Management of Sacral Tumors

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Background

Tumor surgery from oncologic point of view

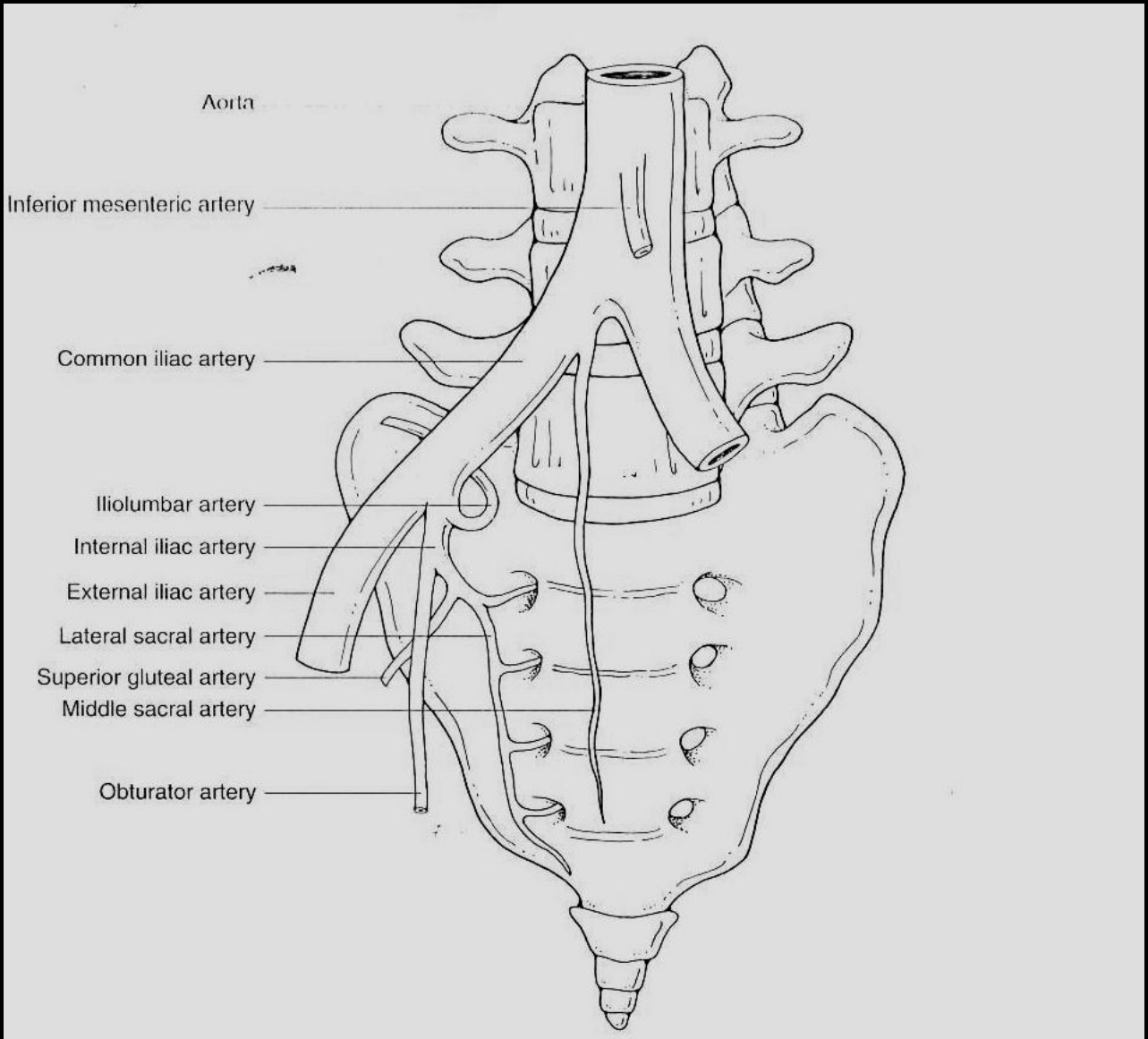
- ✓ Paliative surgery = Intralesional surgery
- ✓ Curative surgery
  - ✓ a)Wide marginal resection - Gross total resection
  - ✓ b)Extra-marginal resection - Total resection

= Radical surgery = Sacrectomy

- ✓An oncologic surgery is possible in sacrum
- ✓Challenges of preservation of roots and visceral structures
- ✓Challenges of sacroiliac fixation

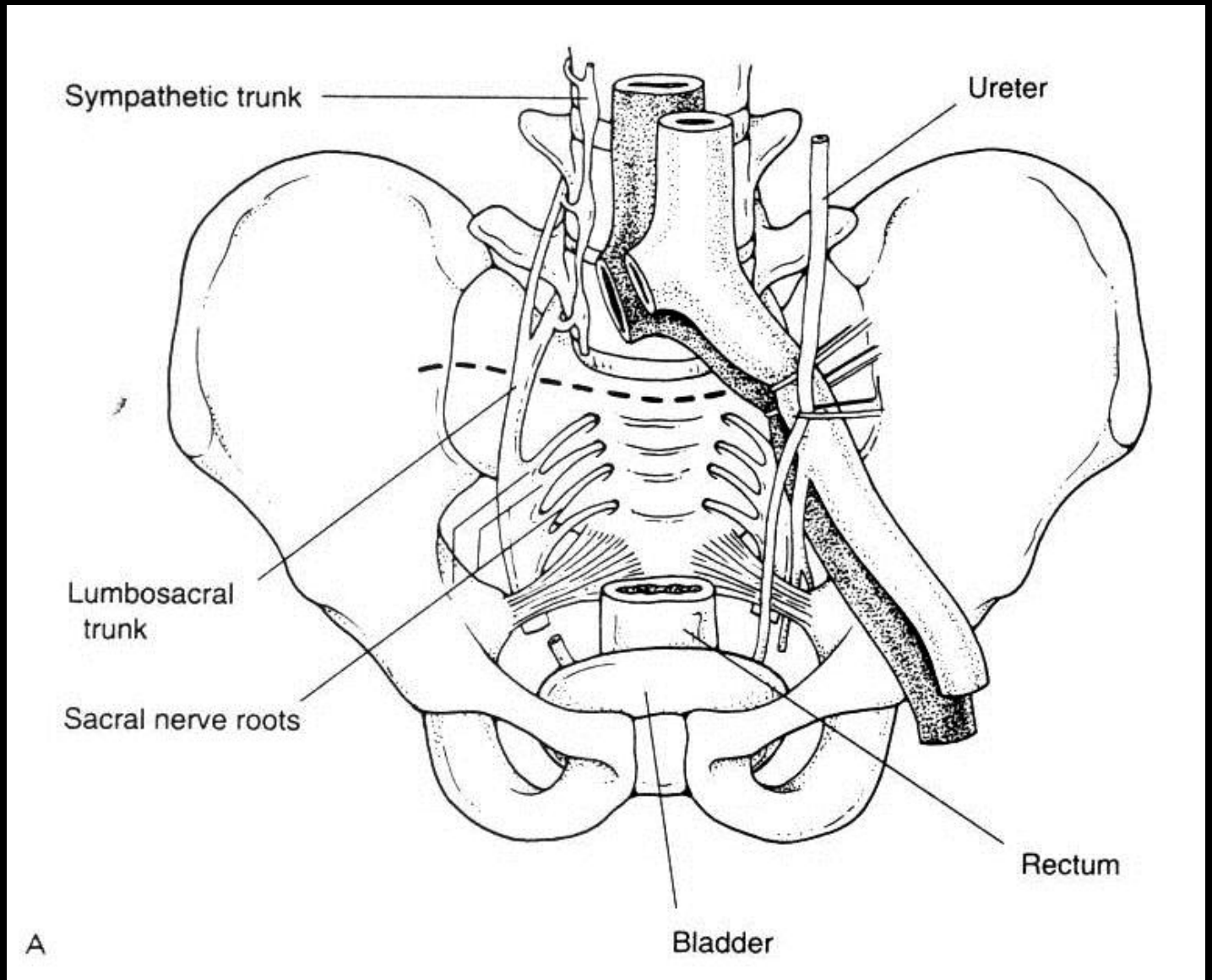
Problems of Radical Sacrum Surgery

1-Protection of the vascular structures



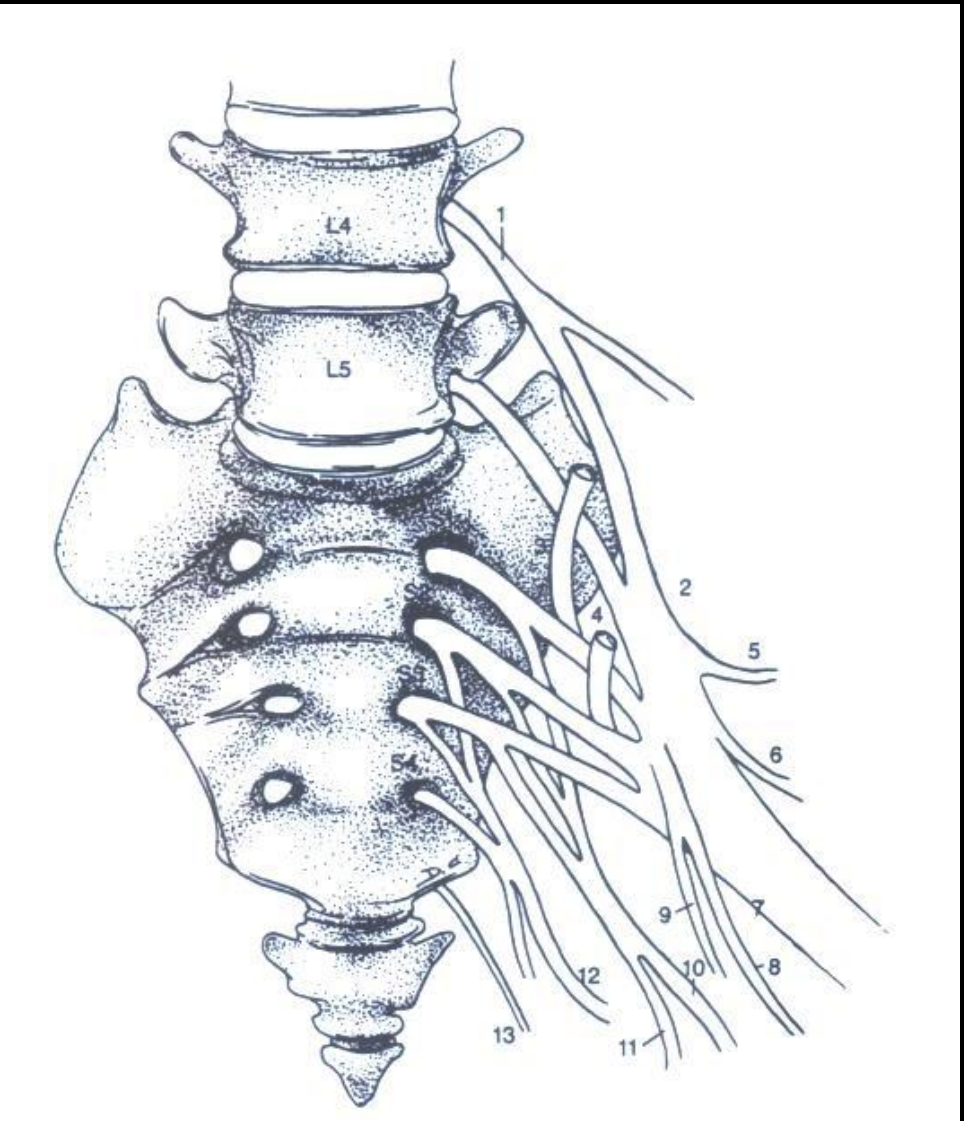
Problems of Radical Sacrum Surgery

2-Protection of the visceral structures



Problems of Radical Sacrum Surgery

3-Protection of the roots and plexus



- ✓Preservation of the lumbar roots allows ambulation.
- ✓Loss of bladder function
- ✓Loss of bowel control
- ✓Loss of sexual function

Problems of Radical Sacrum Surgery

4-Excessive bleeding

Application of

- ✓Fluid nitrogen
- ✓Phenol
- ✓Hydrogen peroxidase
- ✓Hot water

Leaving substances on the bed of tumor

- ✓Hemostatic gauze
- ✓Fibrin glue
- ✓Omentum flap

- ✓Autotransfusion (Cell saver)

