0
OSTEOCHONDROMA	12.1	5.3
ABC	22.7	14.0
OTHER	7.0	6.7



Benign Bone Tumours(Enneking)

- Latent (Stage 1)

Osteochondroma

Haemangioma

- Treatment

Observation

Excision only if symptomatic

Benign Bone Tumours(Enneking)

- Active (Stage 2) Symptomatic

  Osteoid Osteoma, Eosinophilic Granuloma, Haemangioma

  Ostechondroma, Aneurysmal bone Cysts

- Treatment

  Remove

  Curettage

  En bloc if as easy

Benign Bone Tumours(Enneking)

- Aggressive (Stage 3)

Osteoblastoma

Osteoclastoma =GCT

- Treatment
- Enbloc excision preferably with wide margins
- Preserve neurology

Location – Centricity

- Centricity

  Midline - Chordoma

- Eccentric - the Rest

  GCT Subarticular to SIJ

Location - Anterior/Posterior

- **Anterior**
- Most Malignancies
- Eosinophilic Granuloma
- GCT
- Haemangioma

- Posterior – typically younger
- ABC
- Osteoid Osteoma
- Osteoblastoma
- Paraspinal - Chondrosarcoma

Tomita anatomical classification of spinal tumours

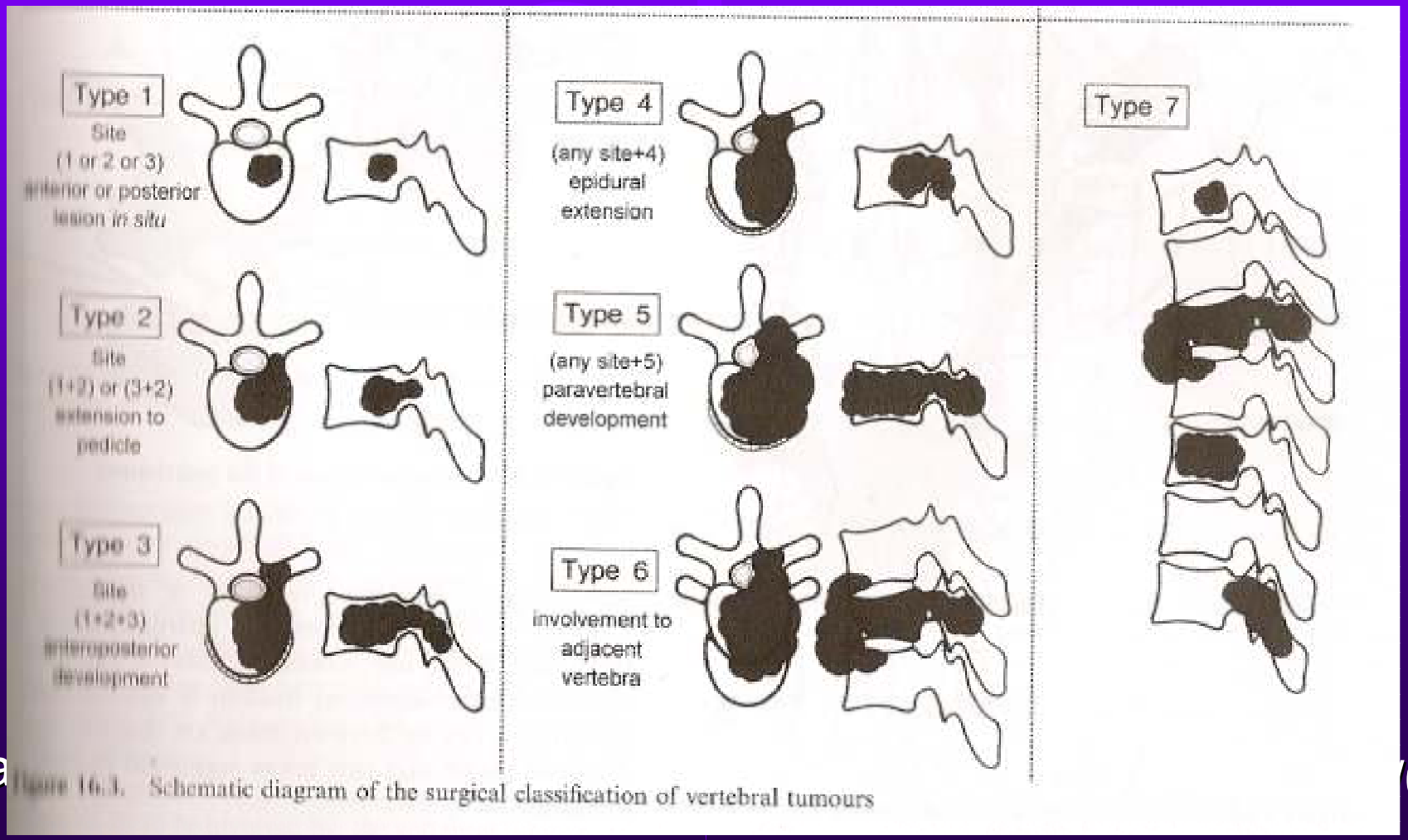
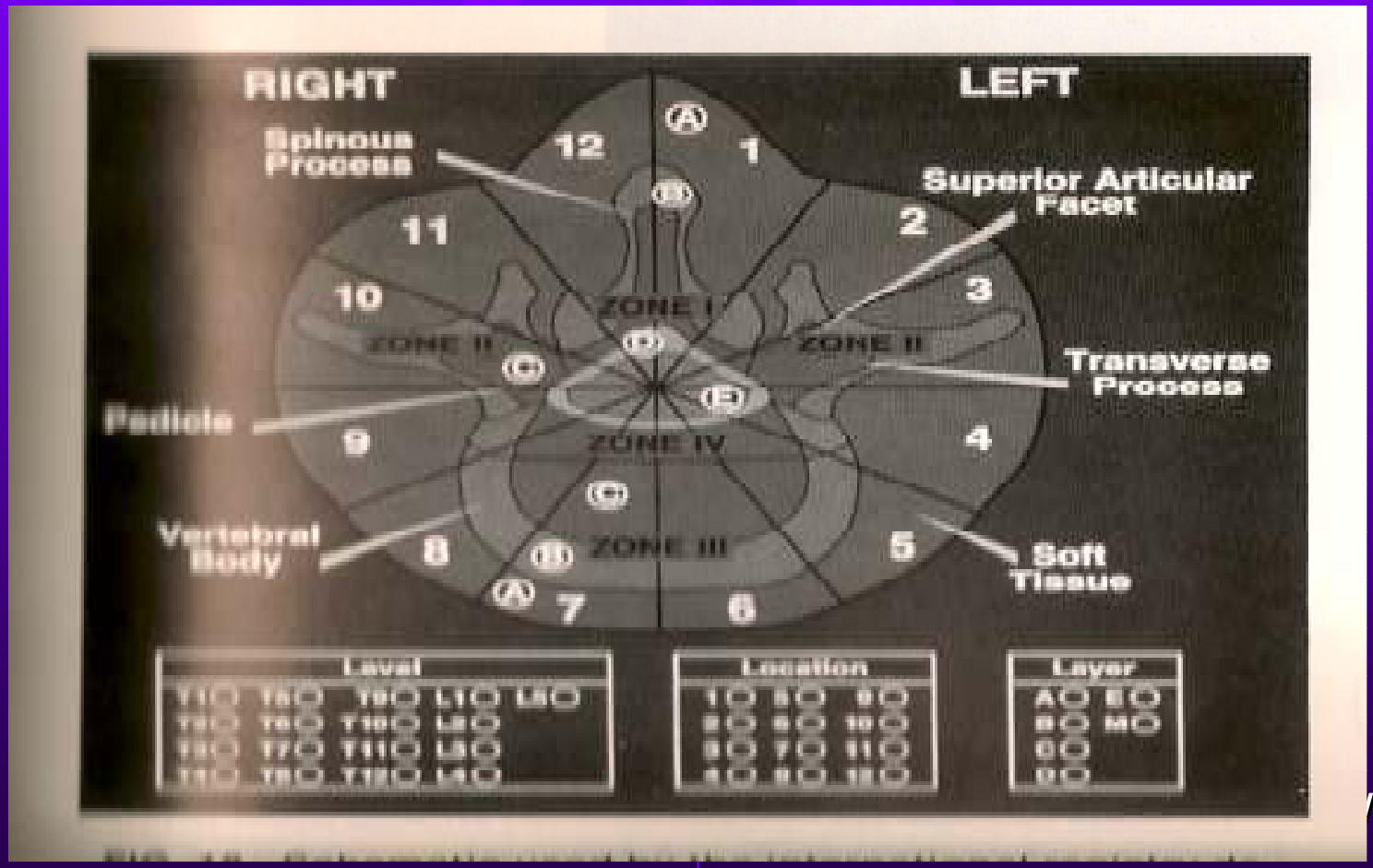


Figure 16.3. Schematic diagram of the surgical classification of vertebral tumours

Layered classification of Spinal Tumours



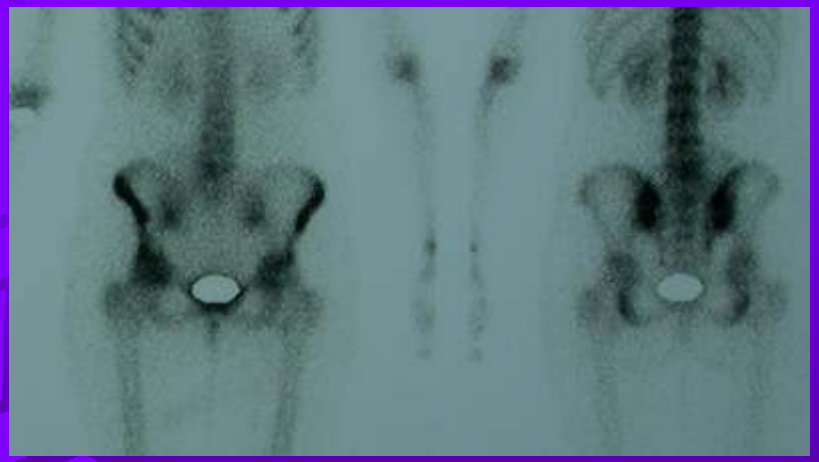
Other Imaging Features

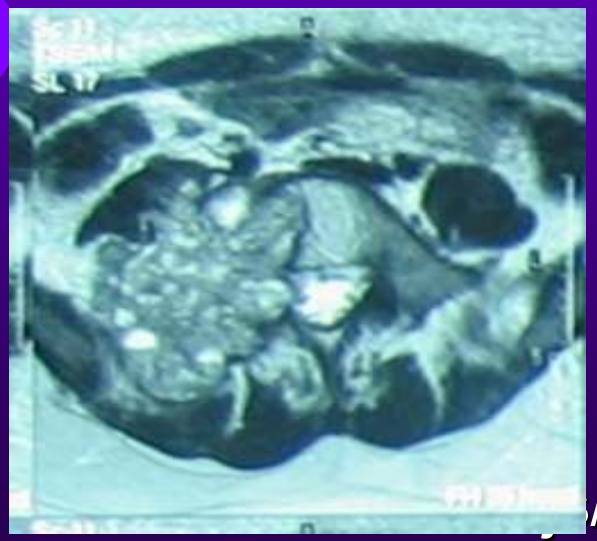
- **No Periosteal Reaction as with long bone** - more difficult to differentiate compared to appendicular tumours
- Fluid Levels ABC
- Appearance - Lobular - Cartilage Tumours
- Matrix Calcification – Chondrosarcoma

Remember!

- Radiological appearance is often misleading
- Rely on biopsy
- Histology is a spectrum with a lot of "grey areas"
- If any suspicion of malignancy - ensure biopsy track is excisable
- **If dubious - Refer**

Paediatric Tumours
14 yo female York





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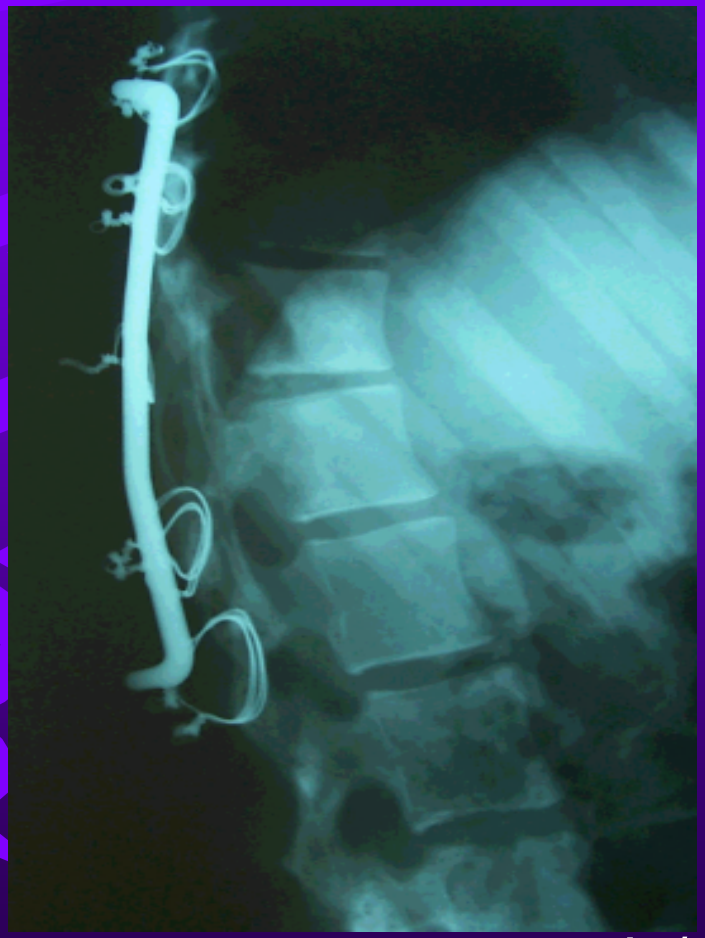
Resected with CUSA and allografted – 9/12 later

ABCs

- 11% in spine
- M=F
- <20y
- LBP +/- scoliosis
- Diff - OB, GCT, TB, EG Ewings,

- Rx
- Embolisation Alone
- With Curettage
- RT alone – 50% succesful

16 year old female (St.Elsewheres) 1996



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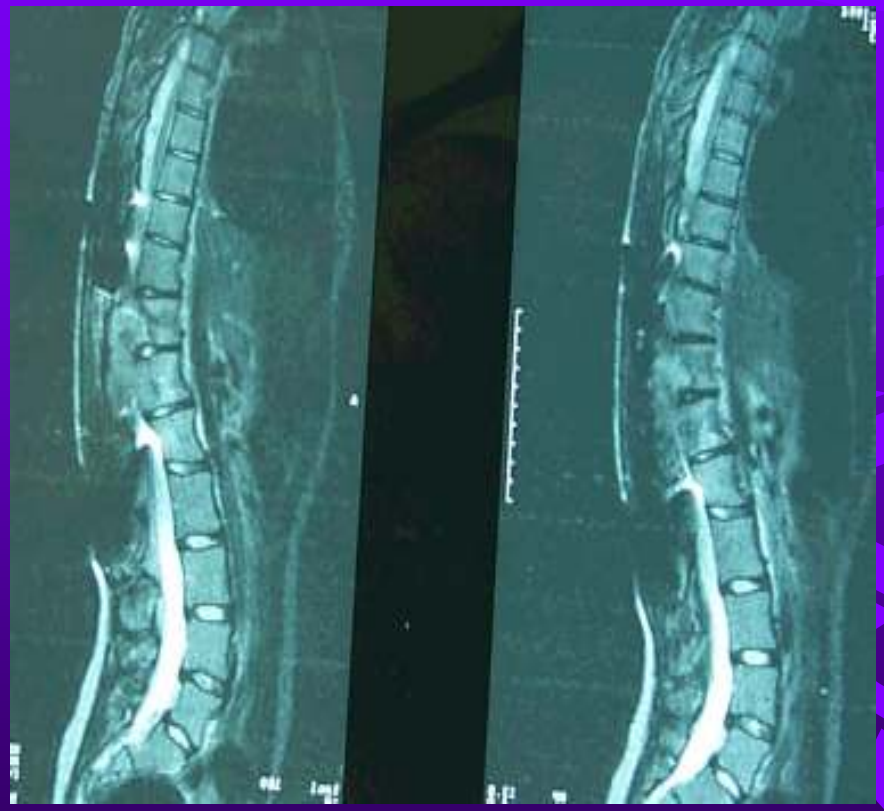
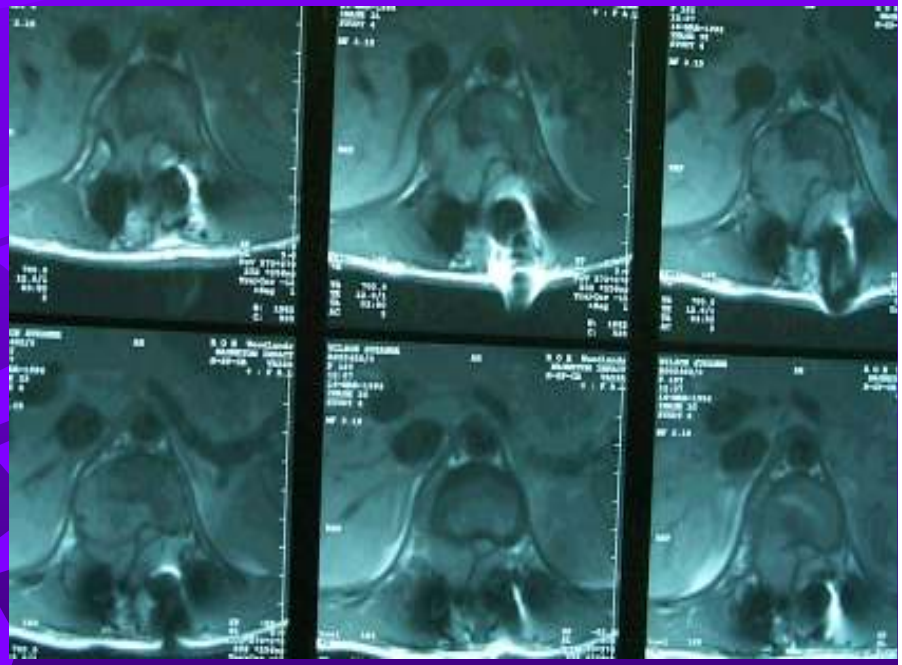
Recurrence

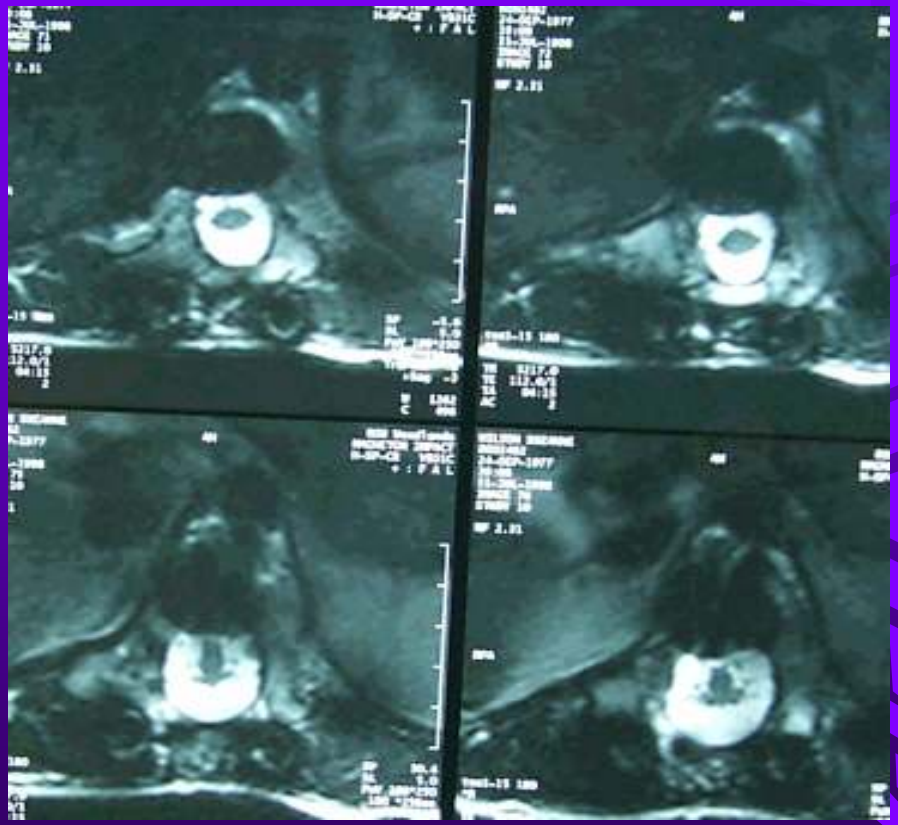




360 degree vertebrectomy for Osteoblastoma

Osteoblastoma - 2nd stage - Posterior Reconstruction

MRI imaging with titanium metalwork in situ



1ary bone tumours

No Recurrence at 10 years

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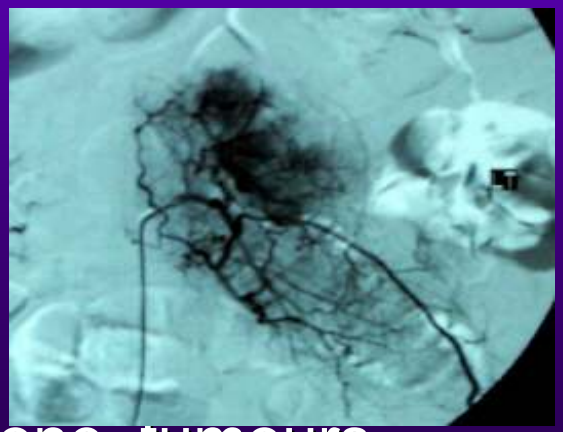
Osteoblastoma

- 10% 1ary spine tumours
- 32% are spinal
- 2nd-3rd decade
- 2M:1F
- Posterior usually pedicle
- 40-50% lumbar

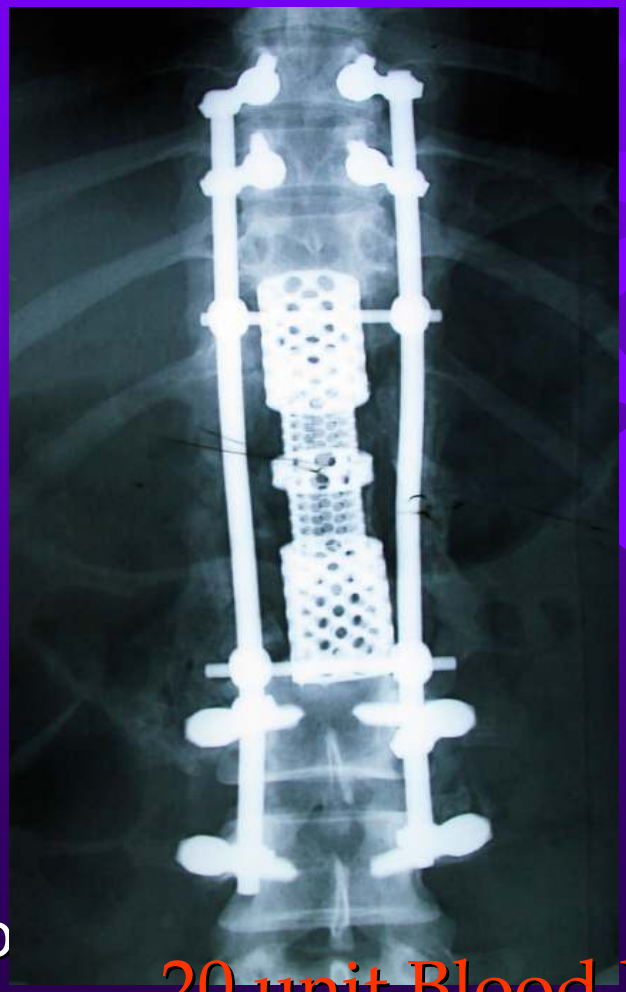
- Diff - OM,Ewings,Lymphoma,ABC
- Rx
- Wide excision when possible
- 10-20% recurrence if not
- Radiation - ineffective

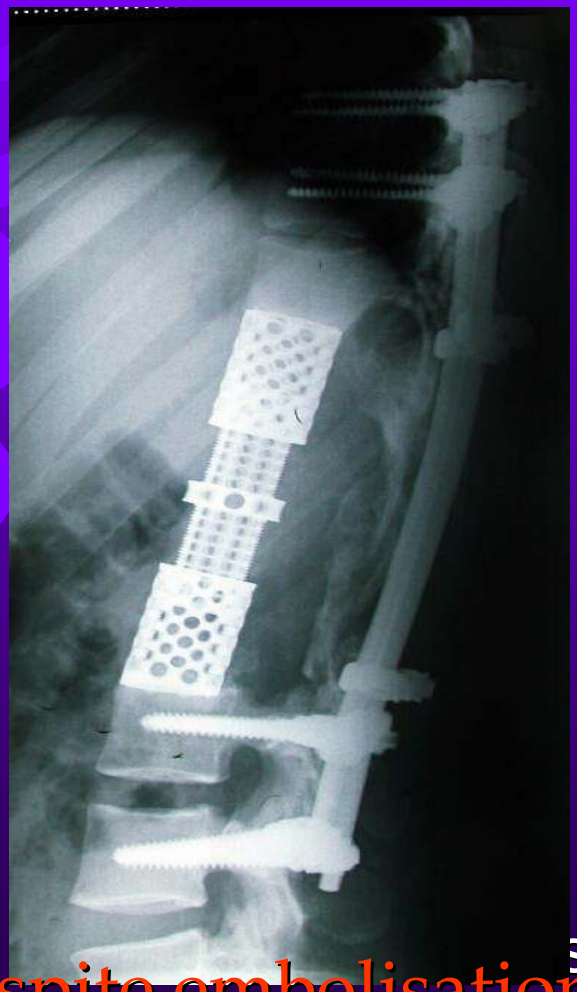
30 y.o.old female G.P. 1999

30yo female G.P.



3 level Osteoclastoma in 30 y.o. female GP





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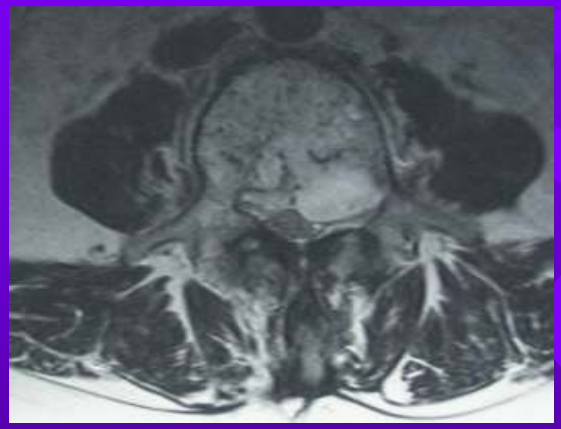
20 unit Blood loss despite embolisation

GCT

- Commonest bengin sacral tumour
- Sacrum - Commonest site after epiphyses
- 1-18% spinal
- 2F:1M
- Unusual before maturity
- 20-80% with neurology at presentation
- 1-11% metastatic
- Rx Embolisation then Enbloc with wide margins
- Radiation

Back and Left leg pain
?Diagnosis

L L3 and L4 sensory and motor symptoms and signs



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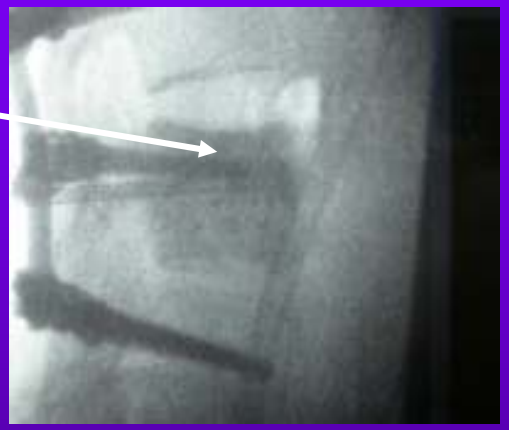
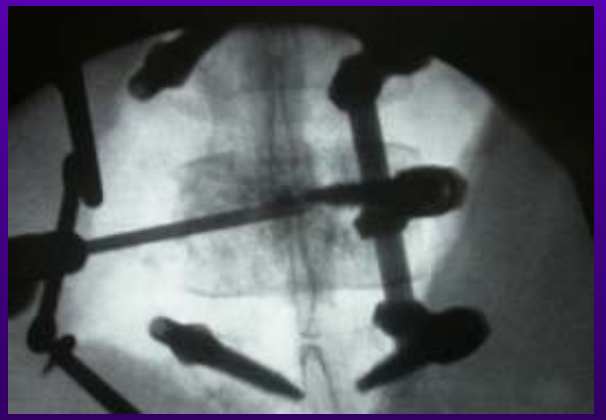
Biopsy - Haemangioma Post Embolisation

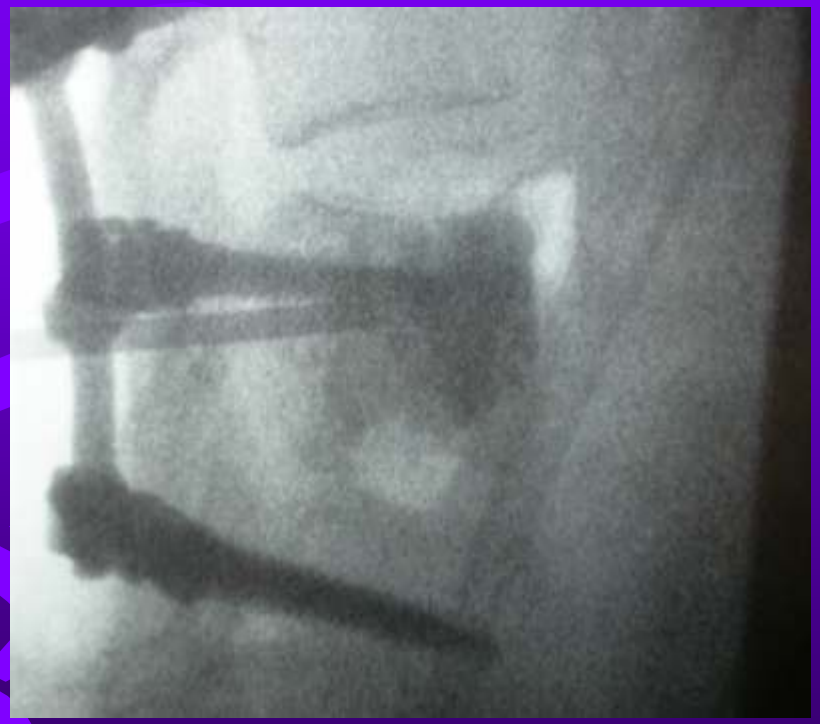
Continuing Pulsatile Flow

Intralesional contrast injection to exclude major canal leakage





Decompression ,Cement Vertebroplasty Pedicle Screw fusion



Cement vertebroplasty with arrest of bleeding

Haemangioma

- Ice – 12%
- 80-90% solitary
- Symptomatic 3-4th decade
- Usually anterior 40% some posterior element
- Increased symptoms in pregnancy
- 10% as pathological fractures
- 60% pain only
- 30% neurology

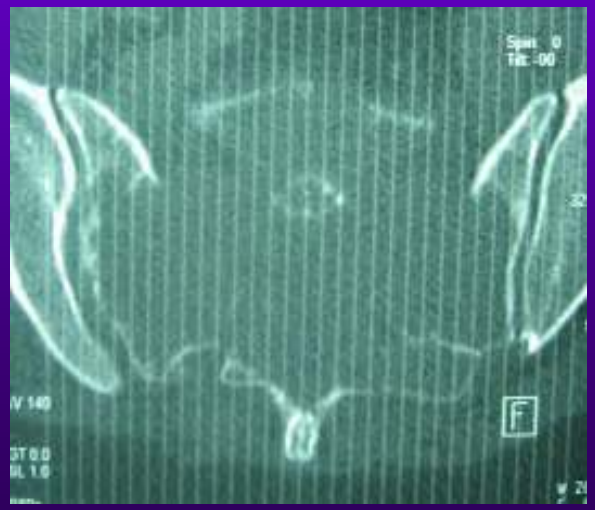
Haemangioma - RX

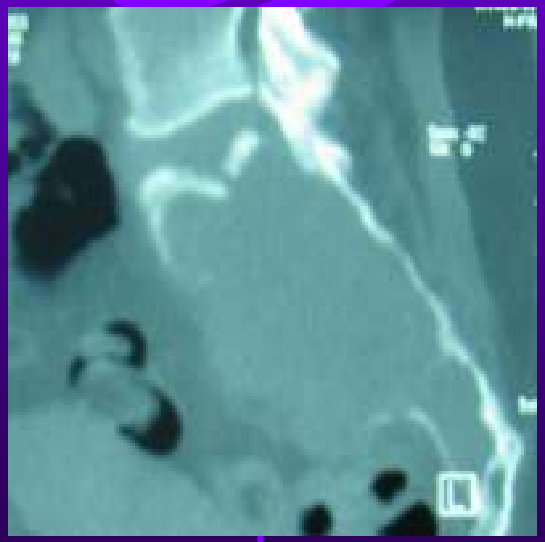
- Rx - 30-40Gy over 6-8/52-> 50-80% resolution
- Surgery
- If pathological fracture or neurology

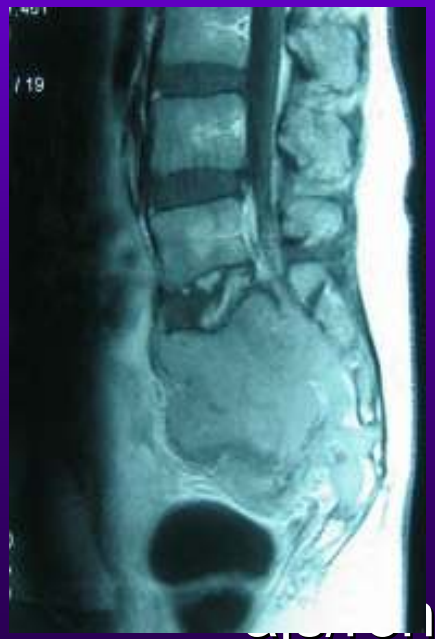
Not resectable

40yo female . Impaired mobility due to pain

R S1 partial deficit and impaired bladder control







GCT Galveston with fibula reconstruction + radiotherapy

Return to work 1 year postop

Question

- Is this a justifiable option
- Loss of most lumbar movement
- Alternatives ?