Problems of Radical Sacrum Surgery

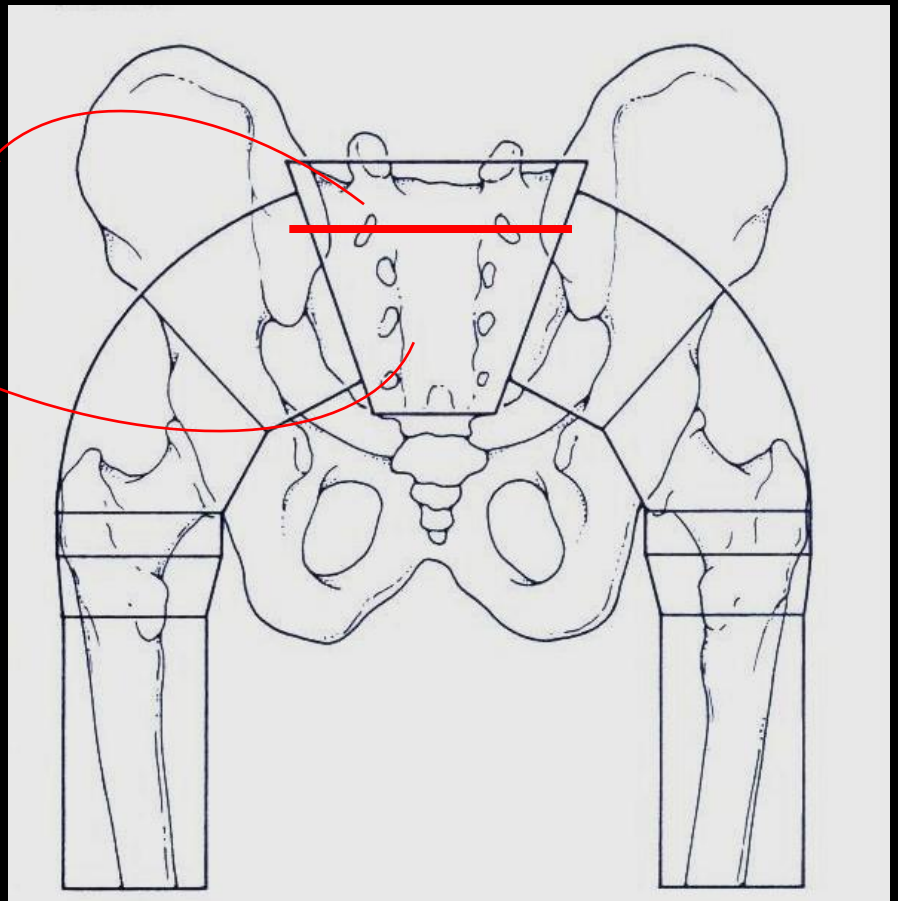
5-Lumbosacral and sacroiliac stability

Lumbosacral junction

- ✓Carries large loads
- ✓Loadbearing is shared by oblique force lines
- ✓Transition from mobile spine to rigid pelvis

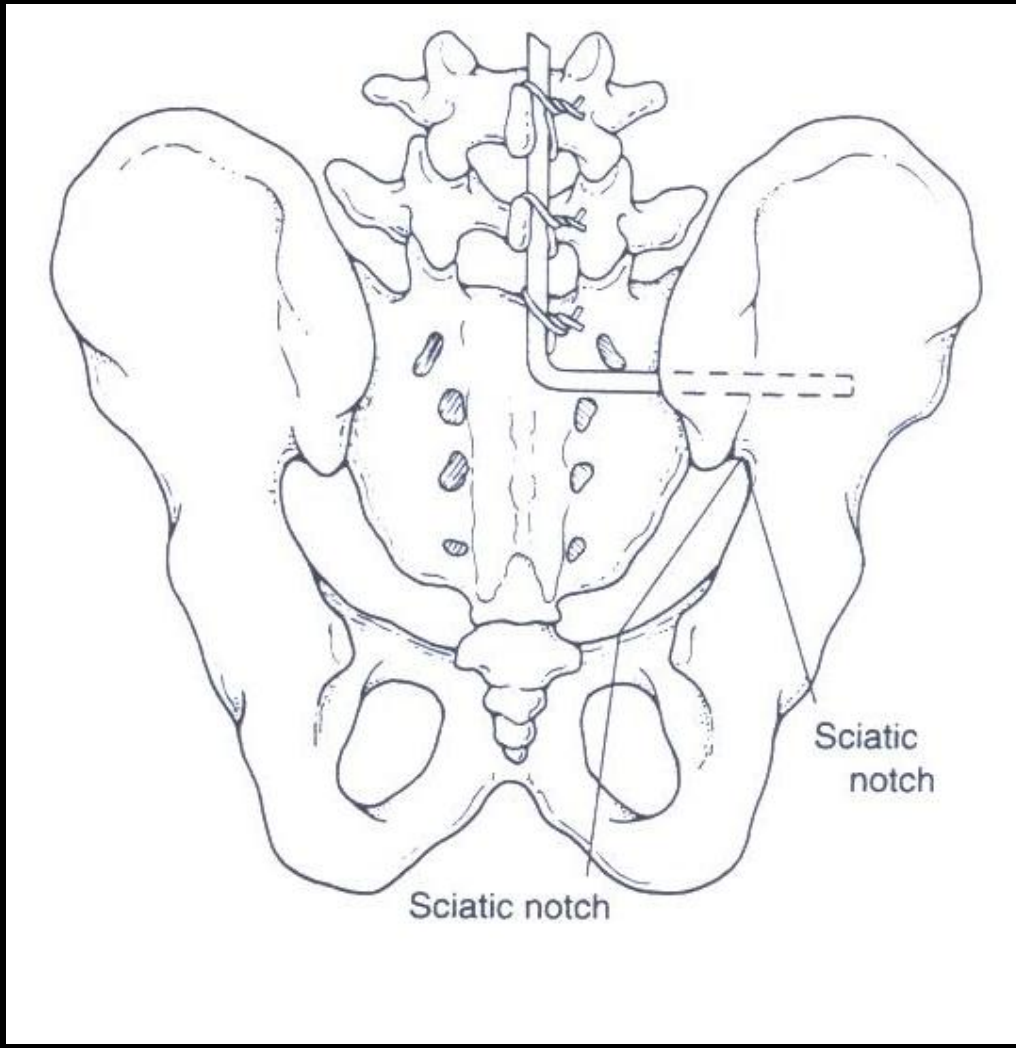
✓Sacrectomy above S1 destabilize sacrum and pelvic ring, and needs fixation

✓Sacrectomy below S1 needs no fixation



Galvestone rods (L-rods) with wires
(Allen & Ferguson, 1982)

- ✓Provides lumbo-pelvic fixation
- ✓Recommended for scoliosis surgery
- ✓Needs intact laminae
- ✓Not rigid as screws

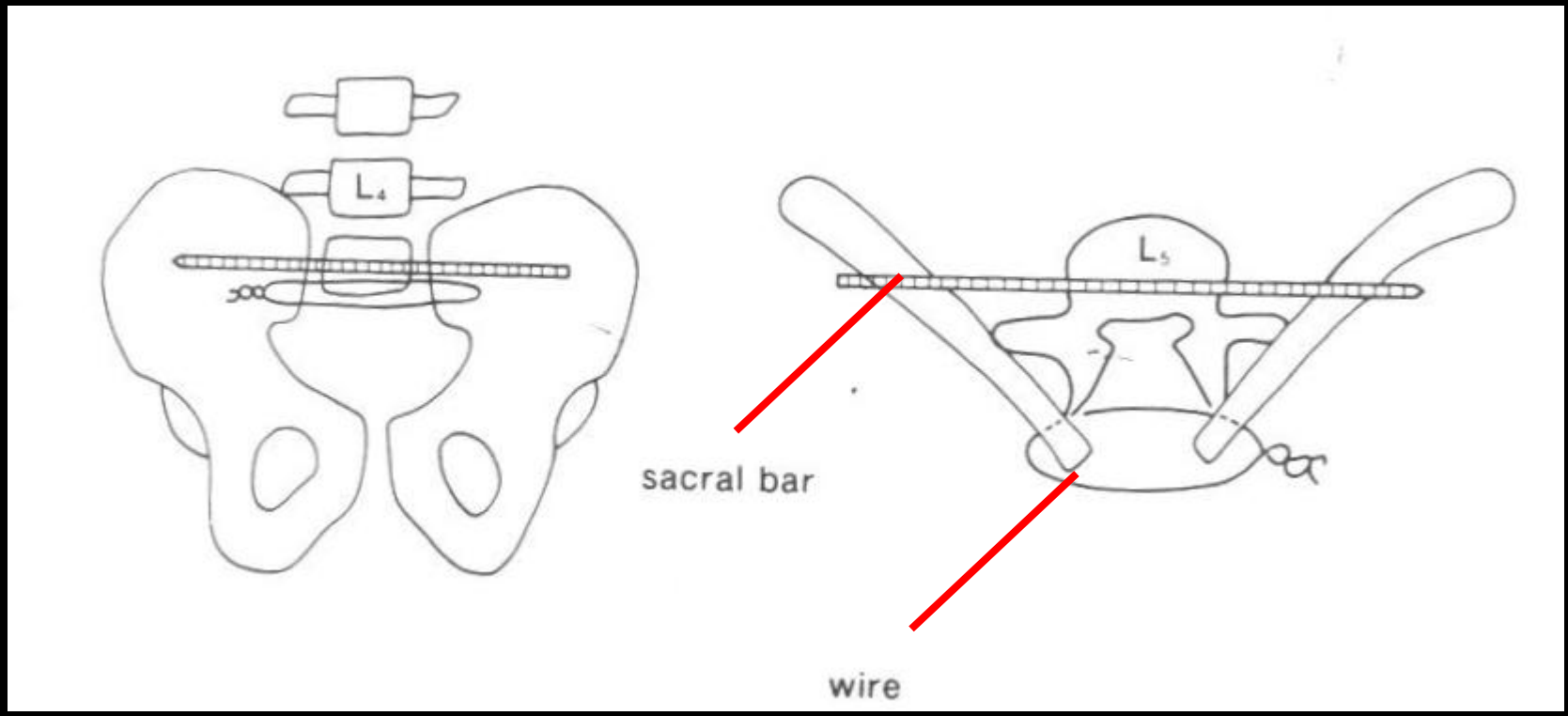


Allen BL Jr, Ferguson RL.
The Galveston technique for L-rod instrumentation of the scoliotic spine.
Spine 7:276-284, 1982

Harrington rods, transvers bar, wire
(Shikata technique, 1988)

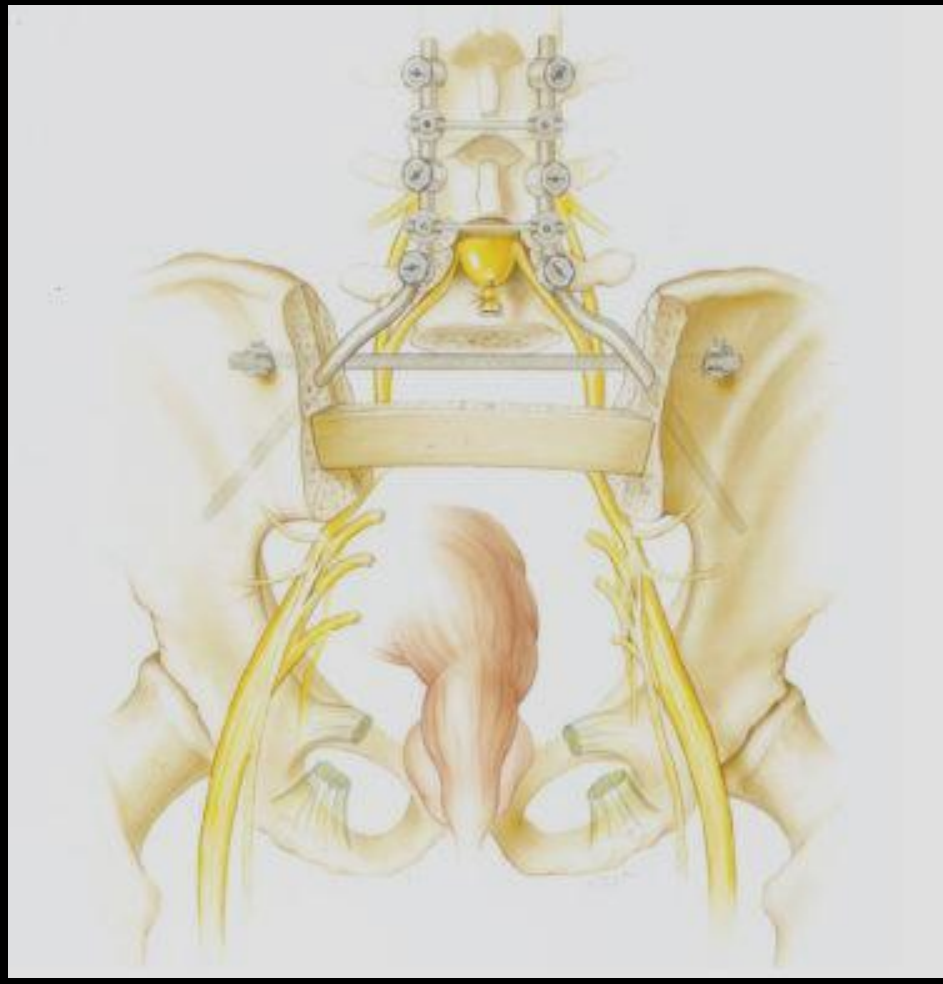
Lumbo-sacro-iliac stabilization

- ✓First stabilization system recommended after sacrectomy
- ✓Combination of Harrington rods, wire and transvers bar
- ✓Iliac bones were brought together with a wire
- ✓L5 was lowered 2 cm and shifted anteriorly



J. Shikata, T. Yamamuro, Y. Kotoura, et al.
Total sacrectomy and reconstruction for primary tumors J Bone Joint Surg Am 70-A:122-125, 1988

Galvestone rods (L-rods) with lumbar pedicle screws
(Gökaslan et al)



✓They added lumbar pedicle screws instead of Harrington rods.

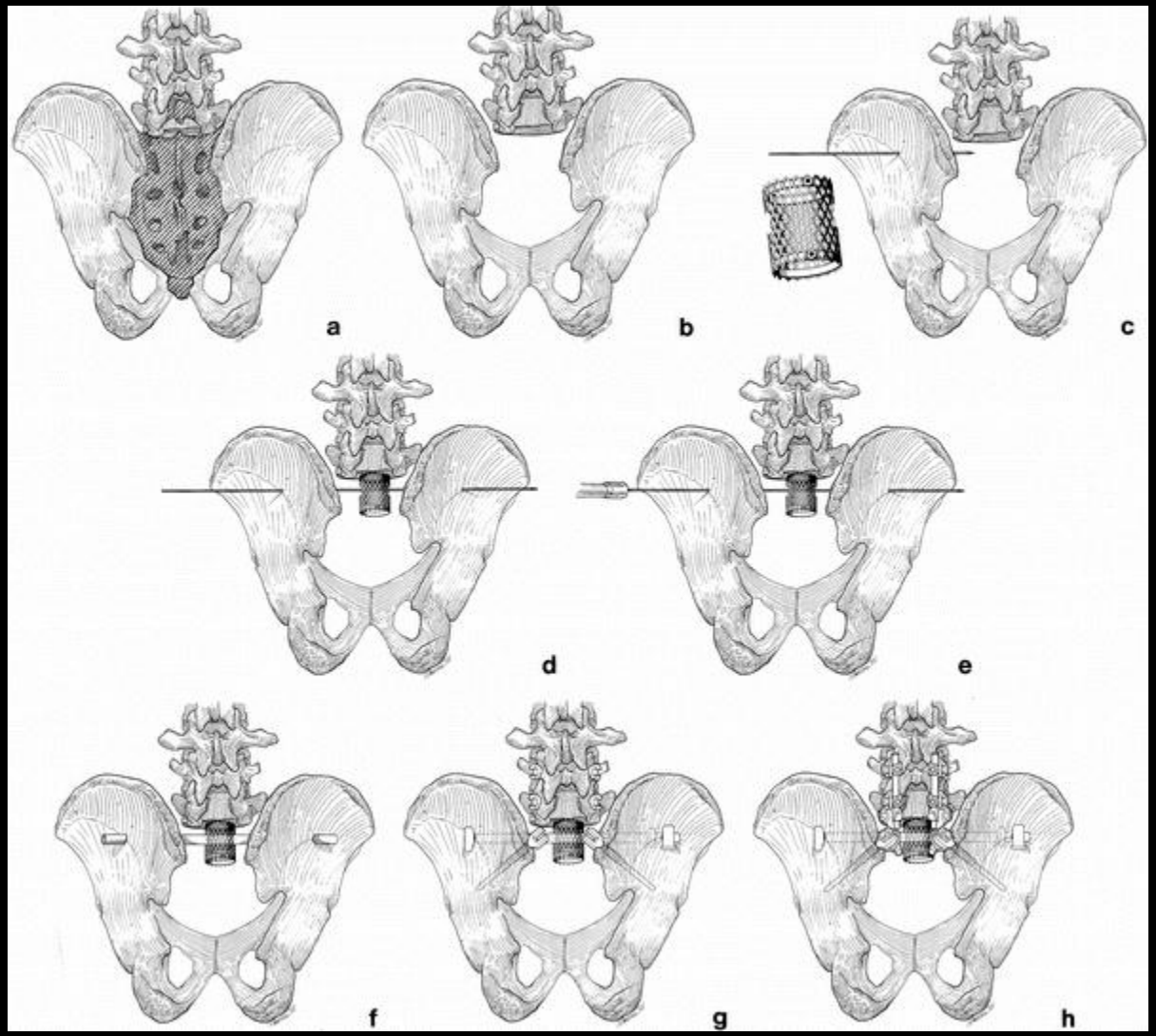
✓Two “L” shaped Galveston rods from lumbar pedicles to iliac wings.

✓One threaded rod connecting left and right ilia

✓Tibial allograft strut between the ilia

Z.L. Gökaslan, M.M. Romsdahi, S.S. Kroll, G.L.Walsh, T.A.Gillis, D.M.Wildrick, M.E.Leavens
Total sacrectomy and Galveston L-rod reconstruction for malignant neoplasms: Technical note
J Neurosurgery 87:781-787, 1997

Custom made system (Salehi et al)



Neural function preservation and early mobilization after resection of metastatic sacral tumors and lumbosacropelvic junction reconstruction - Report of three cases

S.A. Salehi, R.R. McCafferty, D. Karahalios, S.L. Ondra J Neurosurgery: Spine 97/1: 2002

Surgical Team

- ✓ Spinal neurosurgeon
- ✓ Abdominal surgeon
- ✓ Plastic surgeon

Clinical Series

- Primary sacral tumors surgically treated at The University of Ege, Izmir, Turkey (1991 – 2003)
- 34 patients (14 males, 20 females)
- Mean age 42 yrs (range, SD 17 yrs)
- Median duration of symptoms = 20 months
  - (7 days to 10 yrs)
- Median follow-up 42 months (range 1 month-12 yrs)

Pathology

Malignant Tumors	**20**
✓ Chordoma	8
✓ Chondrosarcoma	3
✓ Osteosarcoma	2
✓ Liposarcoma	1
✓ Solitary plasmocytoma	2
✓ Ependymoma	3
✓ Malignant hemangioperycitoma	1

Benign Tumors	**14**
✓ Giant cell tumor	6
✓ Giant schwannoma	6
✓ Aneurysmal bone cyst	1
✓ Hemangioma	1

Clinical Findings

Unilateral sciatic pain	15
Bilateral sciatic pain	6
Local pain only	10
No pain	2

NEUROLOGICAL FINDINGS

Monoparesis	4
Cauda equina syndrome	6
(distal paraparesis & sphincter problem)	
Sphincter problem	18
No findings	16

Surgery

✓ Sacrectomy	14
✓ Gross total resection	12
✓ Intralesional subtotal resection	6
✓ Intralesional partial resection	5

Adjunctive Therapy

RT	10
RT + CT	2
None	22

Surgery

✓Sacrectomy – anterior-posterior	12
✓Sacrectomy (distal) - posterior	2
✓Posterior resection	15
✓Posterior-anterior resection	5
✓Anterior resection	3

✓Number of operations 2.3 ± 2.1

Sacrectomy

- ✓Chordoma 9
- ✓Chondrosarcoma 4
- ✓Osteosarcoma 1

Sacrectomy - Indications

- Lesions above S2 (Sacroiliac joint)
  - Anterior-Posterior resection (Total Sacrectomy)
    - Two sequential approaches
      - (Stener & Günterberg, 1978)
    - Synchronous app
      - (Localio et al 1980)
- Lesions below S2 (Sacroiliac joint)
  - Posterior resection only (Distal Sacrectomy)

E.B. 18 y.o. Female, low-back pain, urinary incontinence for 2 years. 2 previous operations in other departments with partial resection only. Direct X-rays showing ossified mass covering almost all pelvis.

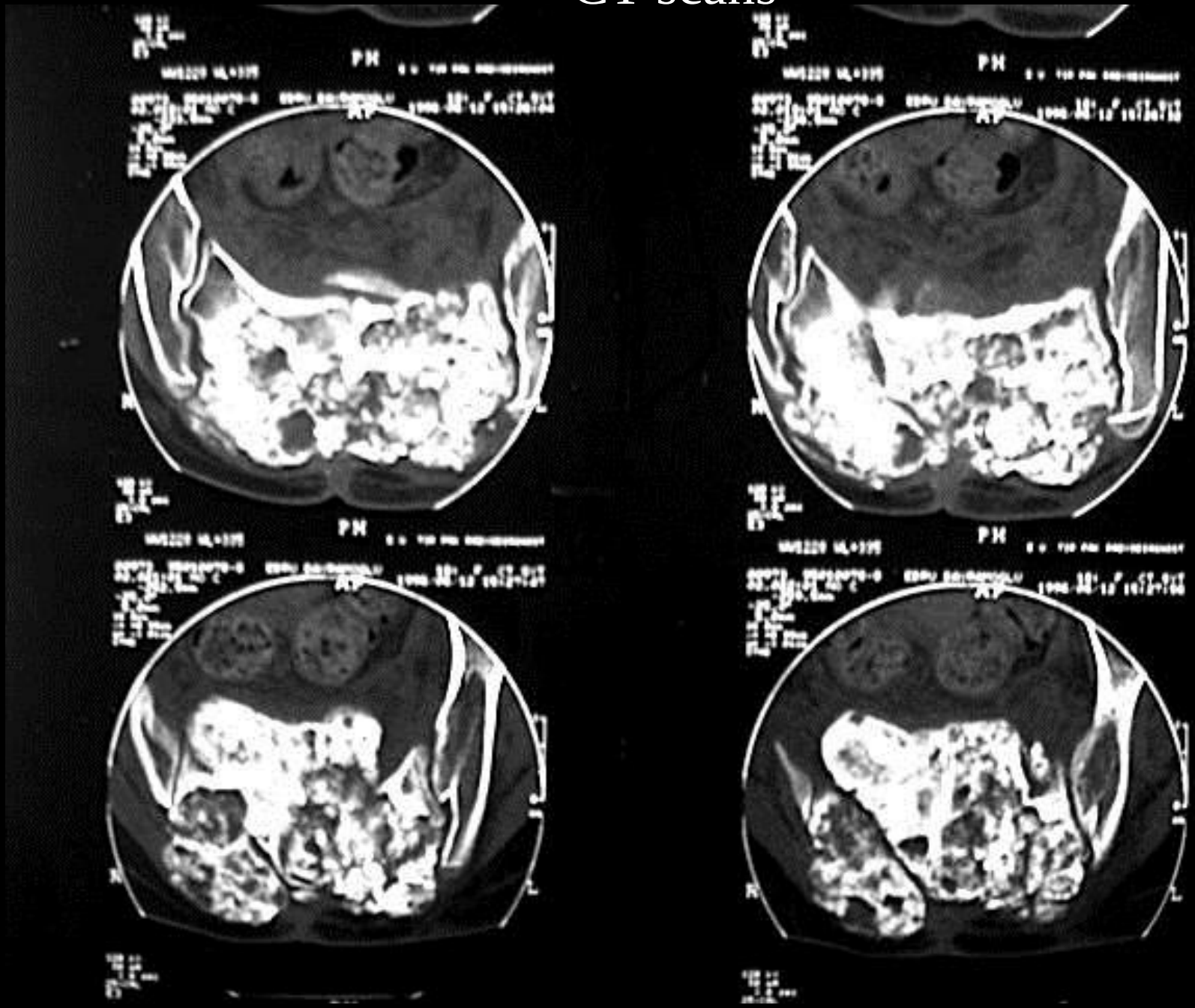
Previous histology was osteosarcoma.