Eosinophilic granuloma EG

- Localised Histiocytosis X
- 7-15% in spine
- T spine
- <20y av 5y
- Vertebra plana
- Biopsy necessary for confirmation

- Usually resolve with some residual deformity
- Analgesia and ? Bracing
- Surgery only for instabilty or neurology
- Curettage and grafting

Malignant spinal tumours

- 40x less common than Mets
- 10% of all primary bone tumours
- 80% malignant in adults vs 30% in children

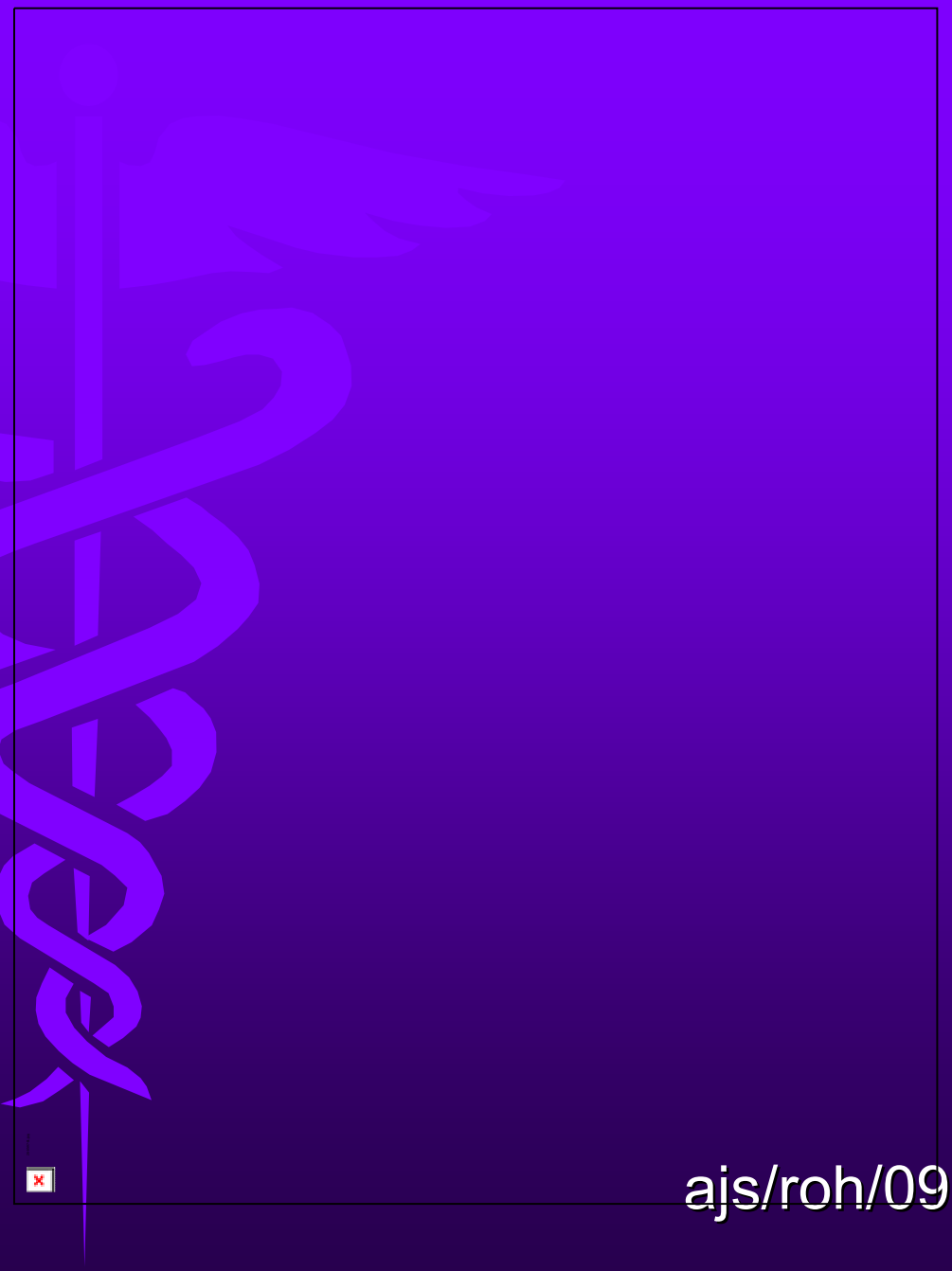
- Presentation
- Same as benign
- Except if round cell Systemic symptoms weight loss, Fever ,Fatigue, anorexia , cachexia
- Mass effect with Pain and neurology

(?)Malignant Tumours

- Require – **appropriate** biopsy
- By those doing definitive surgery
- Preferably excisable and not compromising lines of resection
- Extralesional resection
- Lasting Reconstruction
- Prolonged Followup

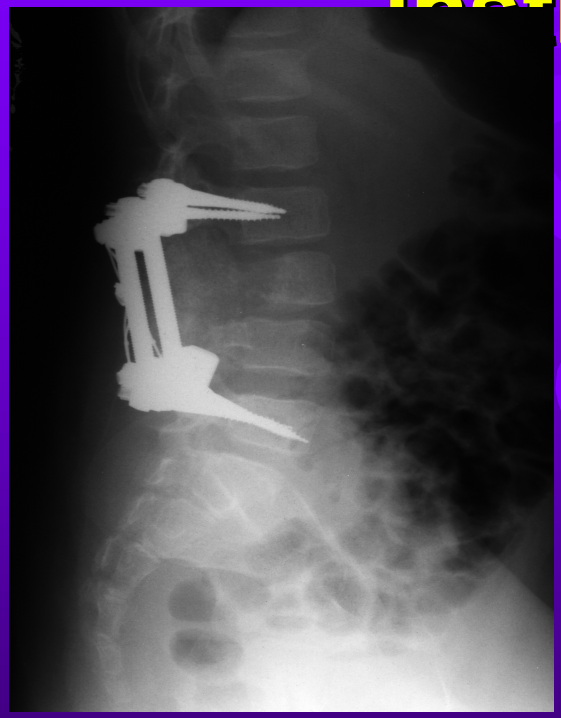
? Cause

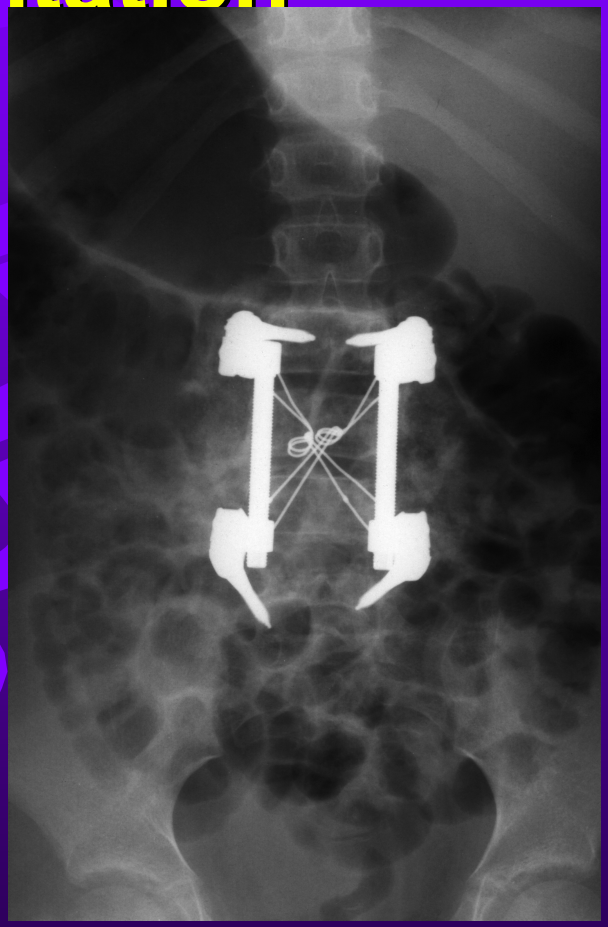
- Previously well 7 year old
- 6/12 R thigh pain
- List to R
- L3 sensory loss
- Absent KJ
- SLR 30



MRI-> Transpedicular biopsy

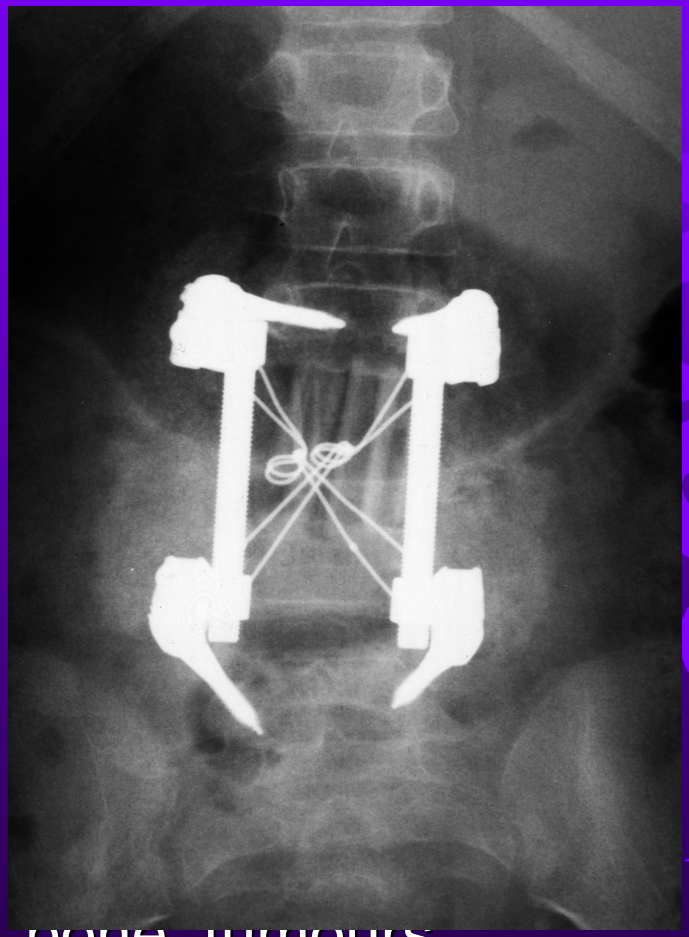
Stage 1 - Posterior decompression and instrumentation