Case 1

MR images: tumor occupying most of the pelvis, sacrum and L5 vertebral body.

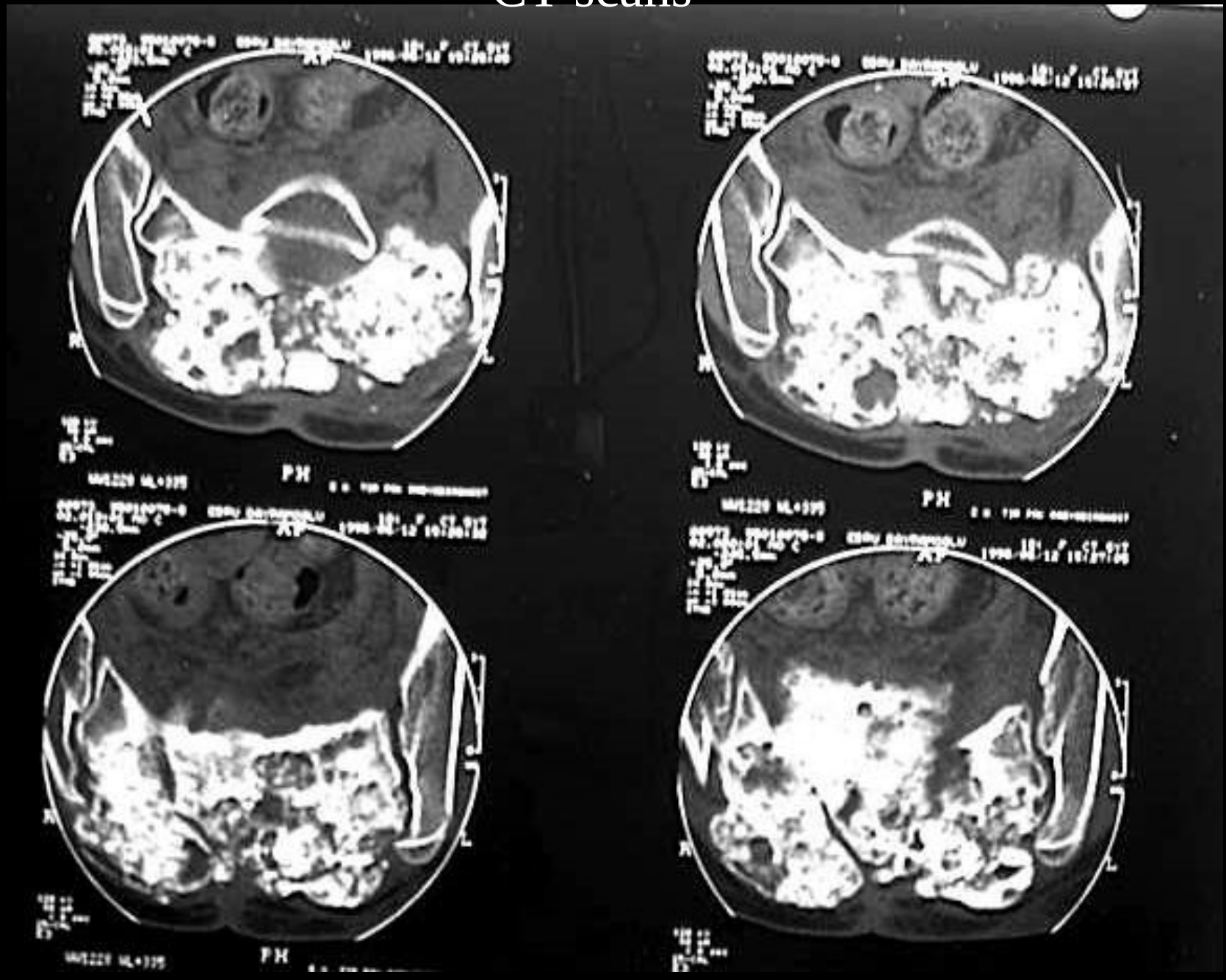
CT scans

Case 1



CT scans

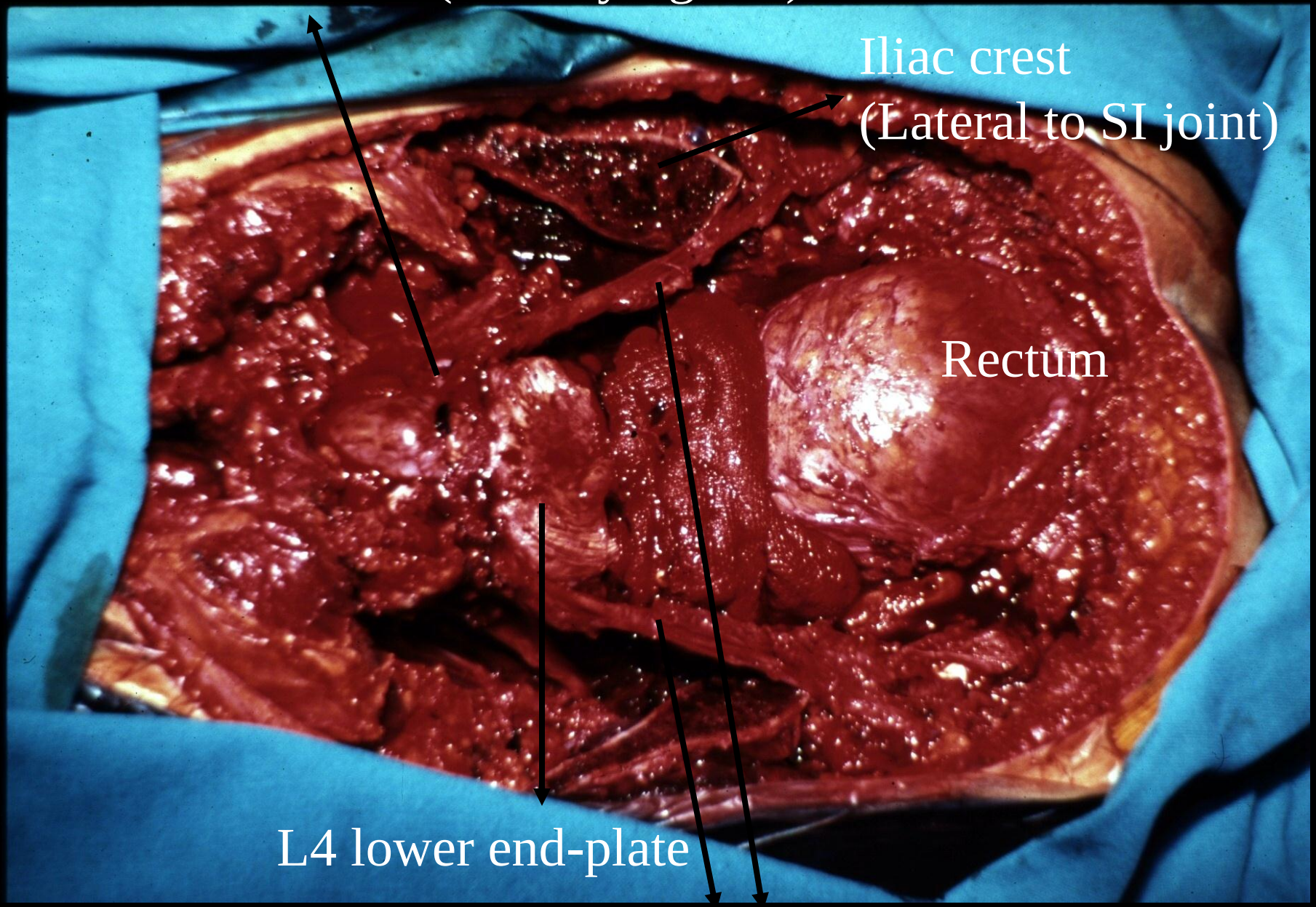
Case 1



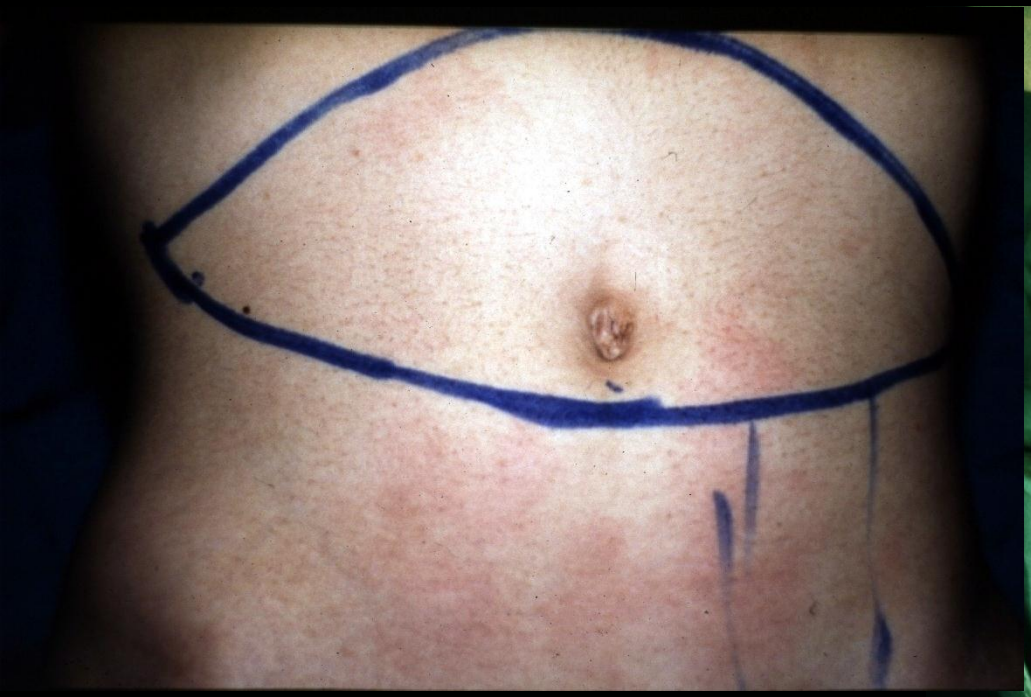
We planned to excise two previous incisions.

1st operation: June 1996
Total sacrectomy + partial hemipelvectomy.
Anterior and posterior approaches.