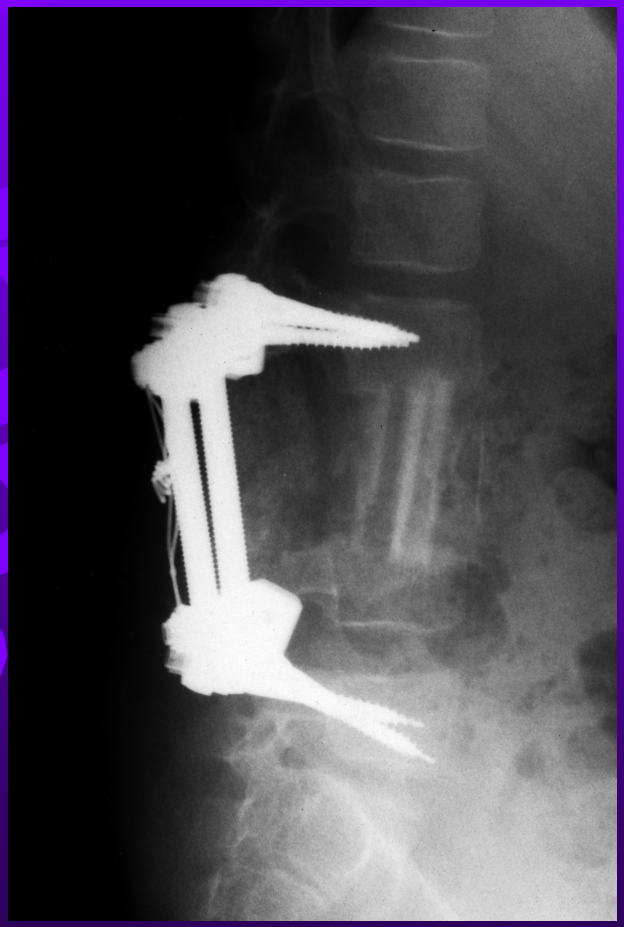




Complication - Complete motor deficit at 18 hrs – Haematoma

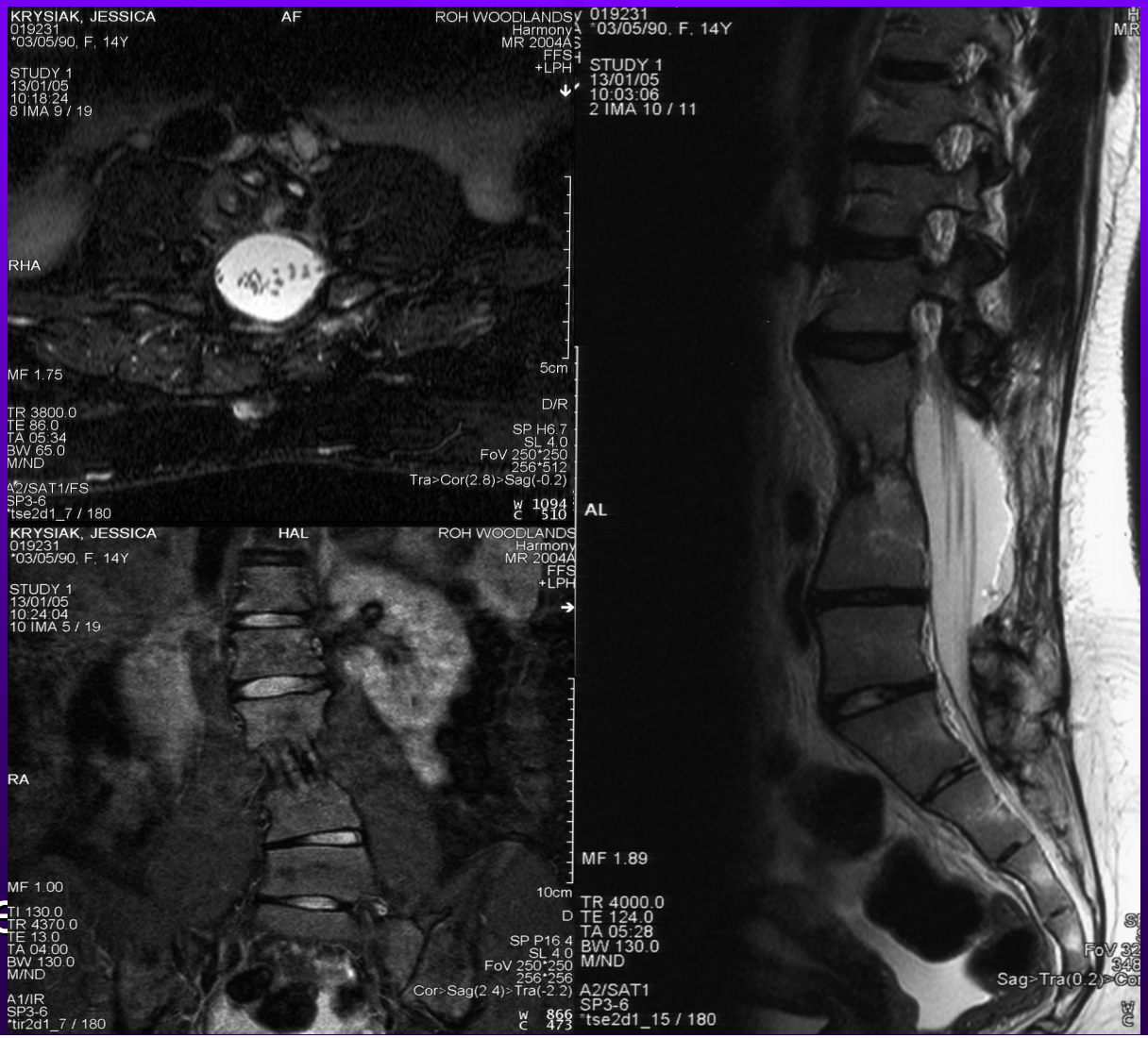
Post second stage - 2 weeks





Five years later

Eight years later



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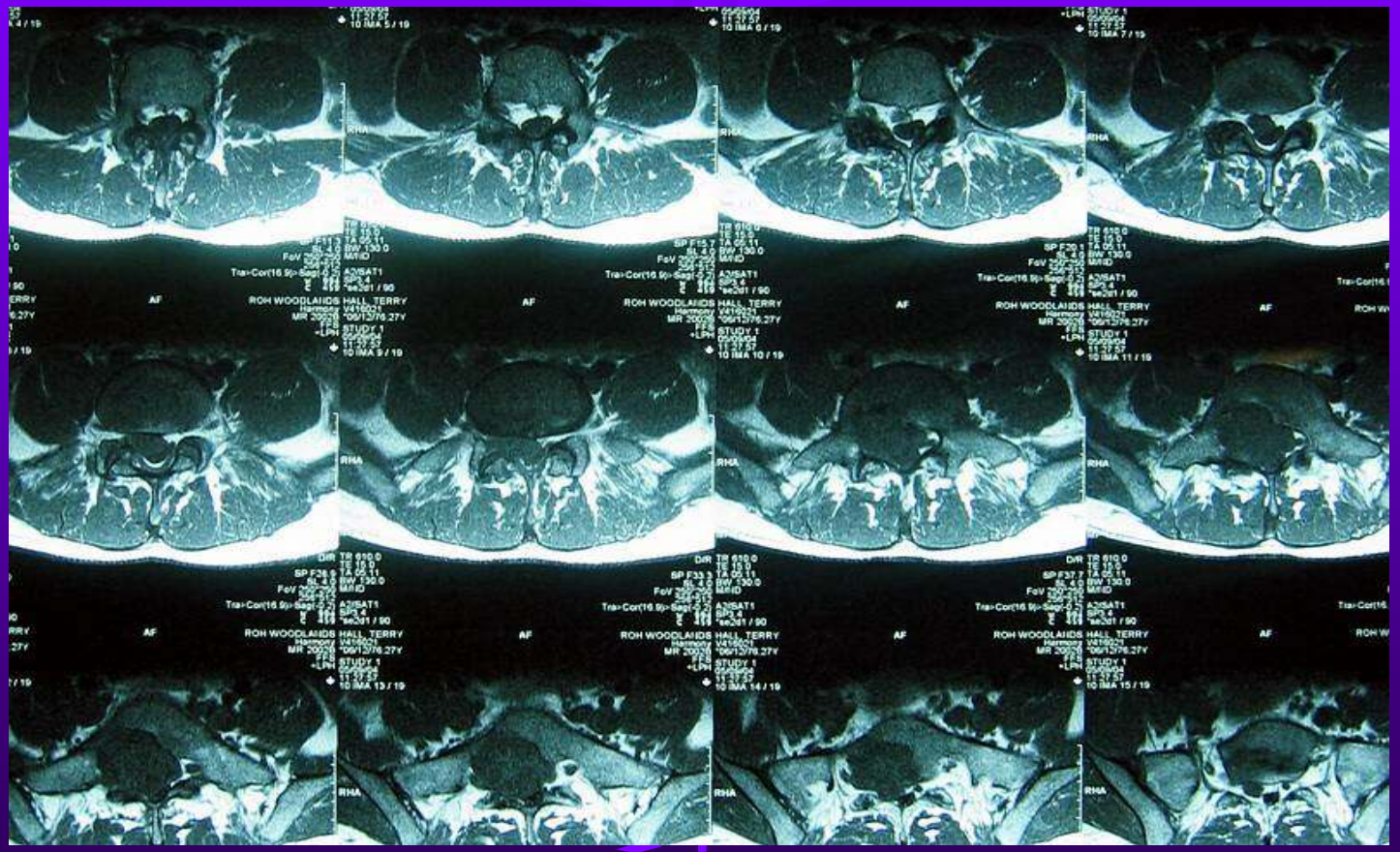
28 yo male

Chordoma



Chordoma – 3 stage excision

- 28yo
- Preop S1 sensory disturbance
- Anterior vascular mobilisation - 2 hours
- L5 transverse oscillating saw osteotomy with II control
- Anterior root division
- Initial sacral division with Osteotomes

Chordoma – 3 stage excsion

- **Posterior** Screw insertion and stabilisation
- Posterior laminectomy Root division
- Sacral cuts with Osteotomes
- Posterior Graft

- **Anterior**
- Completion of sacral cuts Removal of tumour
- Cage insertion and grafting

- Post op Footdrop
- 14 hours operating
- 14 Unit Tranfusion

Resection - 14 hrs later Anticipated Neurological deficit only -

1ary bone tumours

Marginal Excision

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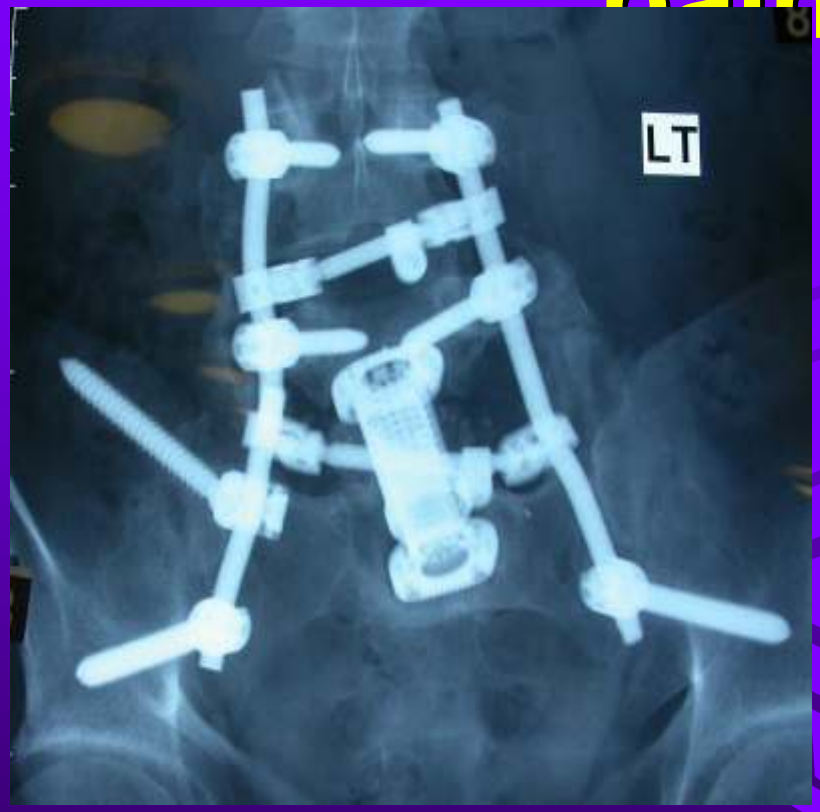
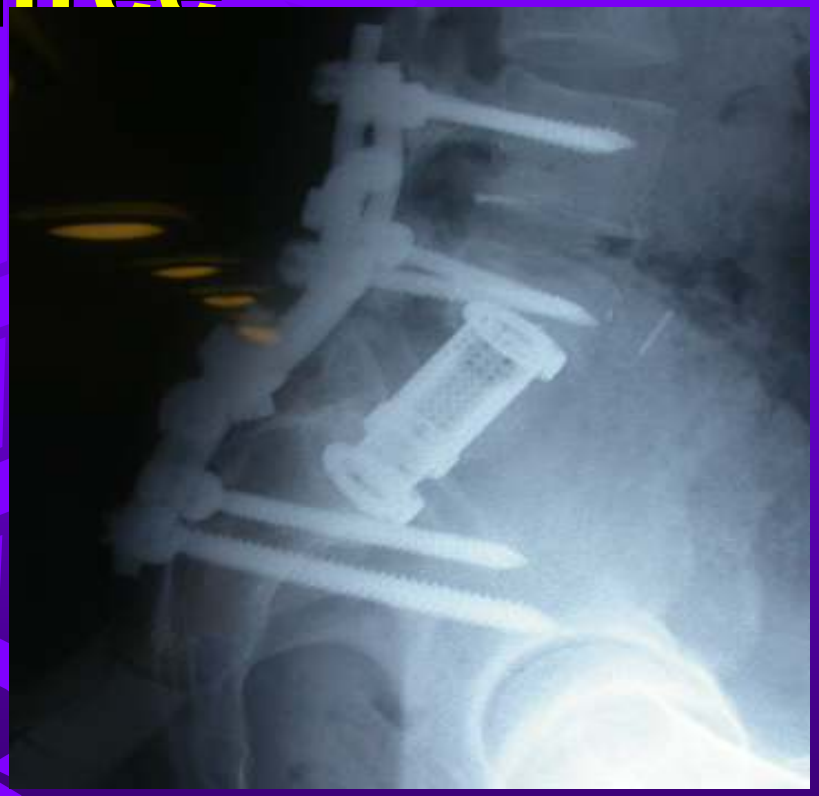
Chordoma at 18/12 - painfree





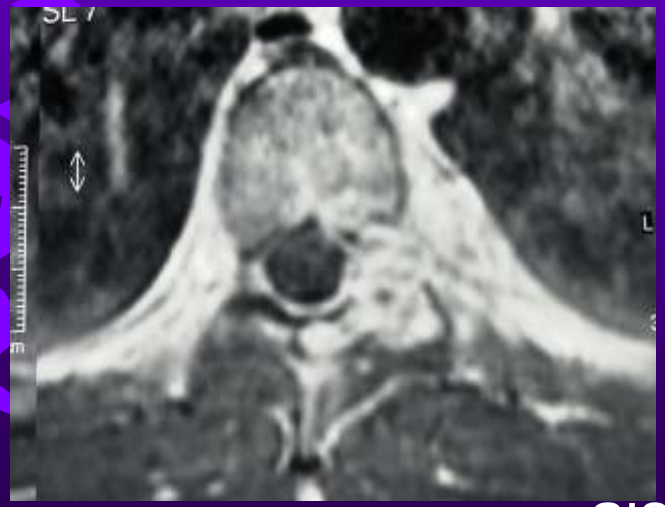
Indefinite followup required

Chordoma

- Embryonic notochord
- 2M:1F
- 5-7Th decade
- 50% Sacrococcygeal
- 30% Clivus
- 20% other spinal

- Locally aggressive and slow to met(5-40%) 1-10 years
- En Bloc - 25% recurrence
- Radiation - ? Value
- 50-75% longterm survival

T7 in 22 y.o. male 4 years ago



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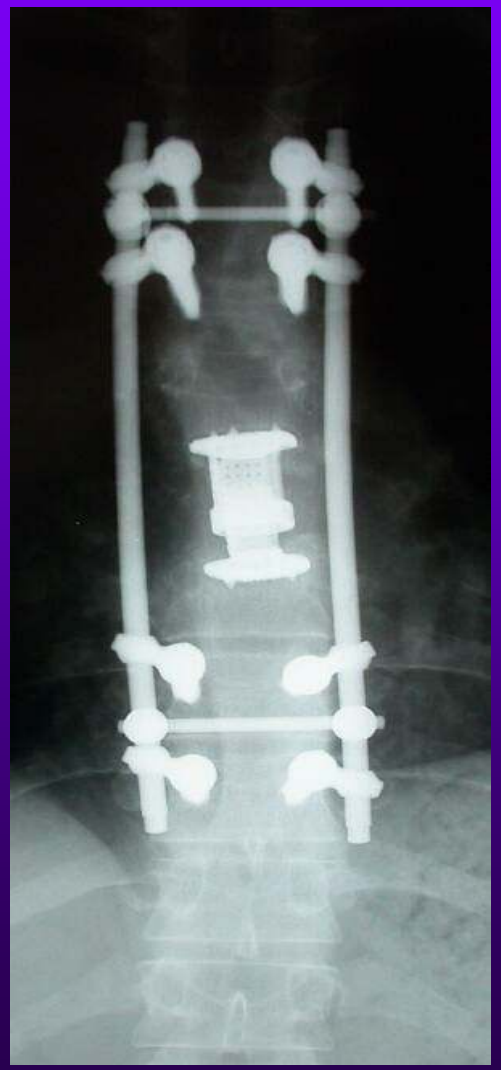
Tomita En Bloc Posterior Resection and reconstruction

Clear Margins

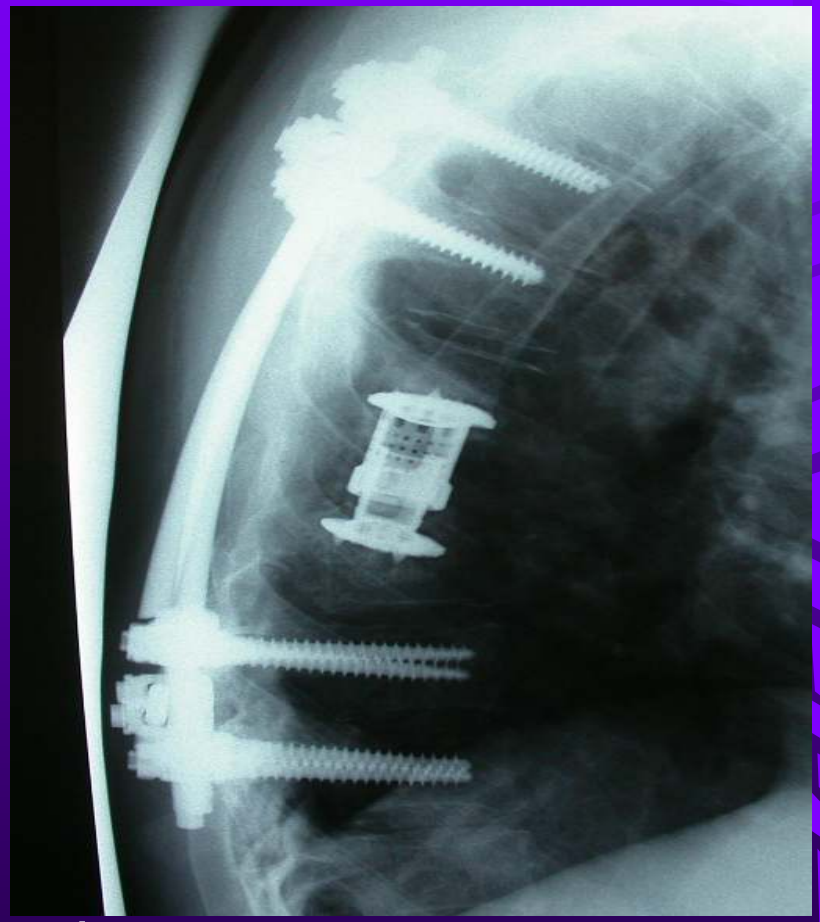
Post operative L1 epidural catheter abscess -

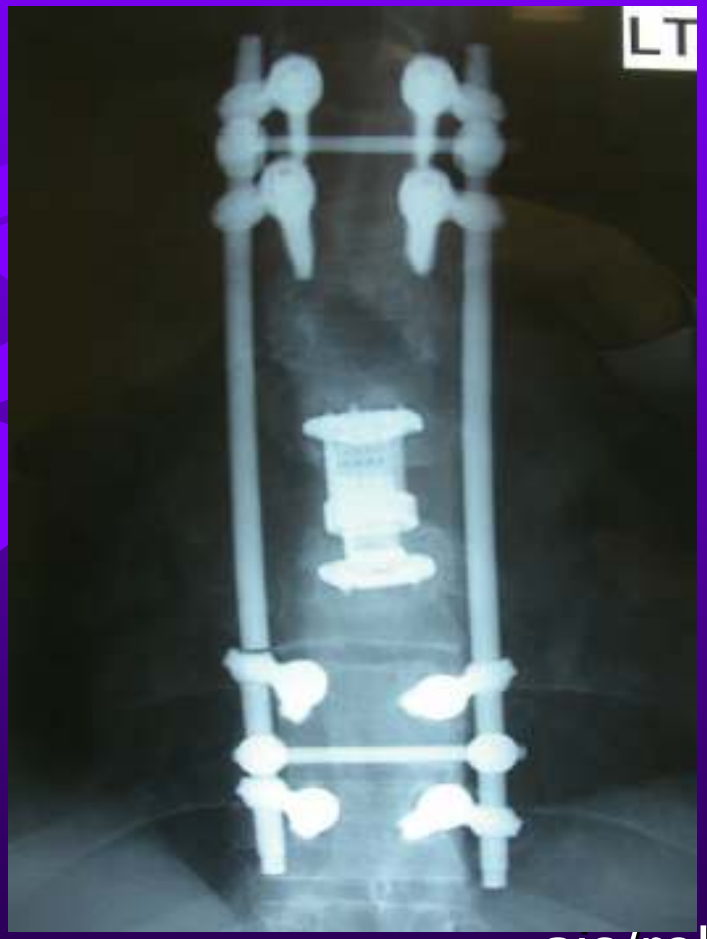
S.aureus

Rx - Partial Laminectomy and drainage

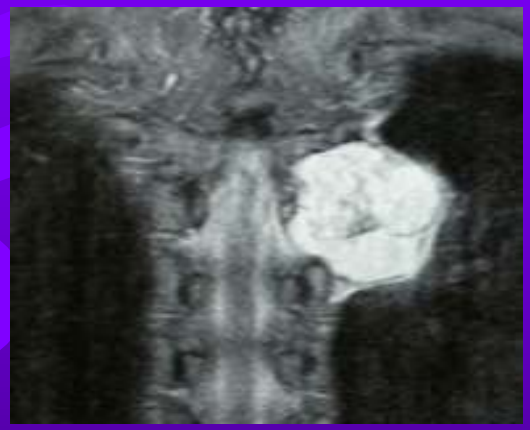


4 years later - Something went click - What now?





50 yo heavy smoker



1ary bone

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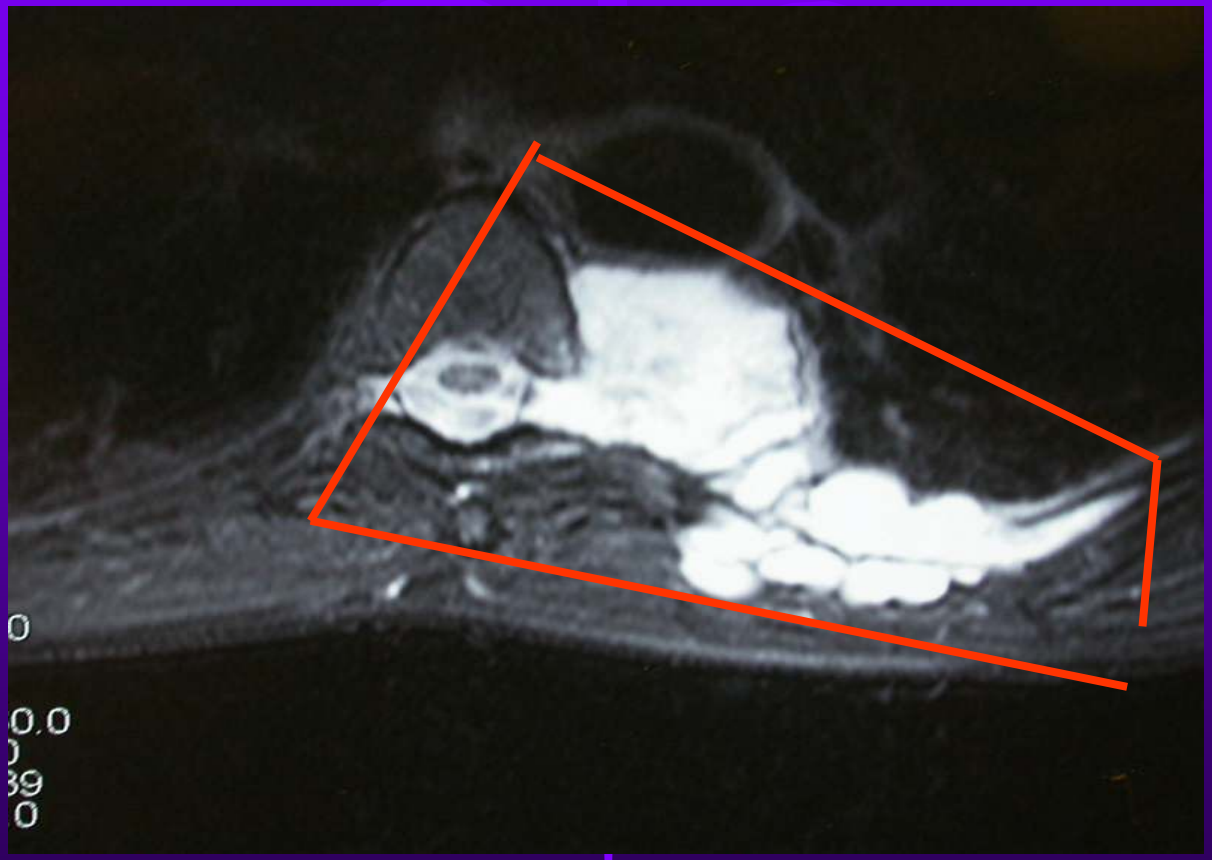
Technique – Partial Thoracic Enbloc resection

- Multiple level Hemilaminectomy
- Total laminectomy at proximal and distal levels to be resected
- Tranfixion ligation of contralateral roots over levels to be resected
- Division of ribs lifting lateral margin
- Anterior Ligation of segmentals ,azygos
- Mobilisation of aorta ,

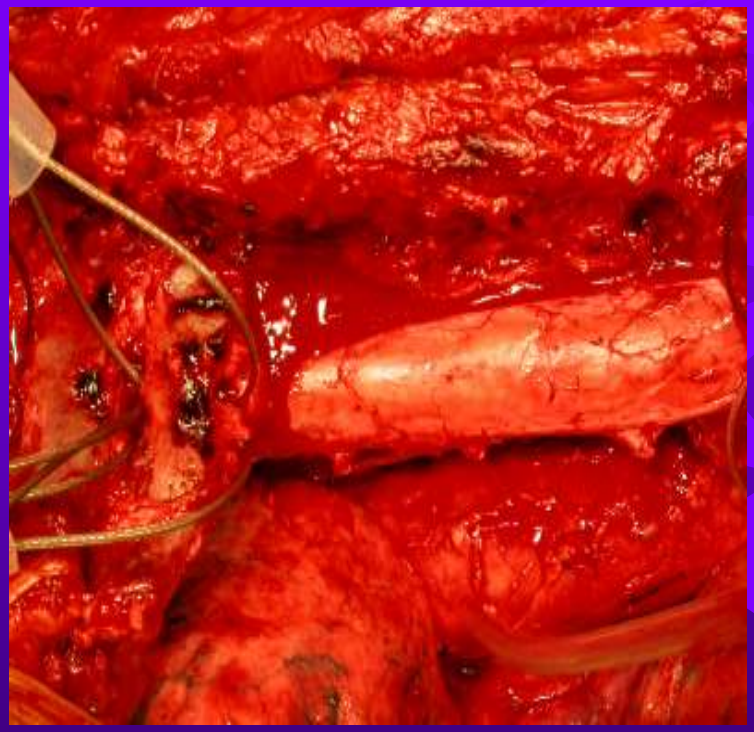
Technique – Partial Thoracic Enbloc resection

- From normal side threadwire through disc , fed round side to be cut and half disc divided
- Sagittal threadwire along anterior spine brought out on normal side
- Remove specimen ligating ipsilateral roots serially under slight tension
- Thoracoplasty

Lines of resection



Specimen removed



Early complication – Contralateral complete Pnemothorax overnight

Chest Drain - Resolution

Clear Margins

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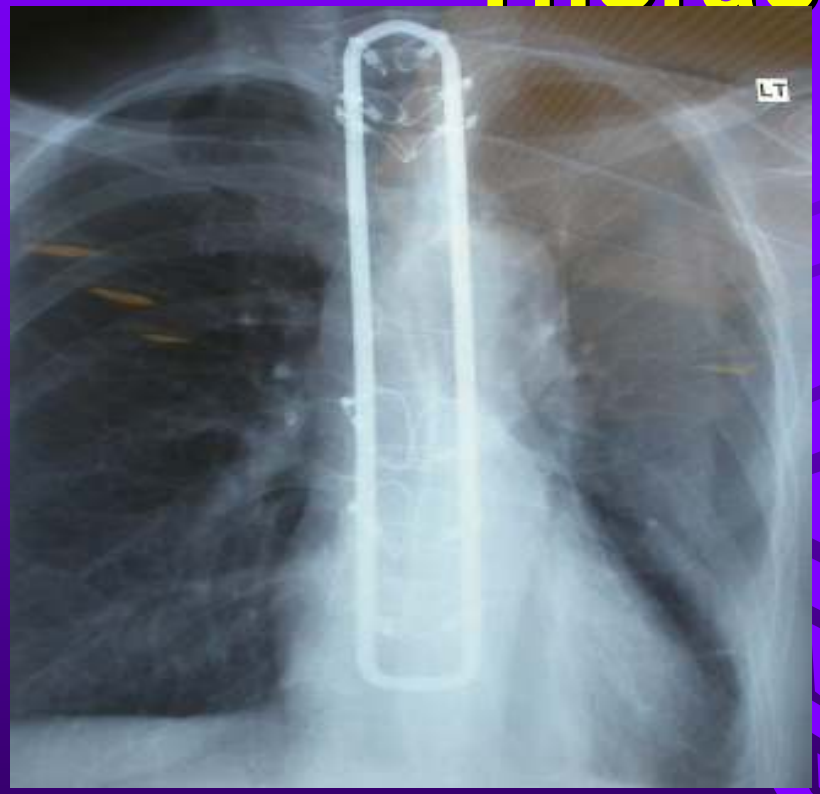
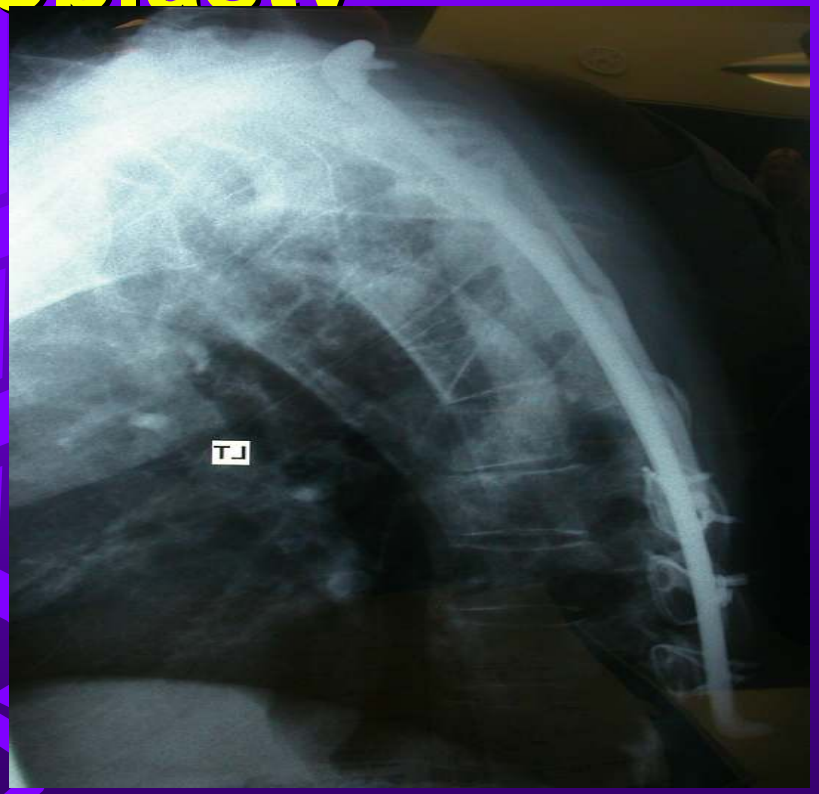
Reconstruction with Auto and allograft Cement Thoracoplasty





Complication - Recurrent Effusions and subcutaneous collections for 3/52

Current Scan

1ary bone tumours

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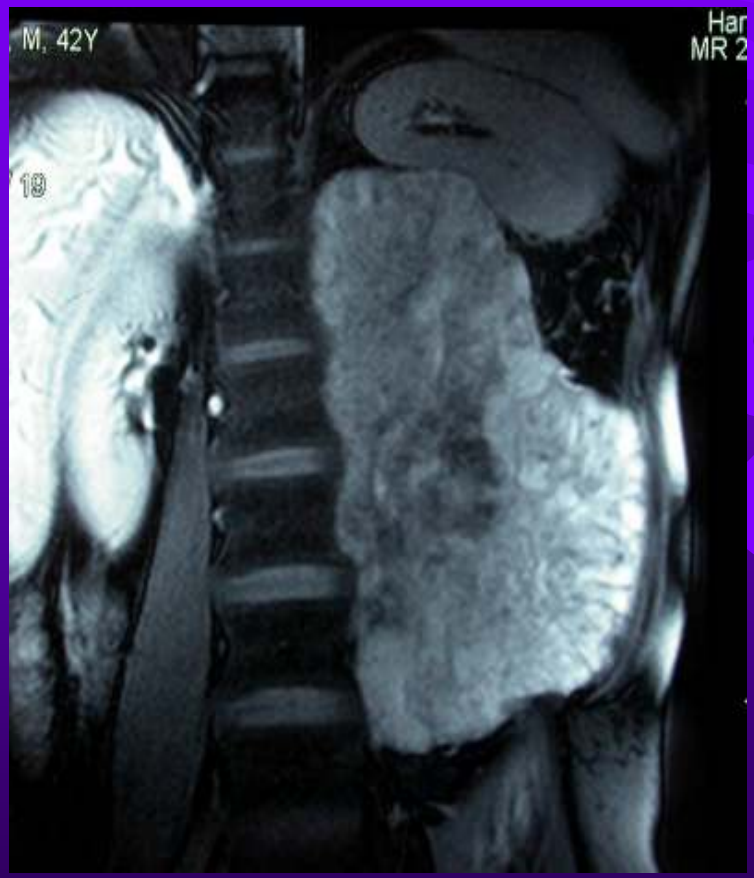
41 yo



1ary bone tumours

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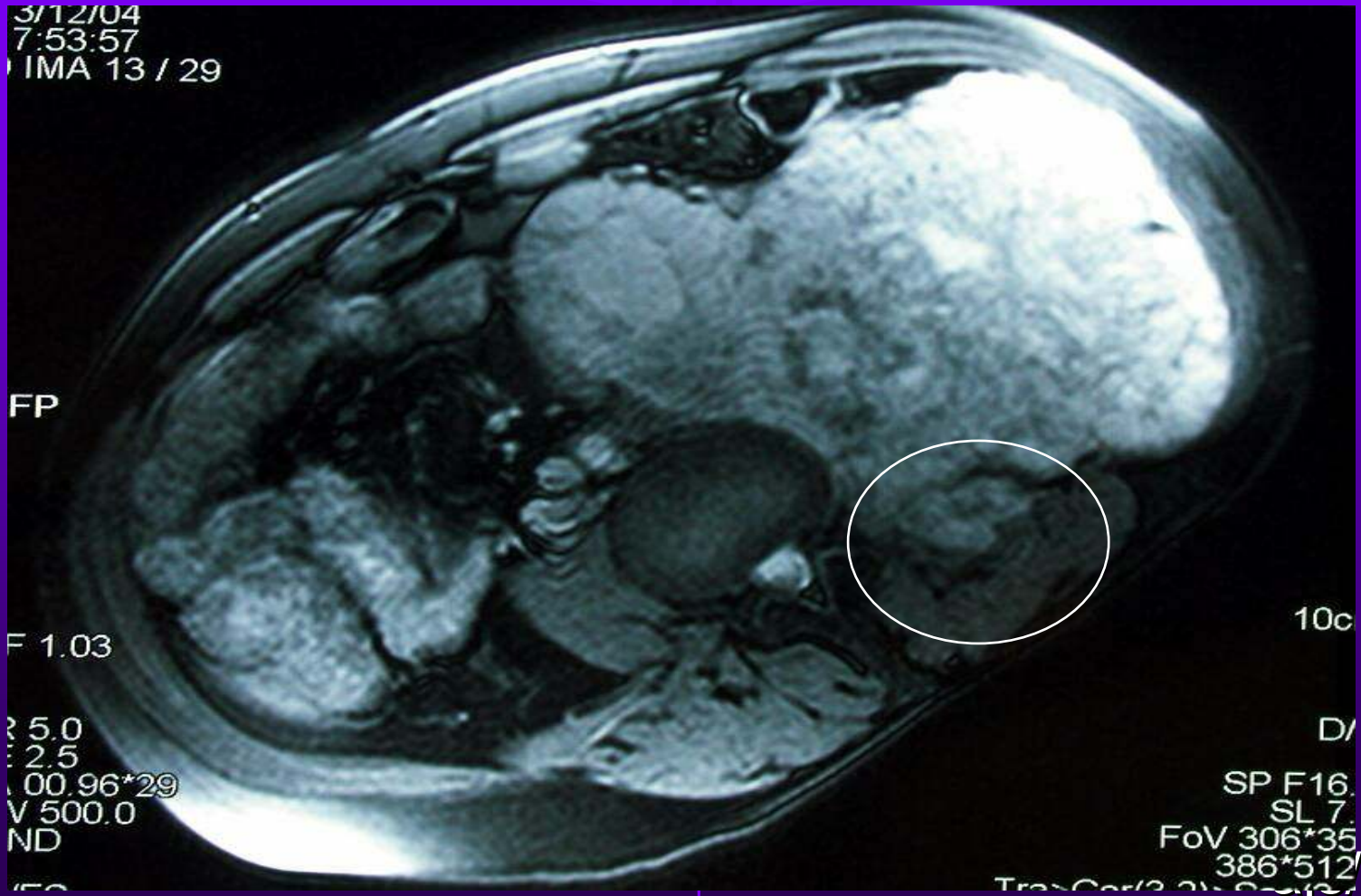
46 yo male Sheffield
6.5Kg Chondrosarcoma
1 year ago

7/12 Post op

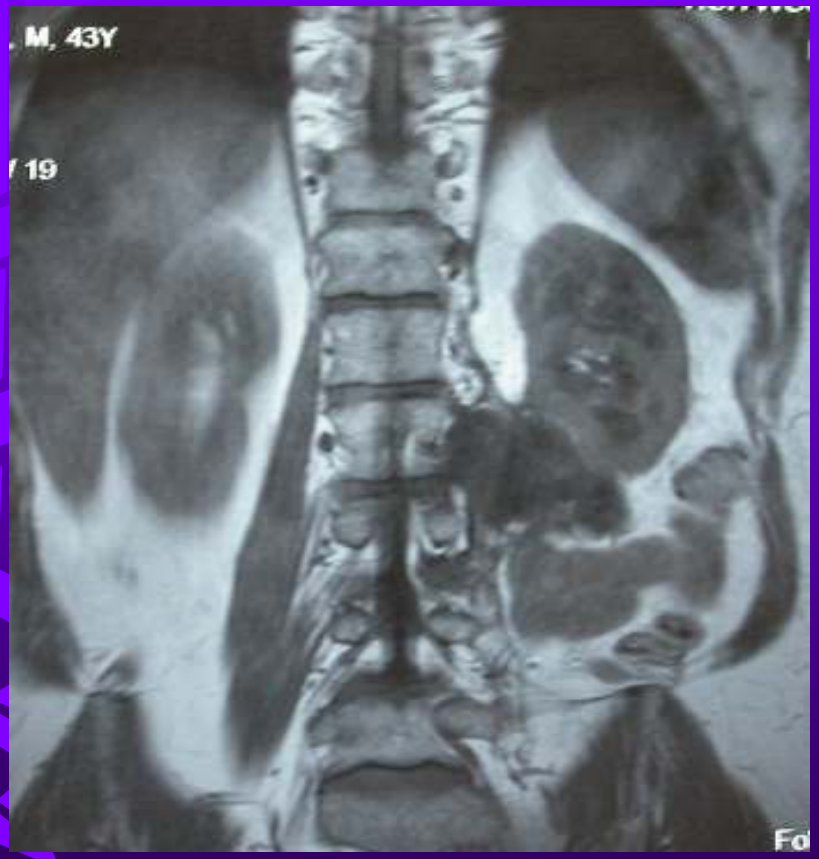
Hindsight



1ary

roh/09

14/12 postop



Technique - Partial Lumbar vertebrectomy

- **“Normal“ Hemilaminectomies of levels involved leaving Paraspinal muscles Spinous processes and ligaments intact**
- **Transfixion ligation and division of contralateral roots from within canal using operating Microscope**
- Excise Pars /facets at distal and proximal levels of section
- Retract thecal sac