Duration: 17 hours
Blood loss: 3400 ml (11 unit blood transfusion)

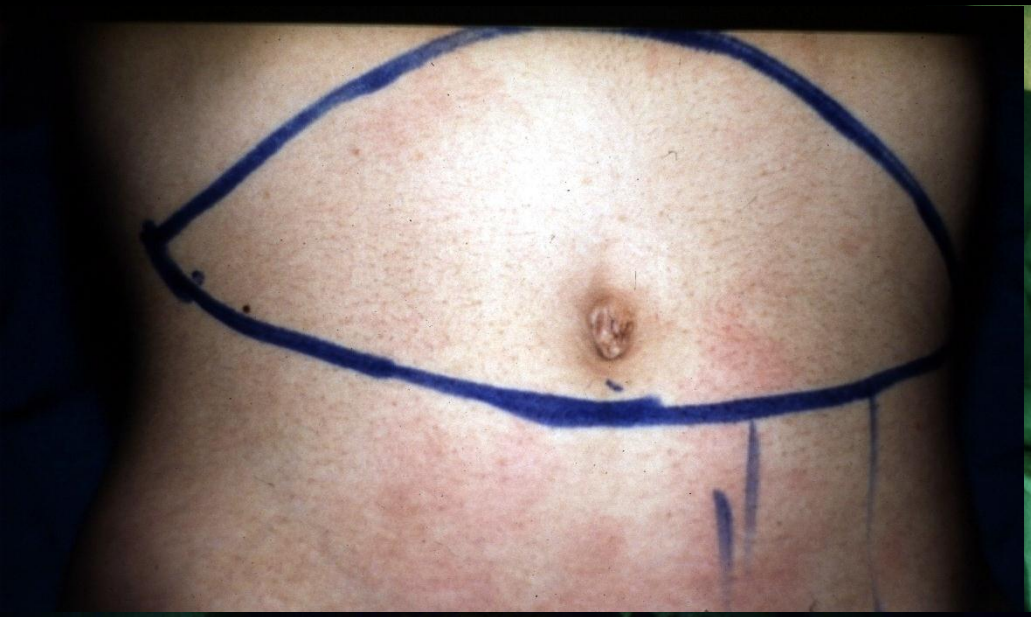

L4 dura mater (Distally ligated)
Case 1
Iliac crest
(Lateral to SI joint)
Rectum
L4 lower end-plate
R & L lumbosacral plexus

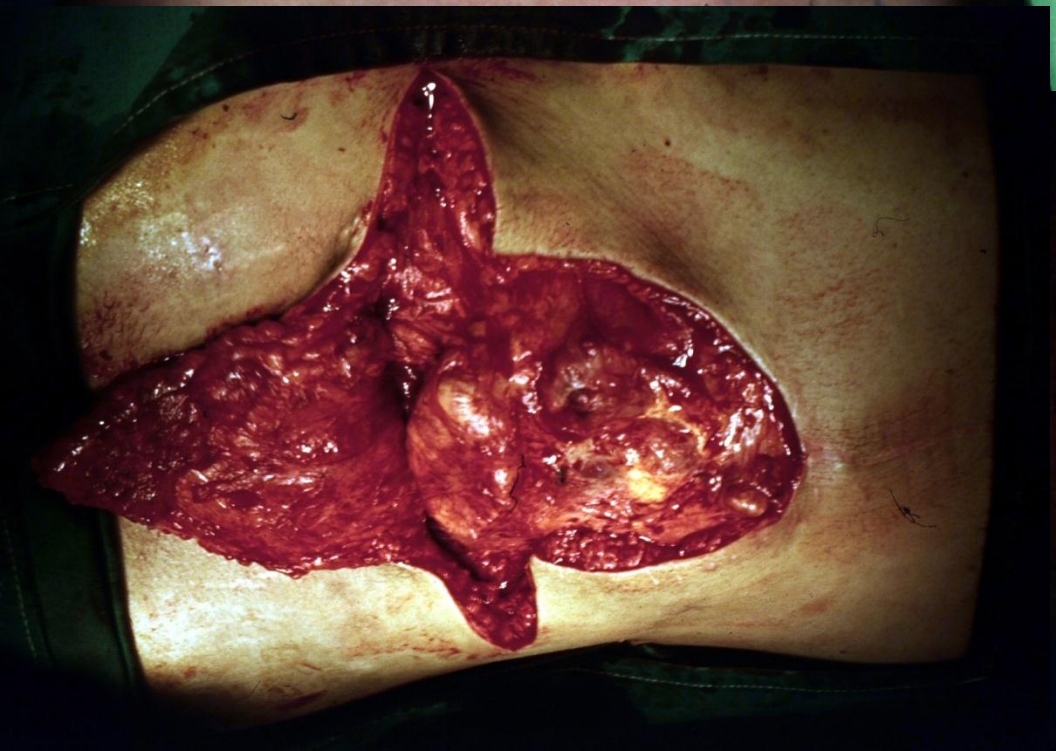
In order to cover the posterior skin defect,
Plastic surgery team has used a vascularized flap of the upper abdominal wall, turned it to the back with left rectus abdominalis muscle. Then they reconstructed umblicus anteriorly.

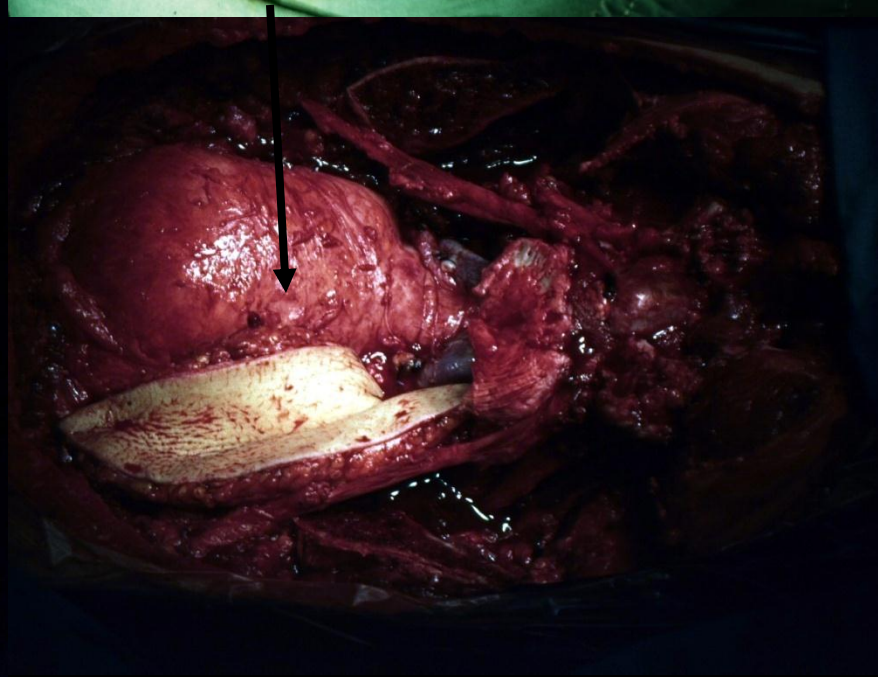


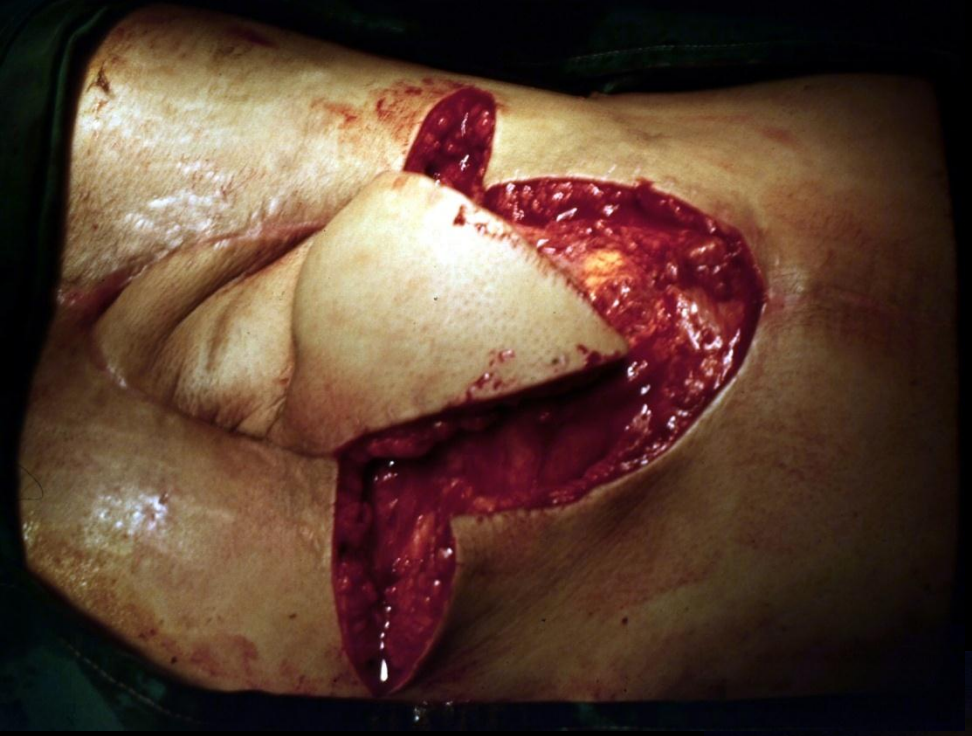
Abdominal flap on posterior wound.

Case 1

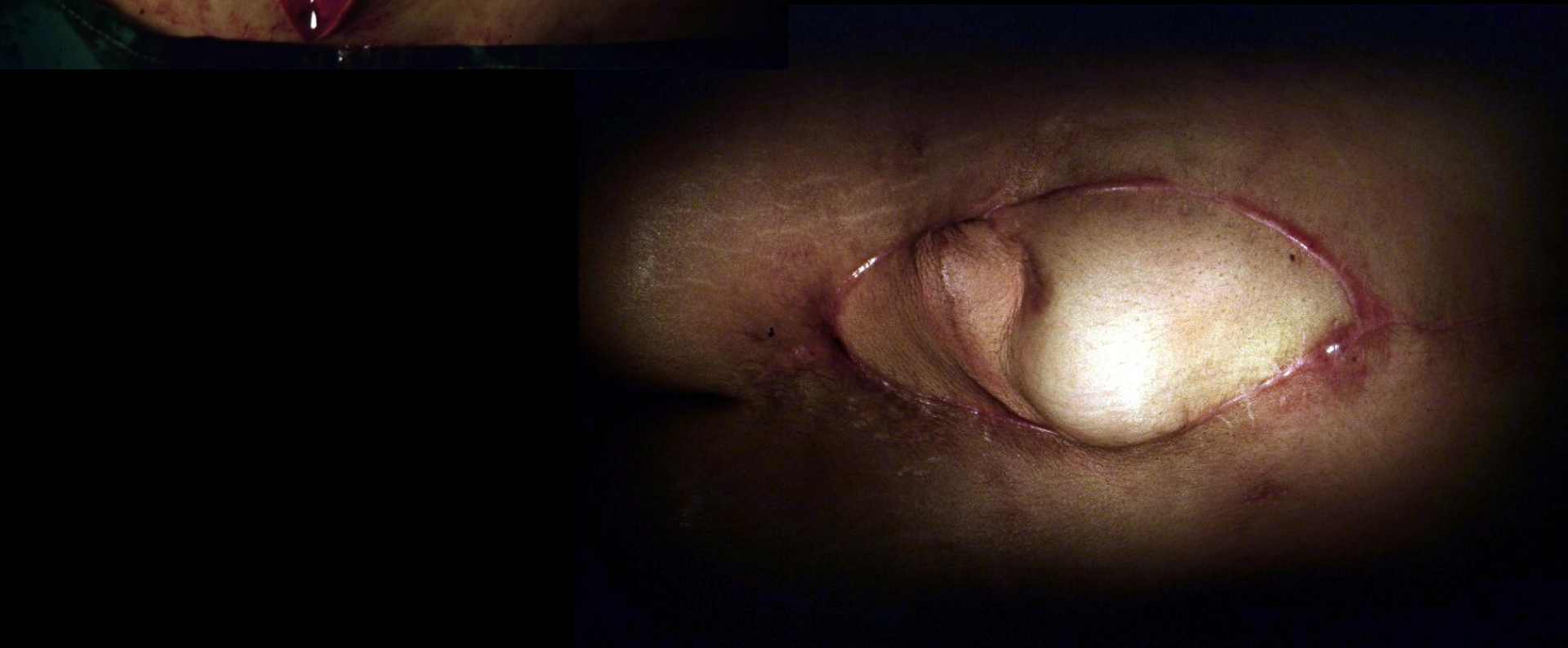






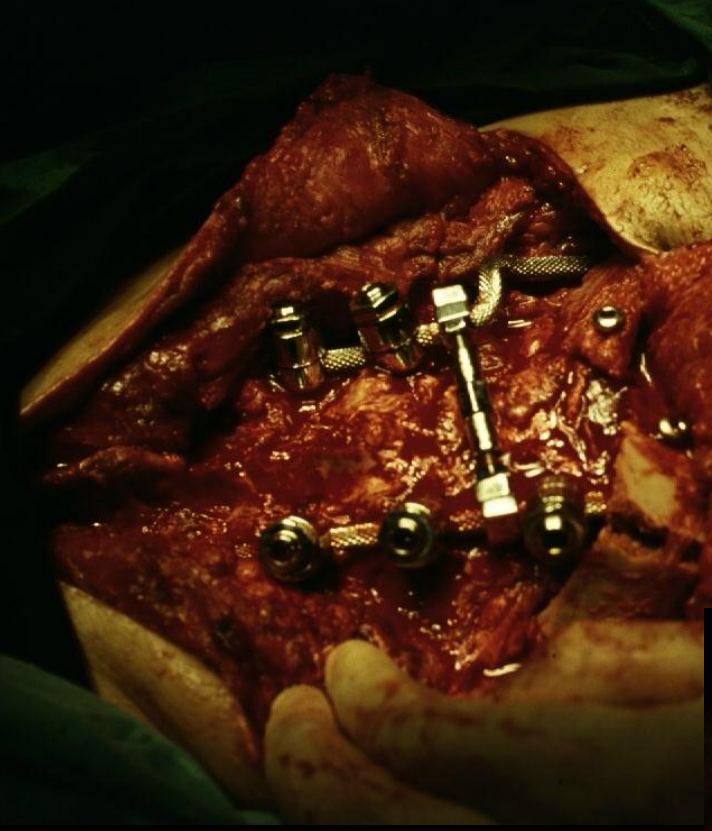


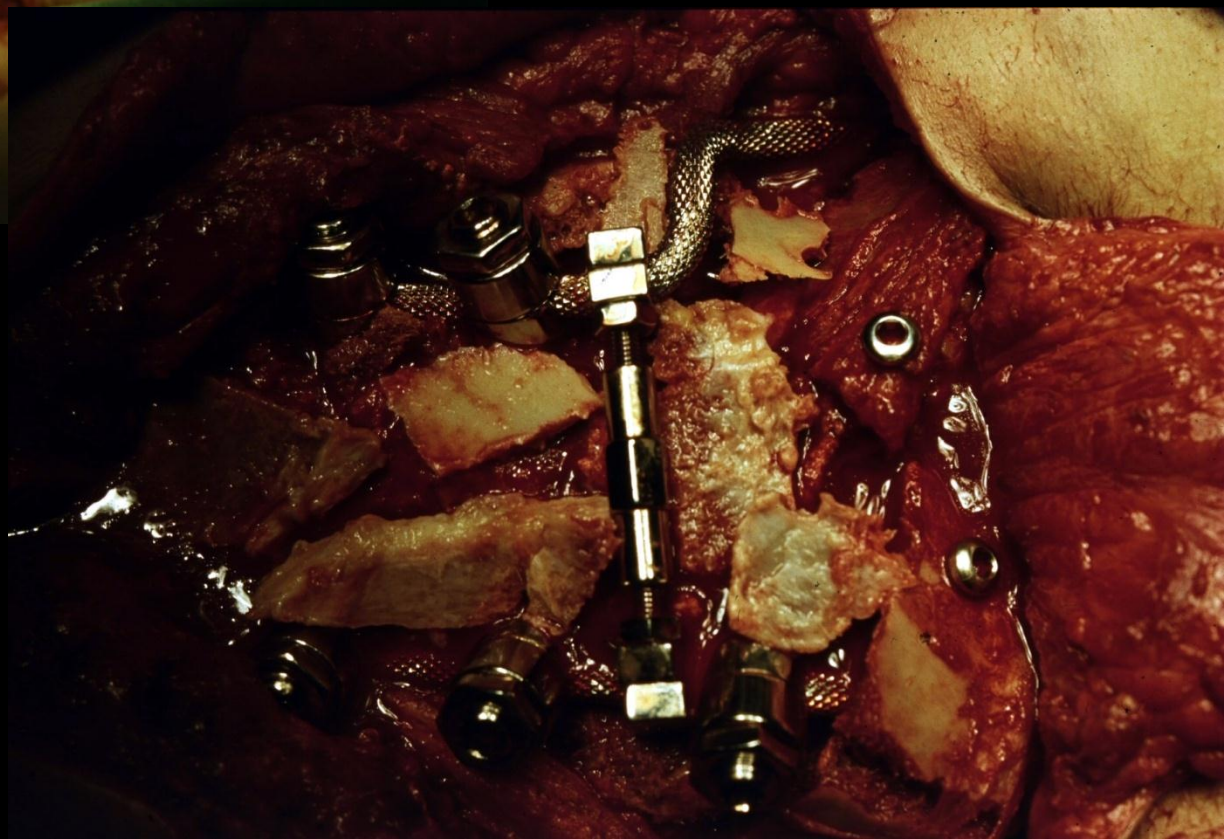
Healed flap 1 month postop



Case 1

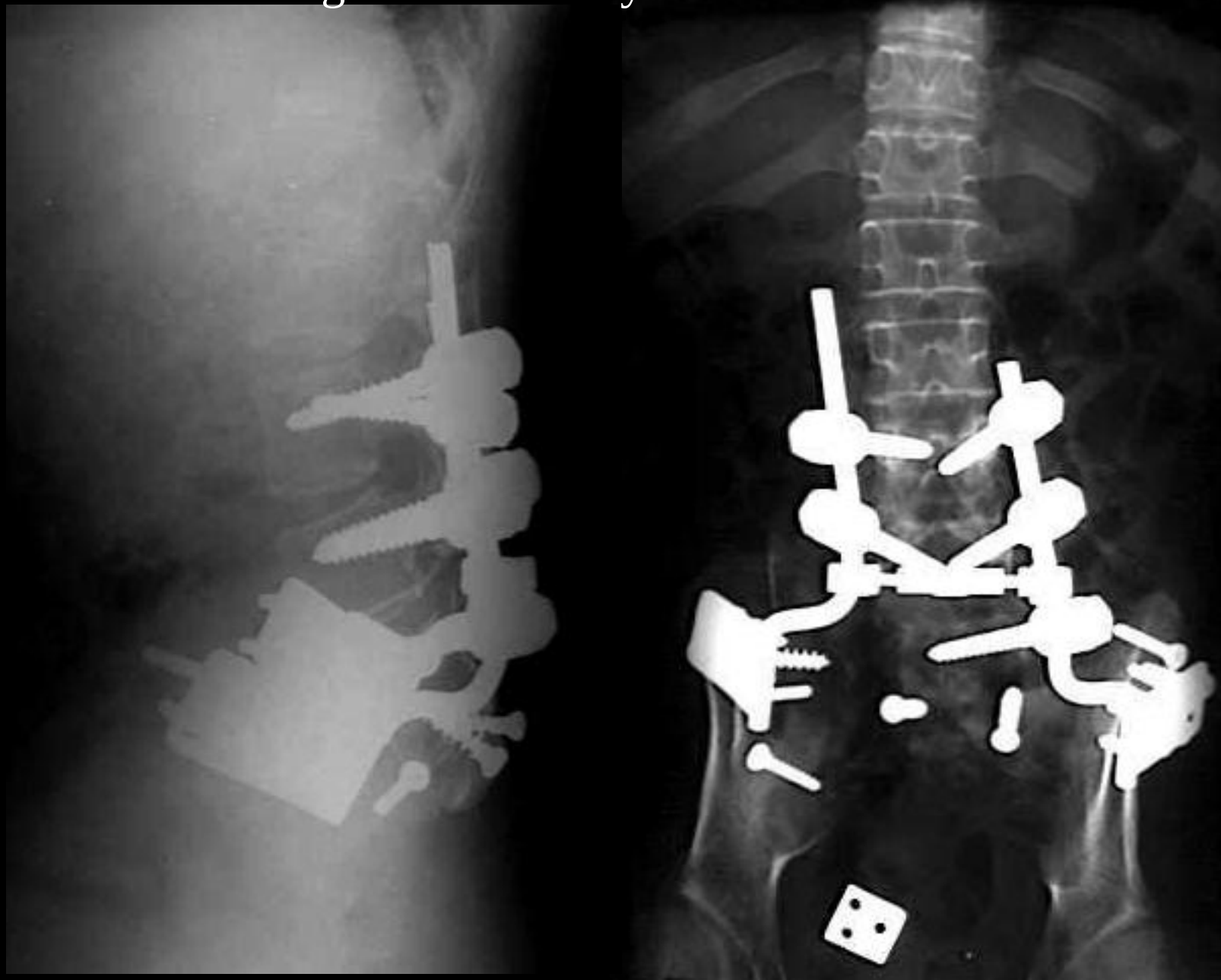
2nd surgery. 3 months later.
Pedicular screws in L2 and L3
Navicular screws through two plates with rods. Onlay iliac crest grafts taken from her father.





Total sacrectomy + L5 spondylectomy + lumboiliac stabilization + allografts from dady.

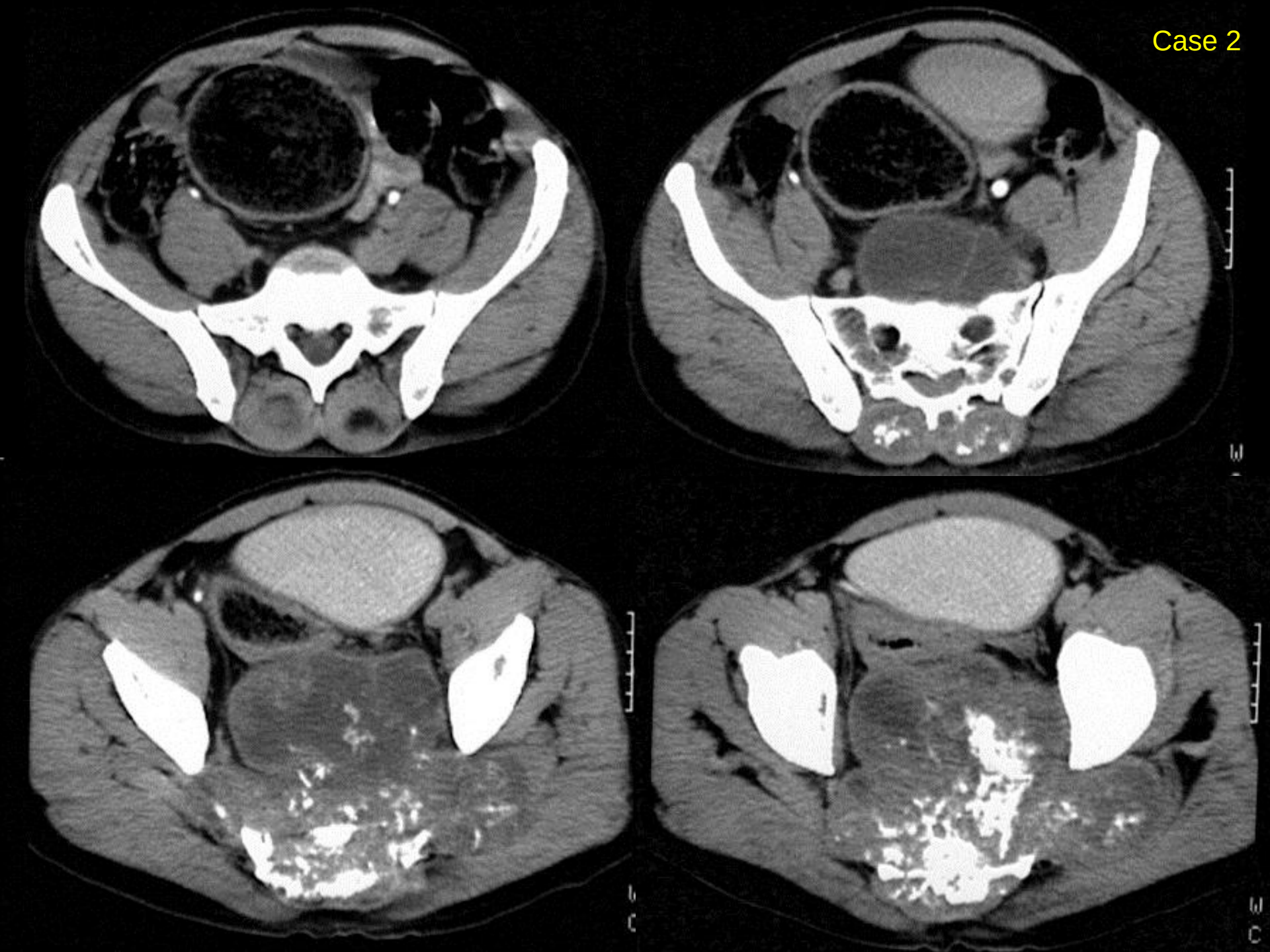
Case 1



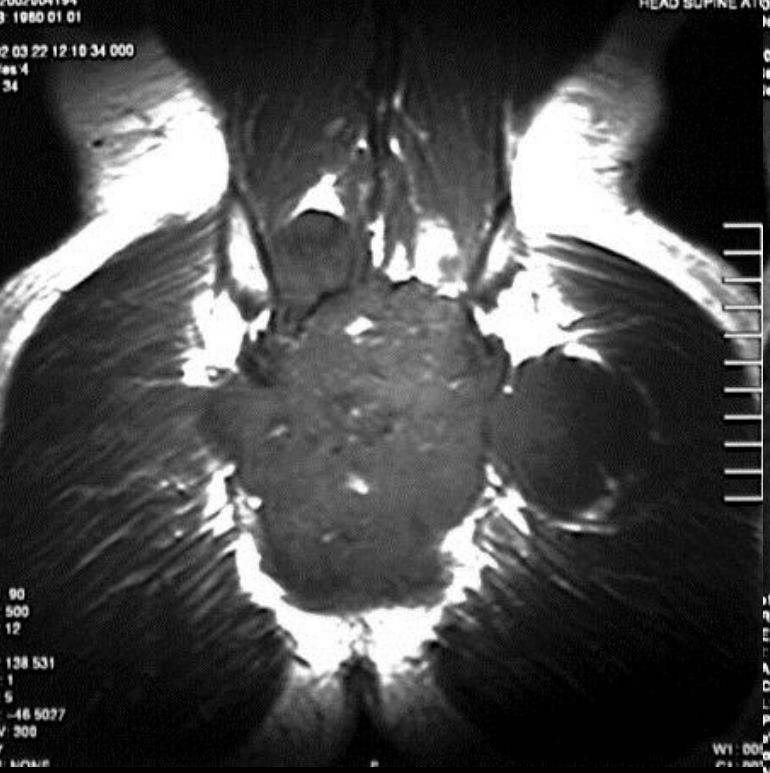
13 years follow-up. No recurrence. She can walk with sticks and aids.