Technique - Partial Lumbar vertebrectomy

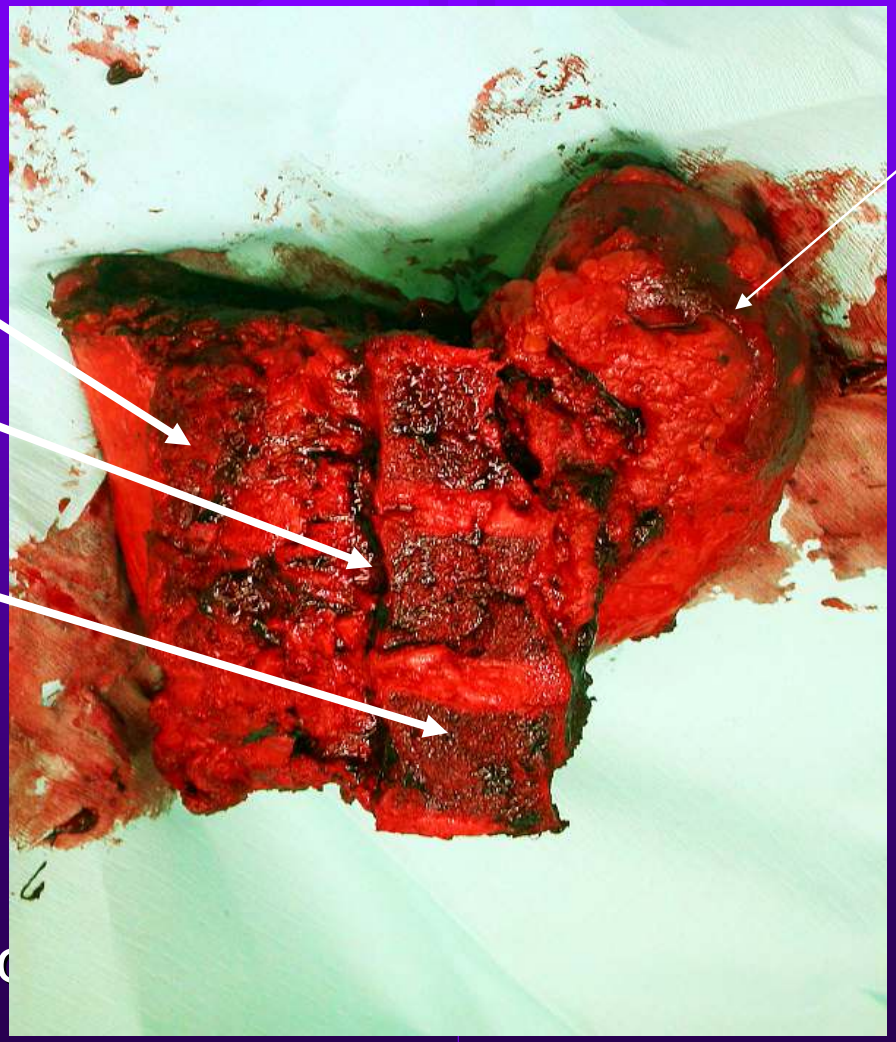
- Il control
- Anterior Mobilisation
- Sagittal Osteotomy of column Osteotomes
- Complete Paraspinal resection
- Complete proximal and distal disc hemisection
- Remove specimen
- Reconstruct Post Abdominal wall

Spinous

Processes

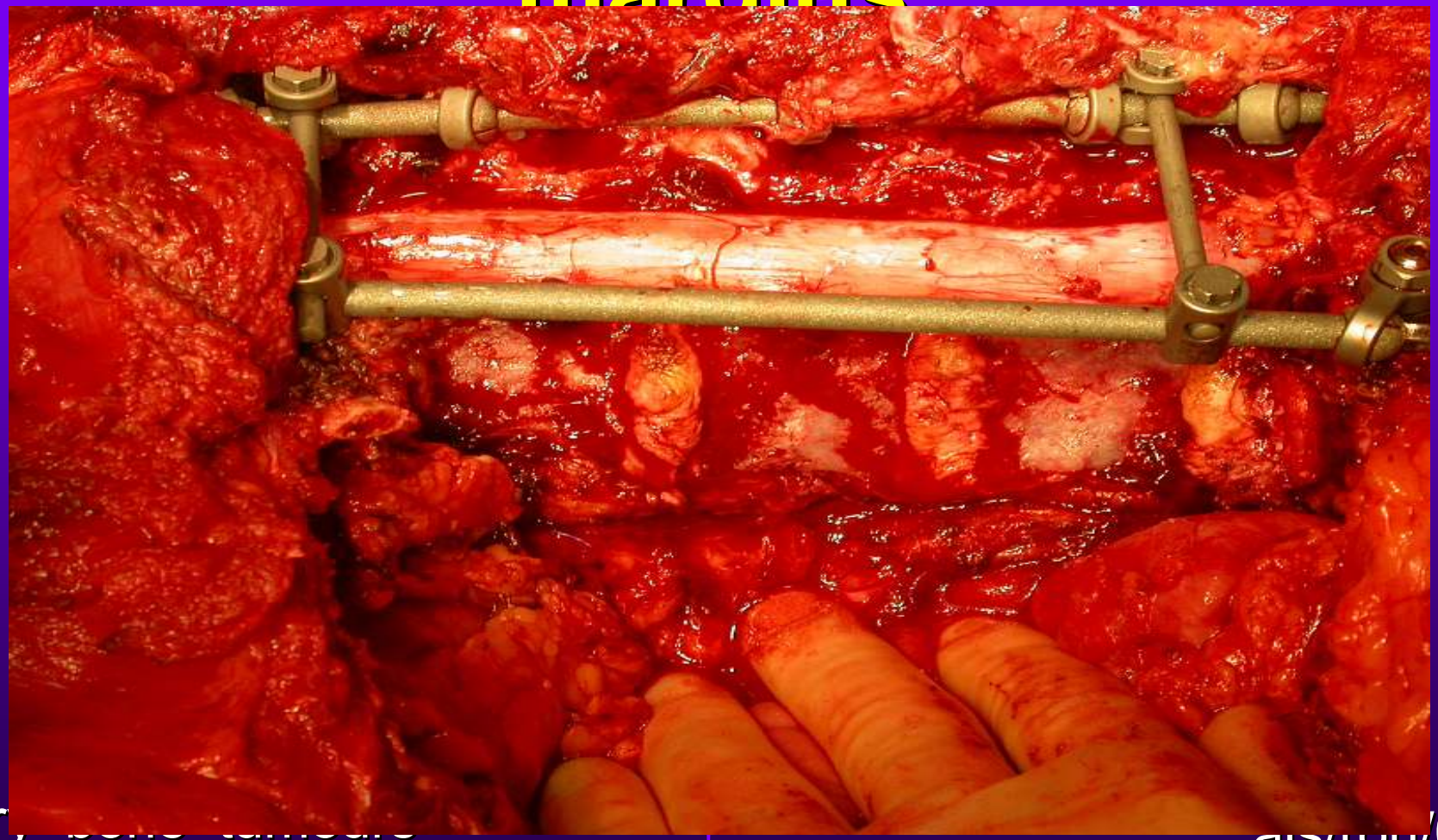
Canal

Vertebral bodies



Kidney

Post resection and reconstruction- clear margins

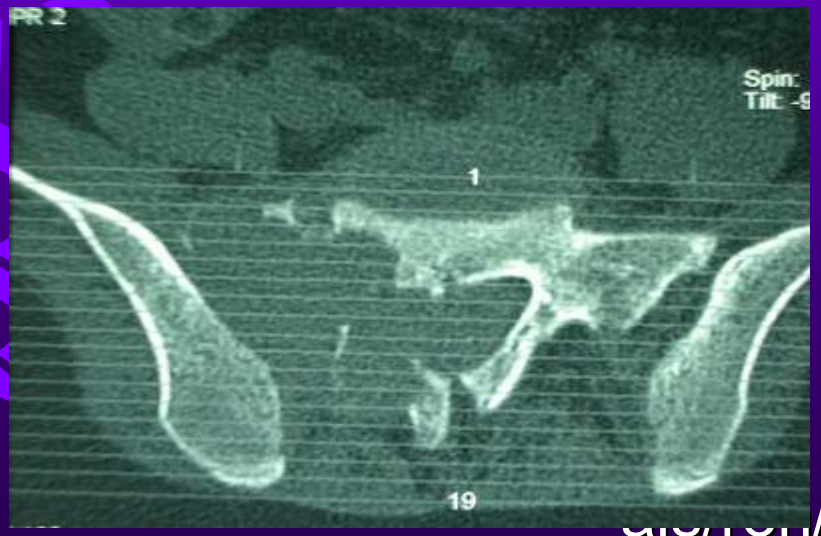


Chondrosarcoma

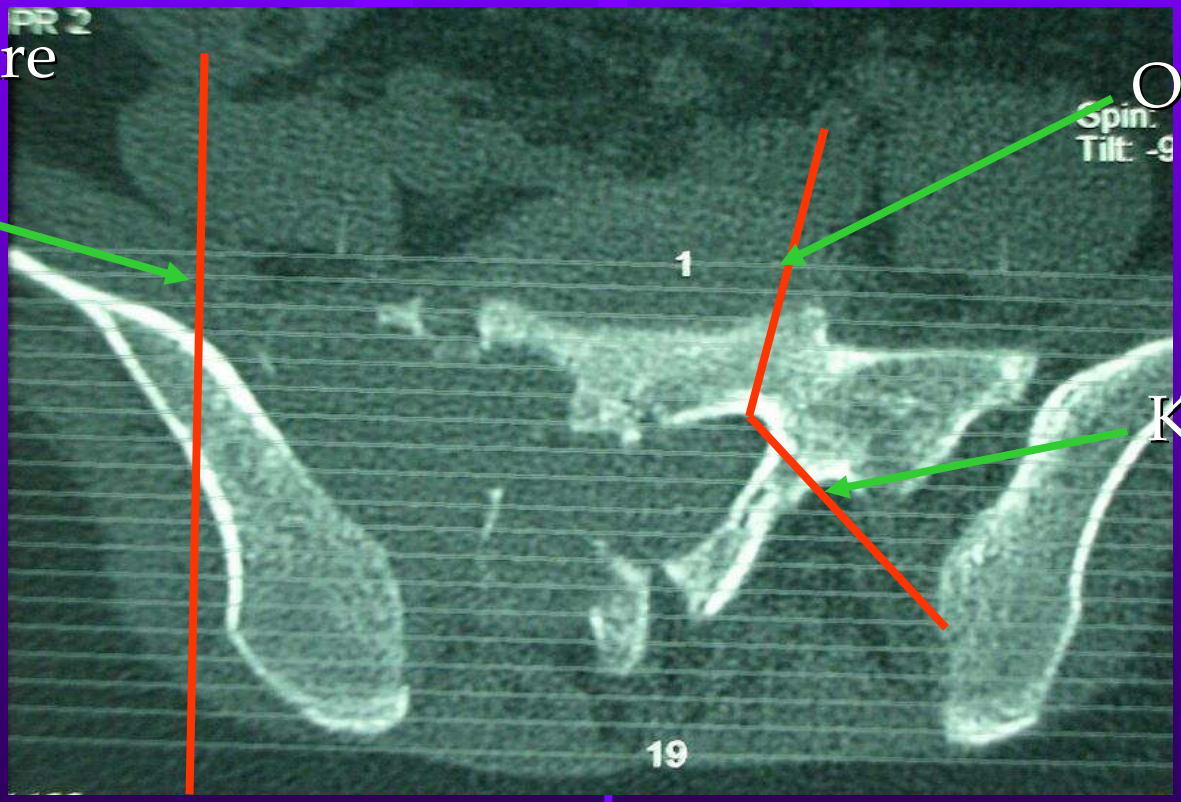
- 4-8% spinal
- 2M:1F
- Commonest 5-7th decade
- Posterior and paraspinal
- 85% primary
- 15% transformation of OC

- Histology Grades 1-3
- Grade 1 - ? Serial observation
- Others - enbloc resection wide margins
- Chemo - No use
- RT - ? Value

Embryonal Rhabdomyosarcoma 8yo Essex Prior Chemo and RT



- Lines of Resection Division of S 1,2,3 roots but Post op foot drop - recovering



1ary bone tumours

Histology - clear margins

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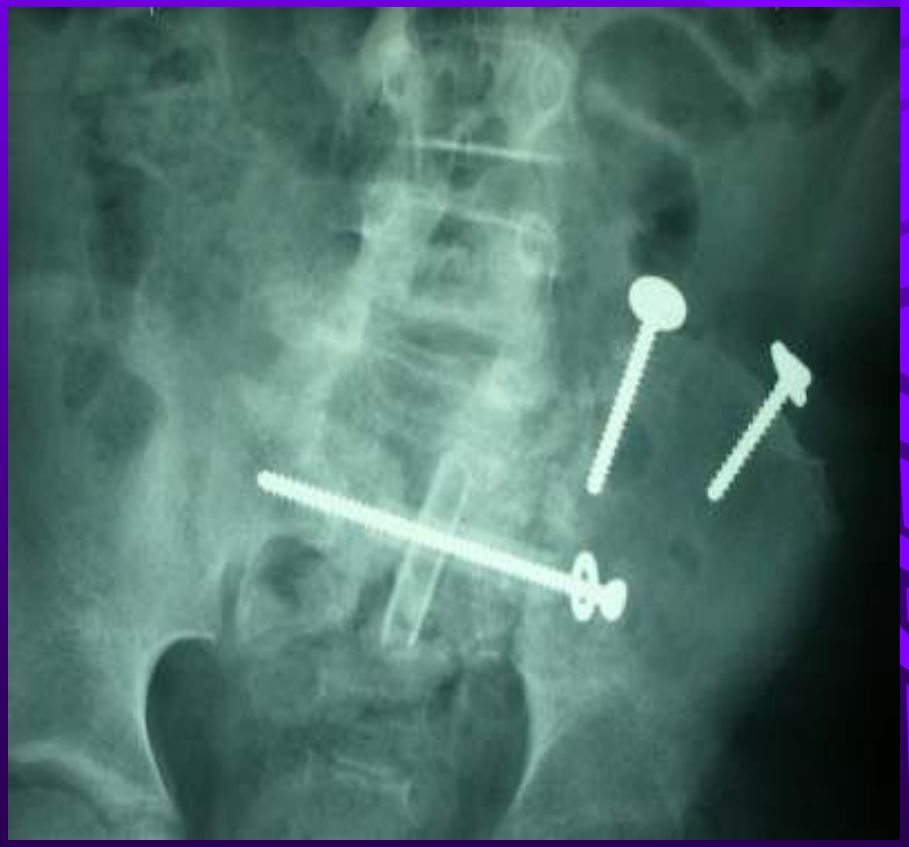
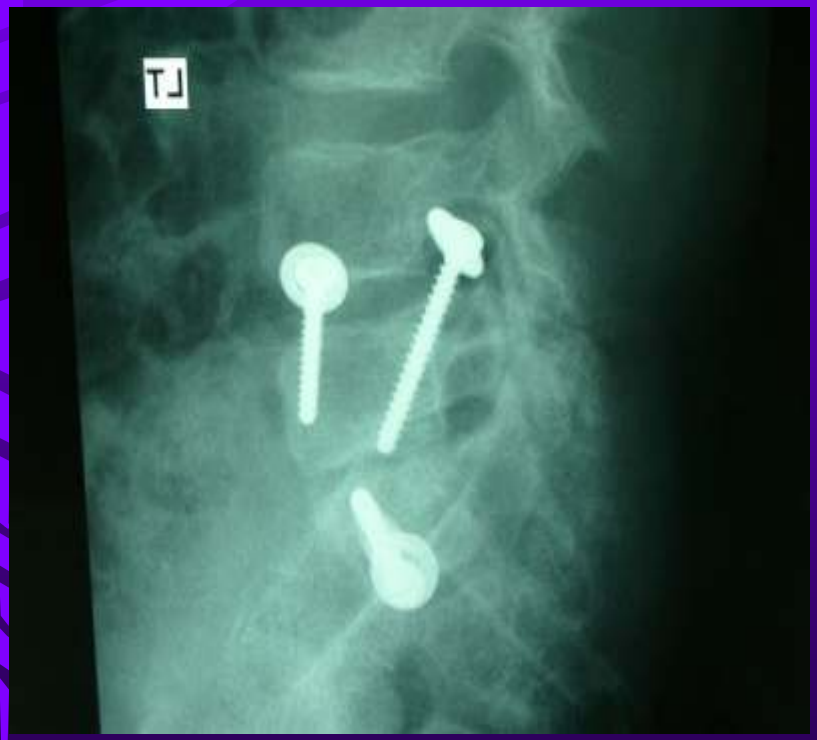
Reconstruction with fibula horizontal and vertical + allograft Spica for 6/12