Case 2

42 y.o. Male, 3 years history of urinary urgency, constipation for 6 mths, rectoscopic exam revealed tumor obstructing rectum. Biopsy: low grade chondrosarcoma


Case 2

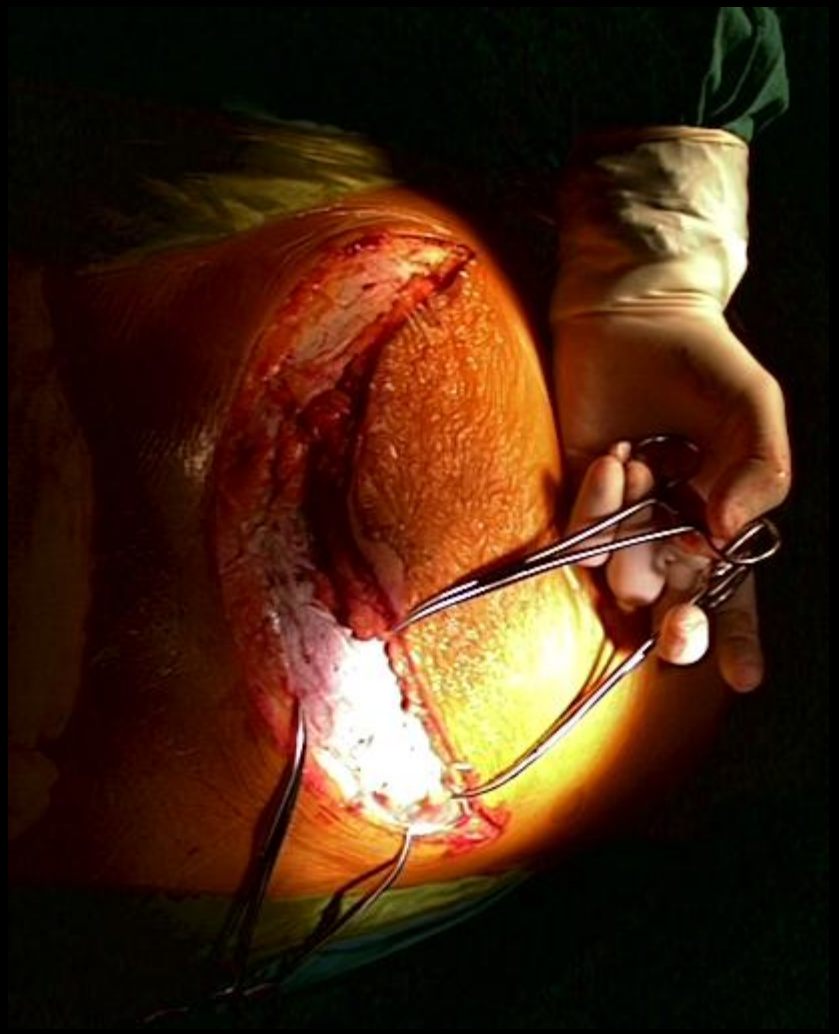
Case 2



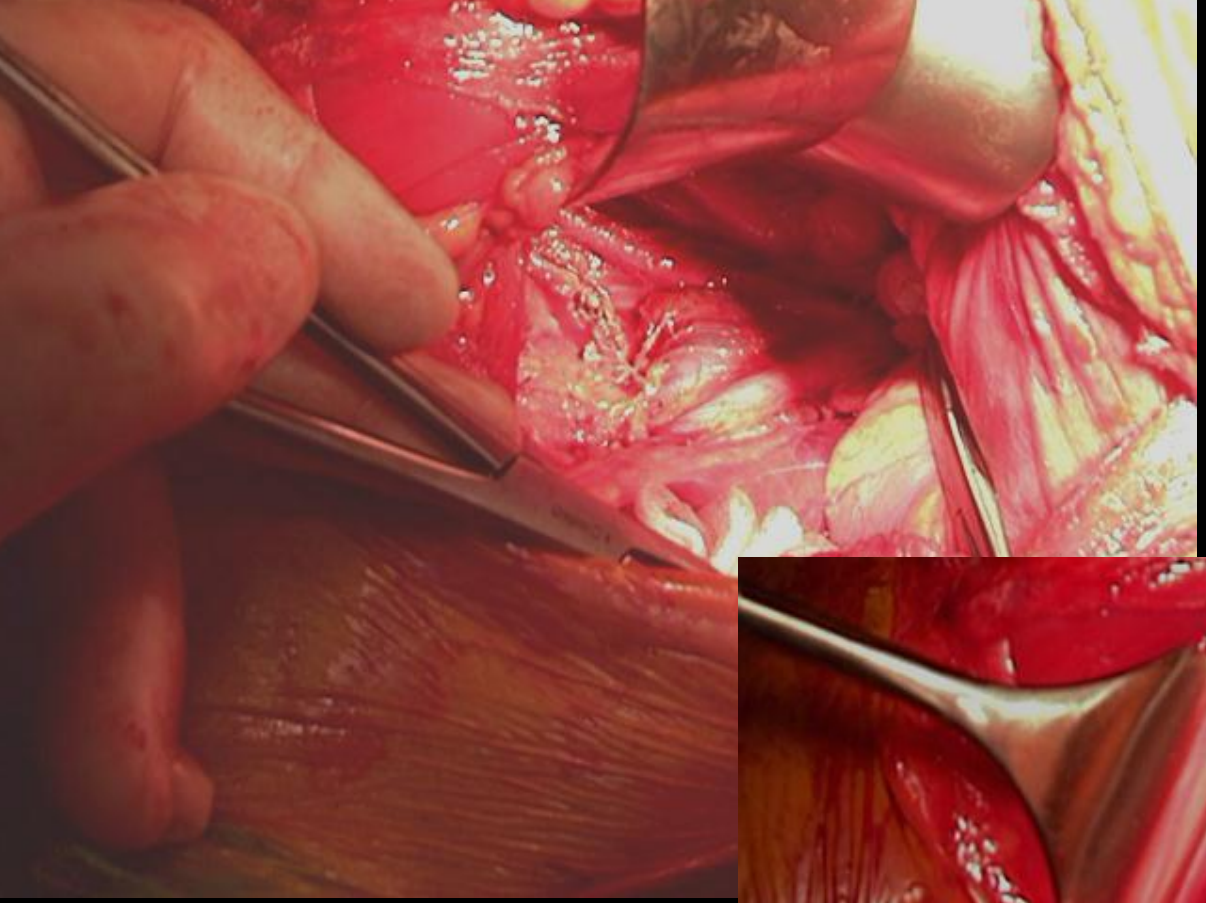
Combined ventral – dorsal surgery

Case 2

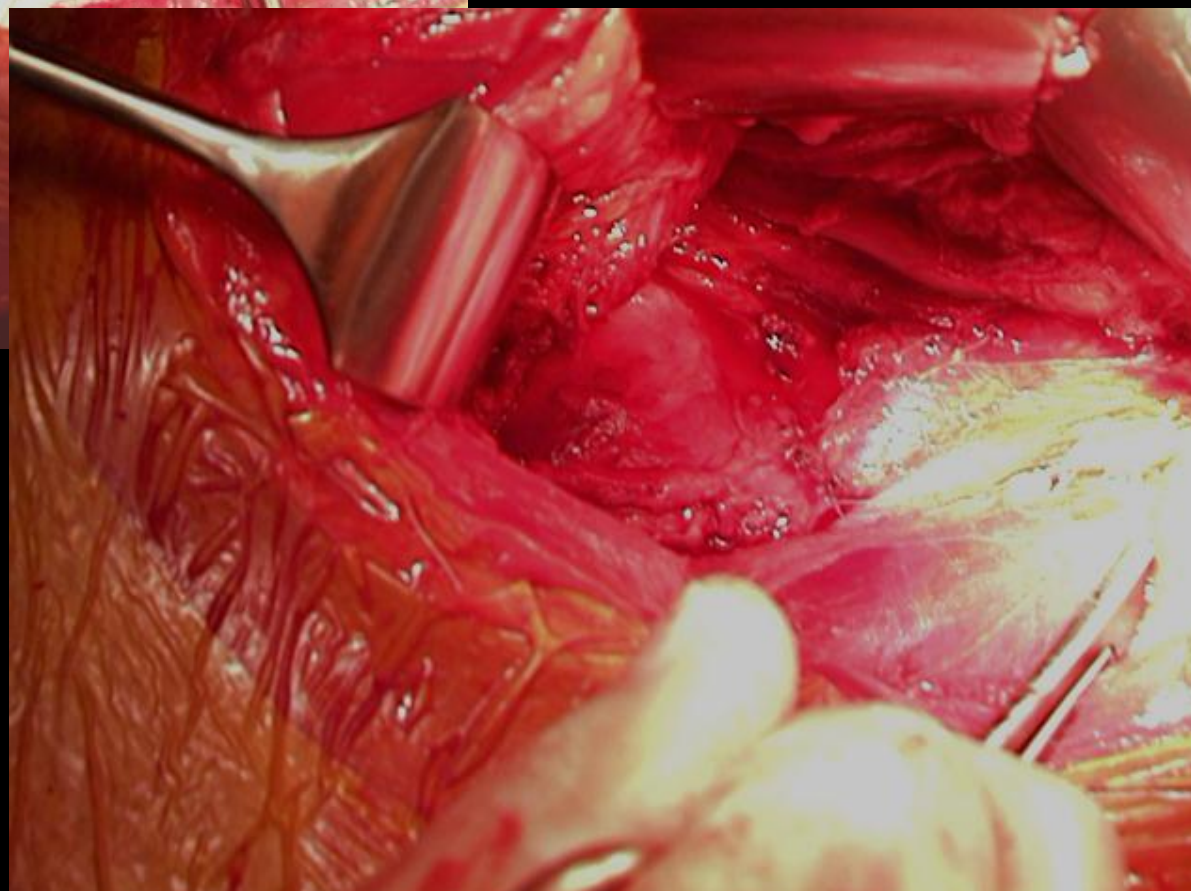
First ventral surgery, “U” shaped incision, retroperitoneal dissection