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Reconstruction with fibula horizontal and vertical + allograft

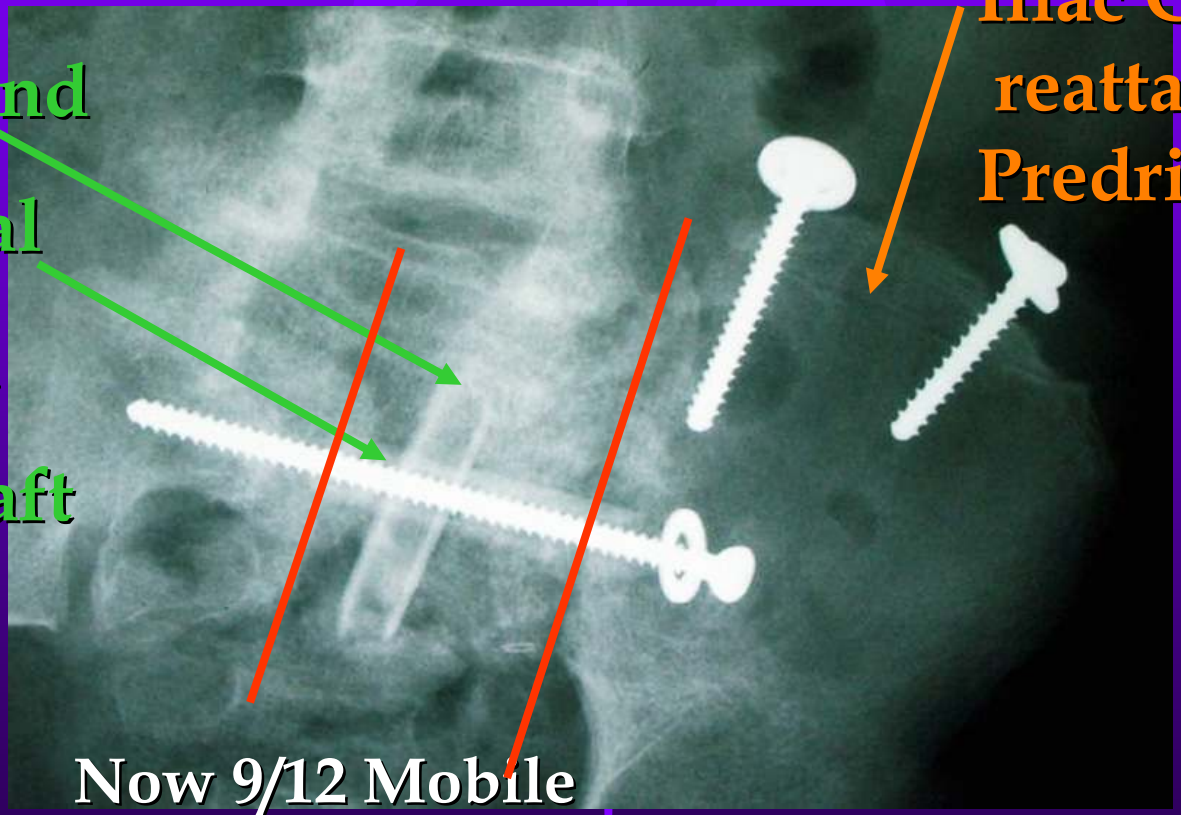
Vertical and

Horizontal

Threaded

Fibula graft

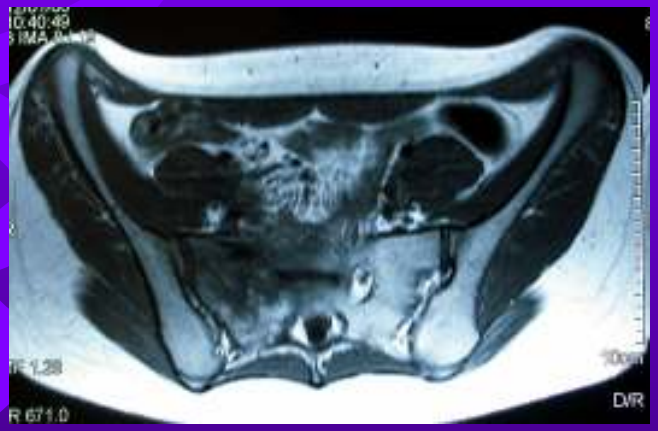
Osteotomised Iliac Crest reattached via Predrilled screws



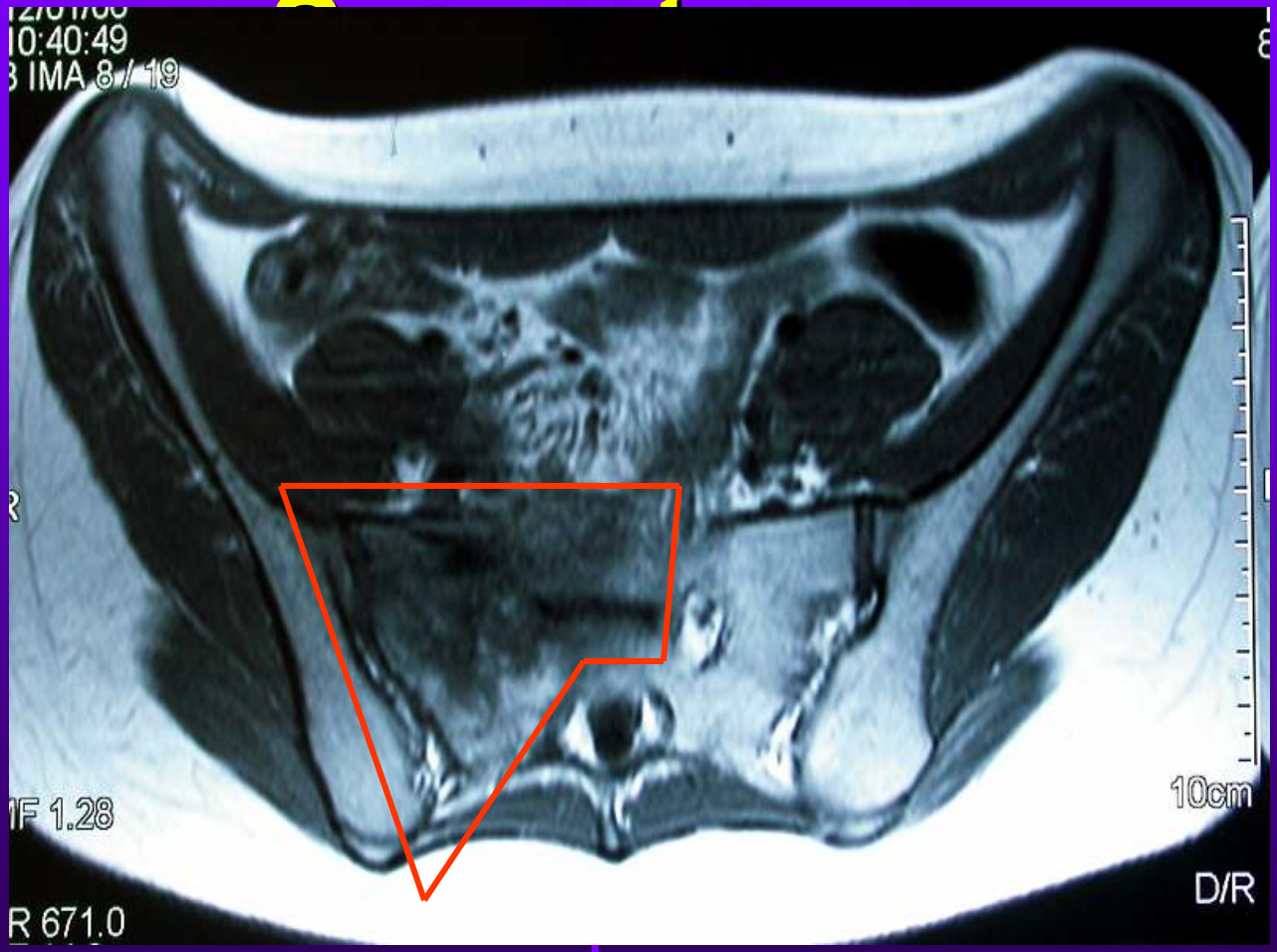
Now 9/12 Mobile ,Recovering footdrop

1 year later - Asymptomatic graft slippage

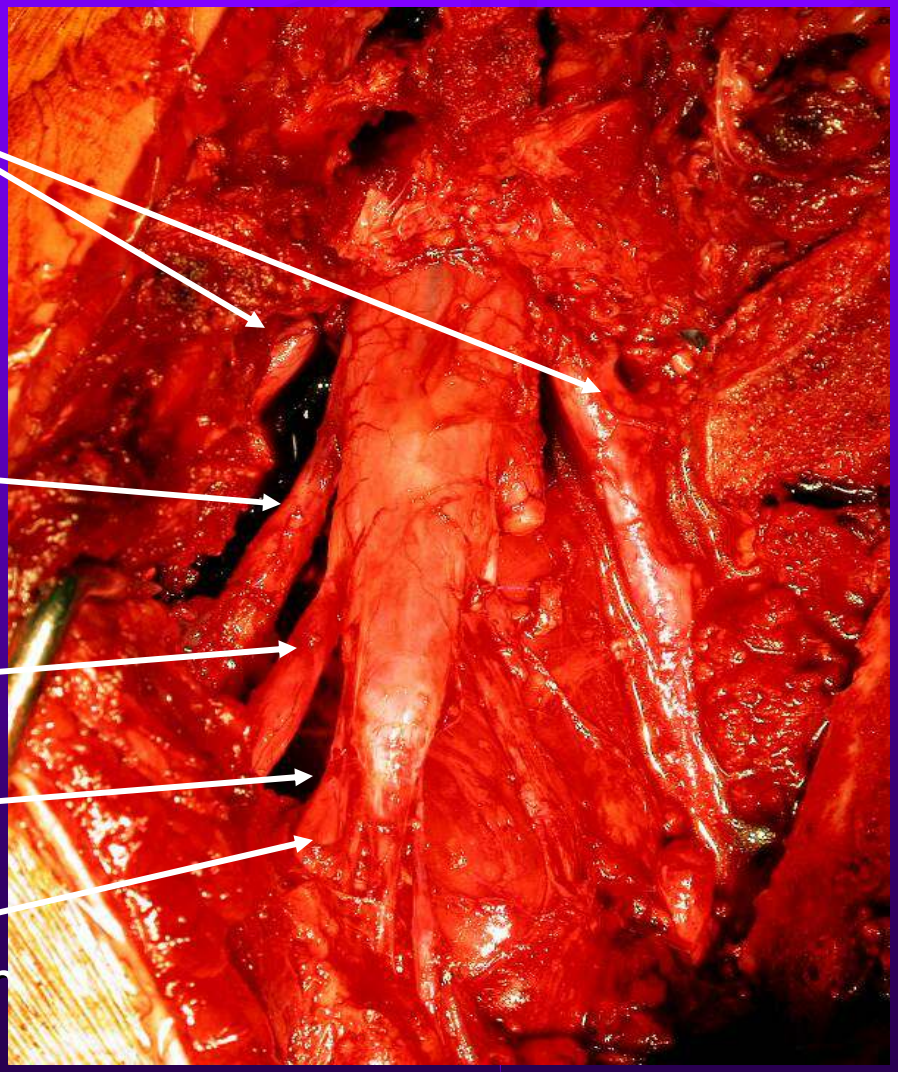
16 yo female Osteosarcoma



16 yo female Osteosarcoma - enbloc posterior



Sacral root Dissection



Division of left S1 – S3 roots

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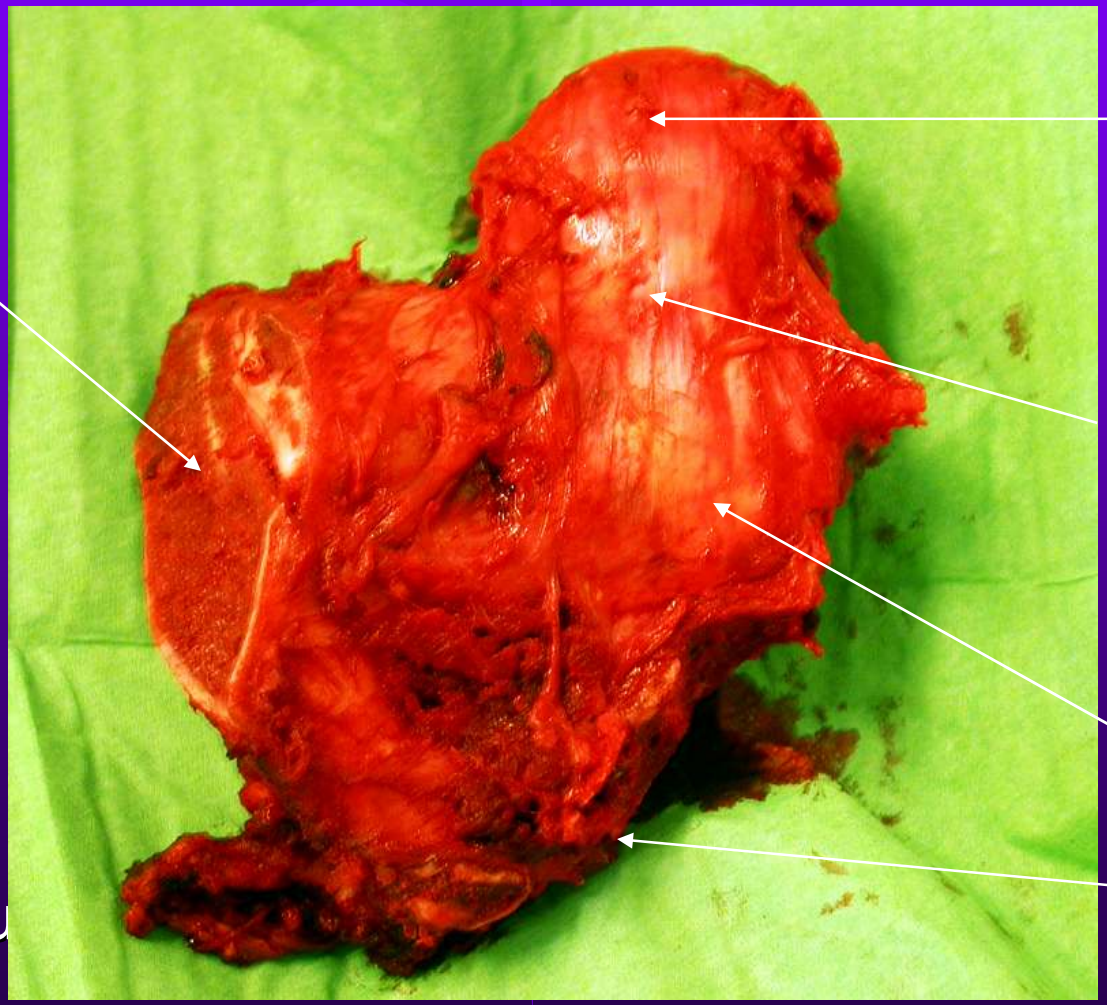
Resected Specimen –Clear Margins



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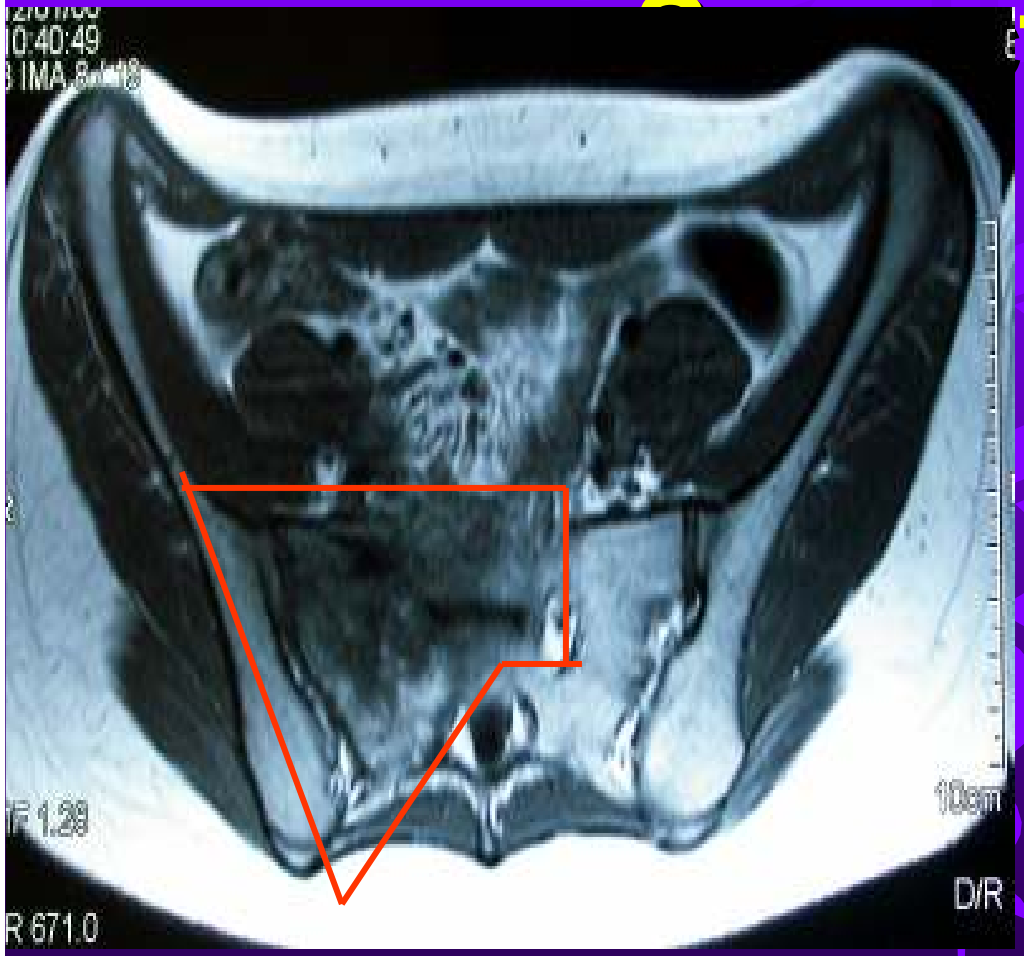
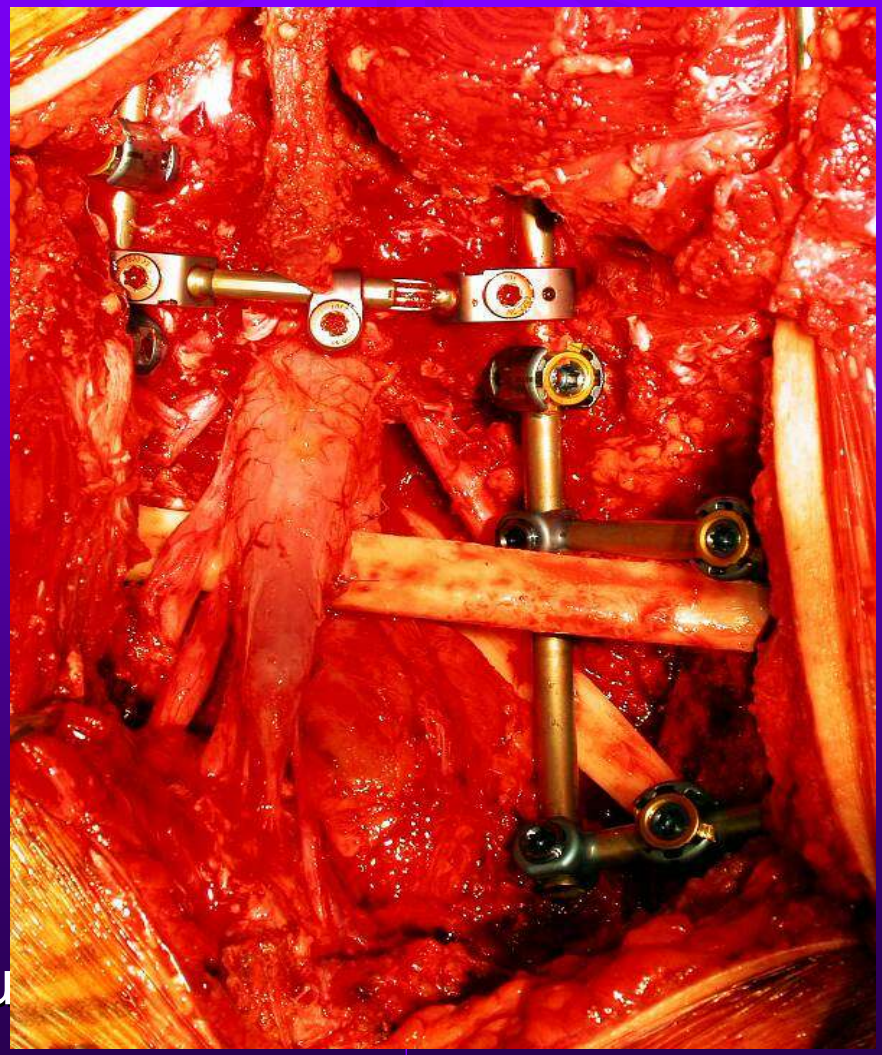
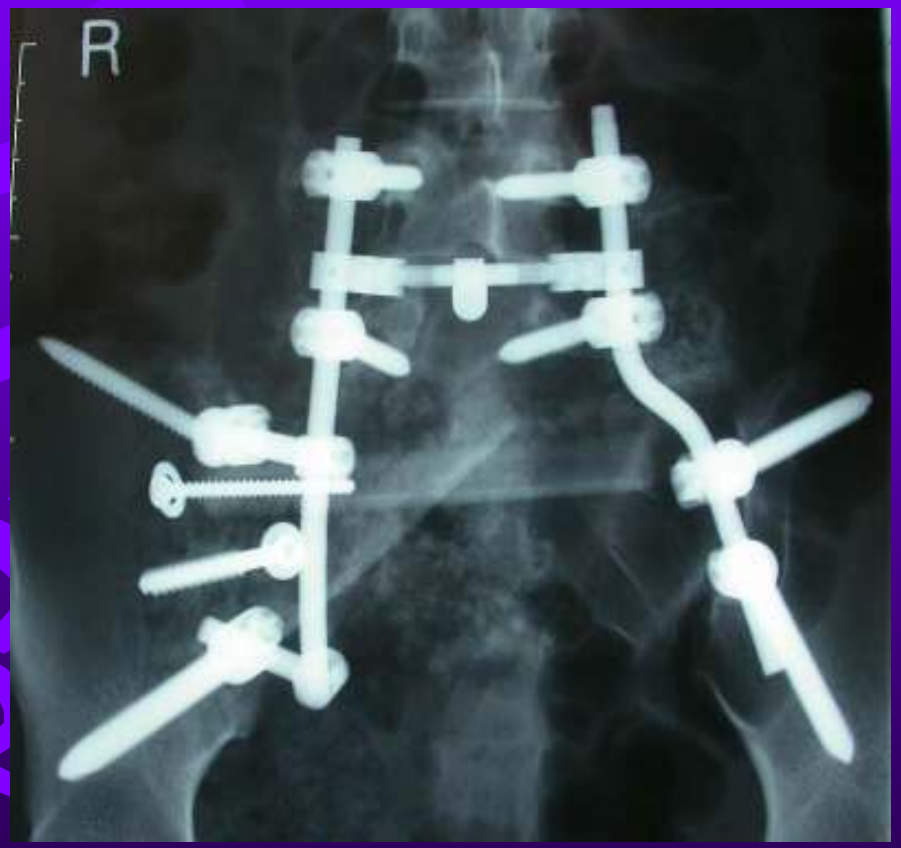
16 yo female Osteosarcoma - enbloc posterior [illegible]tomy



Reconstruction



Post Reconstruction - in spica for 3/12



Osteosarcoma

- 3% spinal
- 5% of primary spinal malignancy
- M=F
- 2/3 some neurology
- Usually anterior
- Usually extracompartmental at presentation

- Rx
- Neoadjuvant chemotherapy 2-3 cycles
- Enbloc with wide margins
- Adjuvant RT - 60 Gy
- Usually fatal

Ewings Sarcoma

- 8% Spinal
- Half sacral
- 1st to 4th decade
- Neurology 80%
- 25% febrile
- ESR 40%
- Anaemia 20%

- Rx
- Resection with wide margins if possible
- If not Neoadjuvant then ? Resection
- RT 40-60Gy
- Survival mean 33/12
- 20% 5 year

Summary

- Incomplete review to date
- Blood loss approx 1 unit /hour of operating time (Range 2-18)
- No mortality
- 2 Unpredicted neurological deficit
- 3 infections 1minor 1 major 1 epidural catheter
- 1 missed Pneumothorax

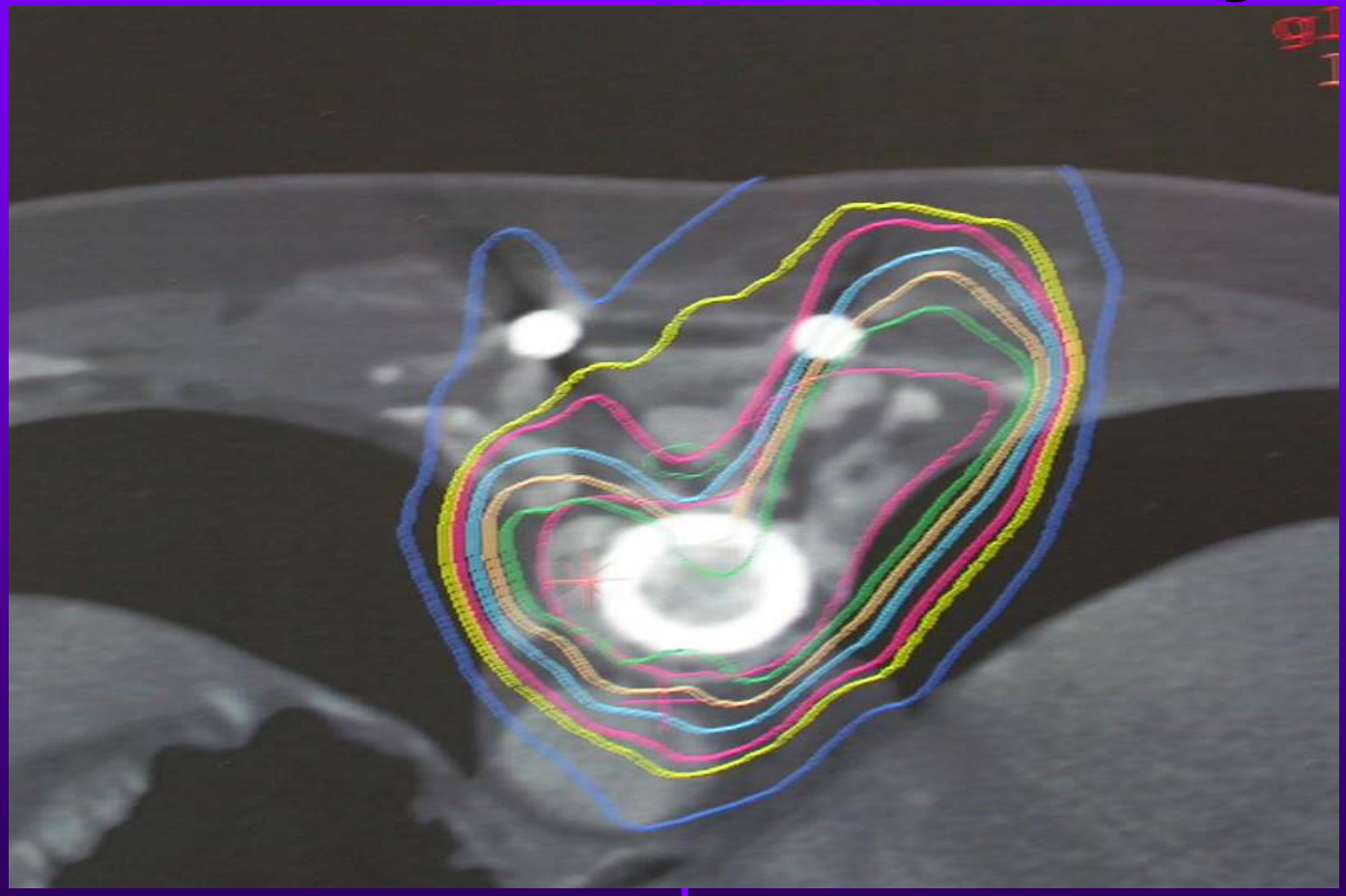
Summary

- Early experience with novel methods of partial thoracic and lumbar multi level enbloc resections
- Lumbosacral En bloc resection and reconstruction
- Microscope .v useful for ligating roots within canal
- Fibula useful for reconstruction

Conclusion

- Often “designer “ operations
- Suggest develop Consultant colleagues in other disciplines who enjoy Novel Procedures
- Rewarding to date with no unanticipated recurrence
- Only time will tell

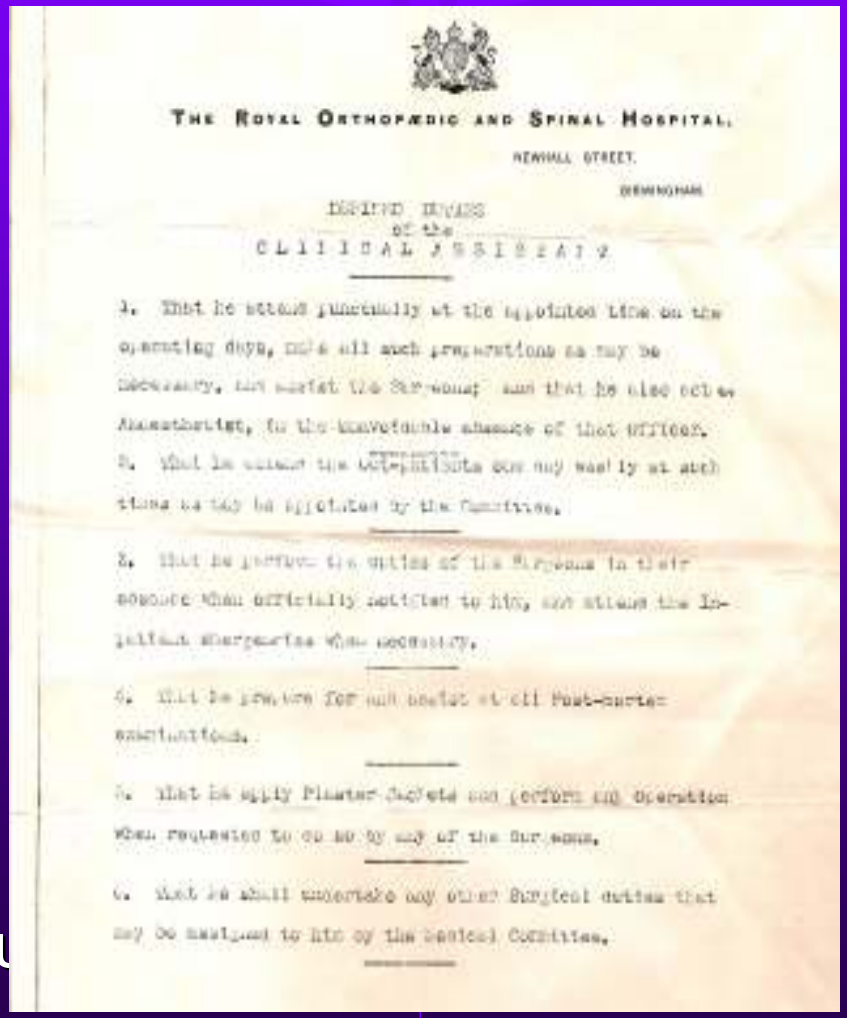
Future - Contoured radiation fields 70 Gy



In the World of Surgical Oncology -

- Biology is King
- Selection is Queen
- Technical Manoeuvre is the Prince
- Occasionally the Prince tries to usurp the throne ;he almost always fails to overcome the powerful forces of the King and the Queen

My Job description



THE ROYAL ORTHOPÆDIC AND SPINAL HOSPITAL,

NEWHALL STREET,

BIRMINGHAM

DUTIES
of the
CLINICAL ASSISTANT

1. That he attend punctually at the appointed time on the operating days, make all such preparations as may be necessary, and assist the Surgeons; and that he also act as Anæsthetist, in the unavoidable absence of that Officer.

2. That he attend the out-patients once only weekly at such times as may be appointed by the Committee.

3. That he perform the duties of the Surgeons in their absence when officially notified to him, and attend the In-patients when necessary.

4. That he prepare for and assist at all Post-mortem examinations.

5. That he apply Plaster Jackets and perform any Operation when requested to do so by any of the Surgeons.

6. That he shall undertake any other Surgical duties that may be assigned to him by the Medical Committee.

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Thank You Surgeons

- Spinal Unit
- **Alistair Thompson**
- **David Marks**
- **Andre Jackowski**
- **Jonathan Spilsbury**
- **Mel Grainger**
- Ian Pitman
- Mushtaque Ahmed
- Adrian Gardner

- **Pelvic**
  Rob Grimer
- **Retroperitoneal**
  Mike Wallace
- **General**
  John Fielding
- **Thoracic**
  Frank Collins
- **Plastics**
  Francis Peart

1ary bone tumours

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Thank You – Allied Disciplines

- Oncologists
- David Spooner and David Peake
- Radiology
- Nick Evans
- Steve James
- Histology
- Chas Mangham
- Prof Knid-Blom
- Theatre Staff
- Oncology Nurse Specialists
- Anita Killingworth
- Plaster Room
- Patrick