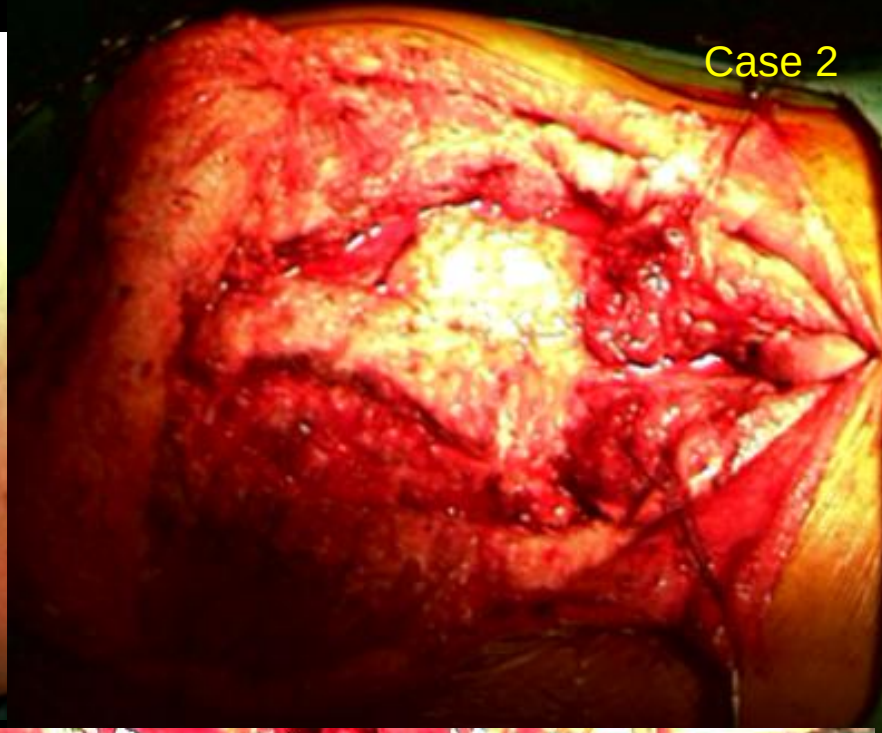


Case 2



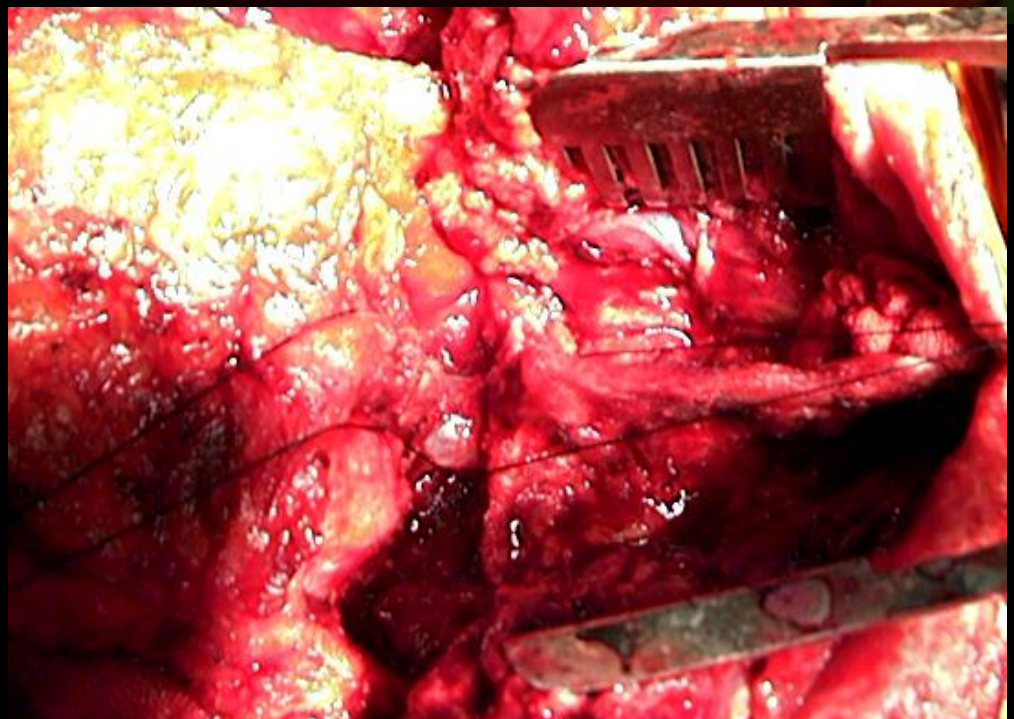
Ligation of both internal iliac arteries, median sacral artery



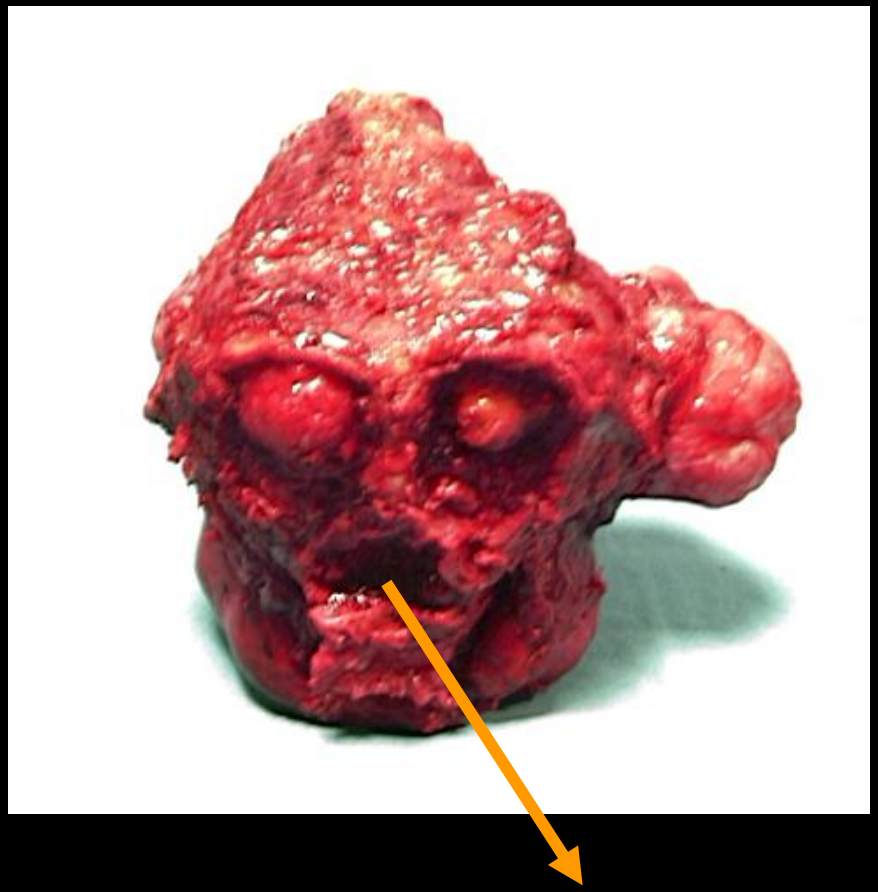


Case 2

Then, dorsal surgery, Kravse incision, dissection of gluteal muscles, sciatic nerve, L5 partial laminectomy, ligation sacral dura with roots distal to L5 roots, L5-S1 discectomy, posterior osteotomy at the level of sacroiliac articulation.

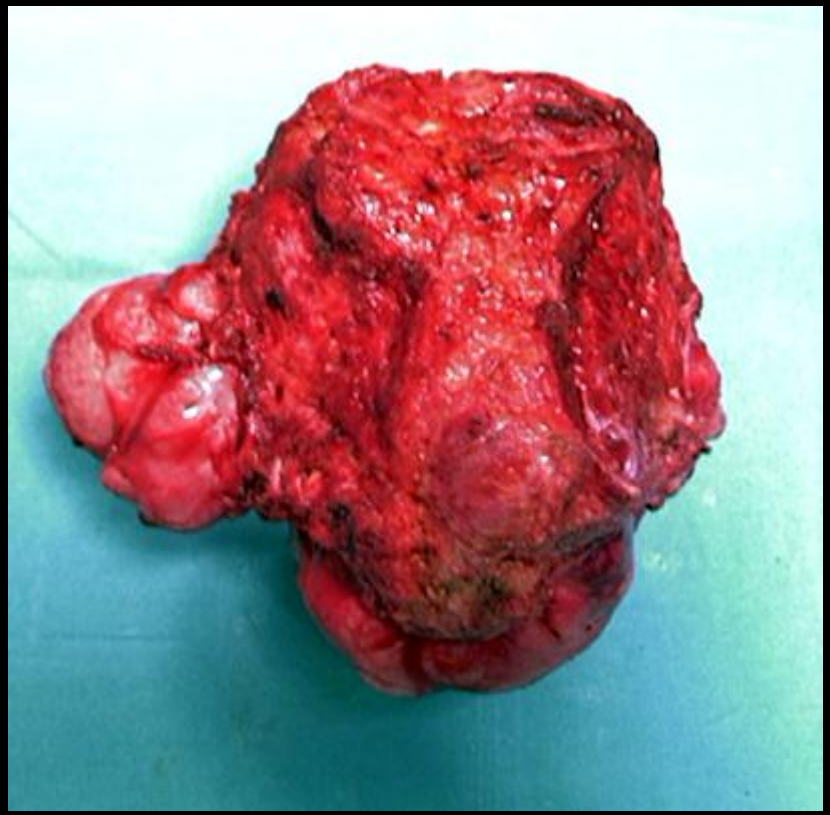


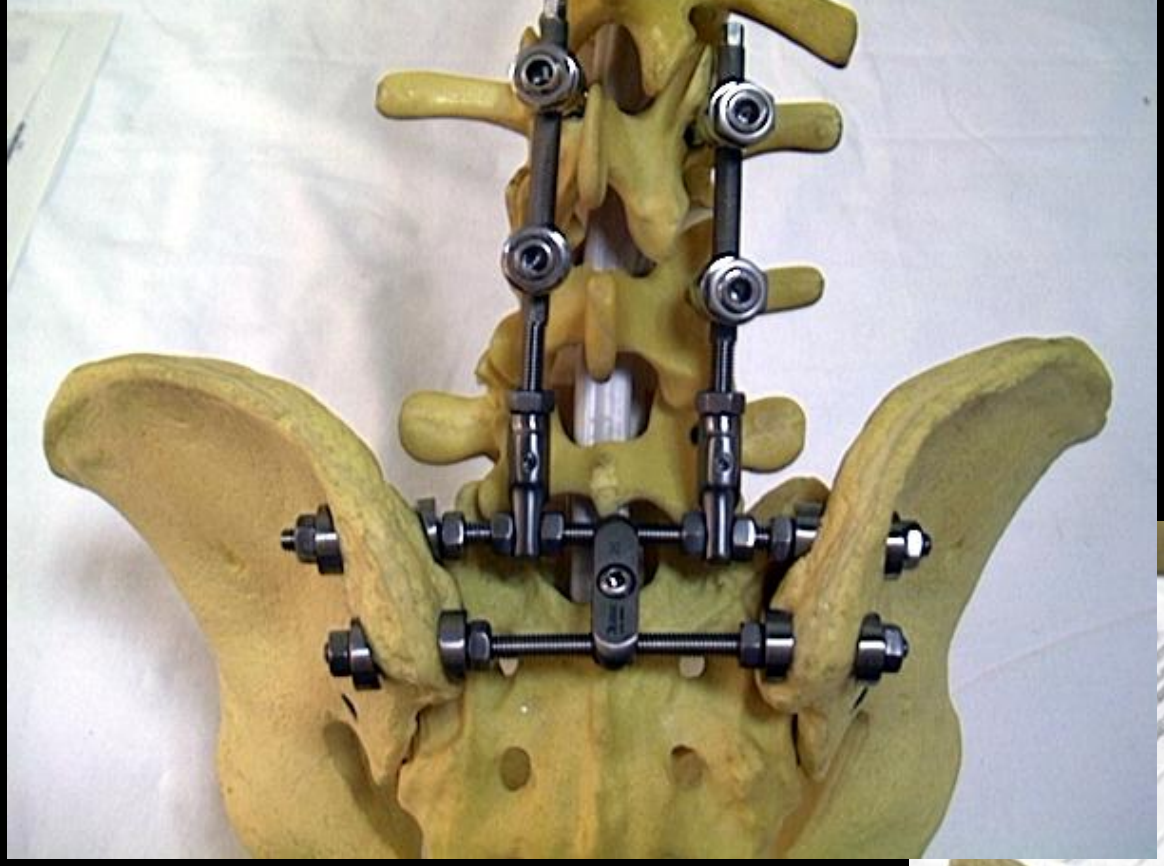
Tumor from above



Sacral canal

Tumor from ventral

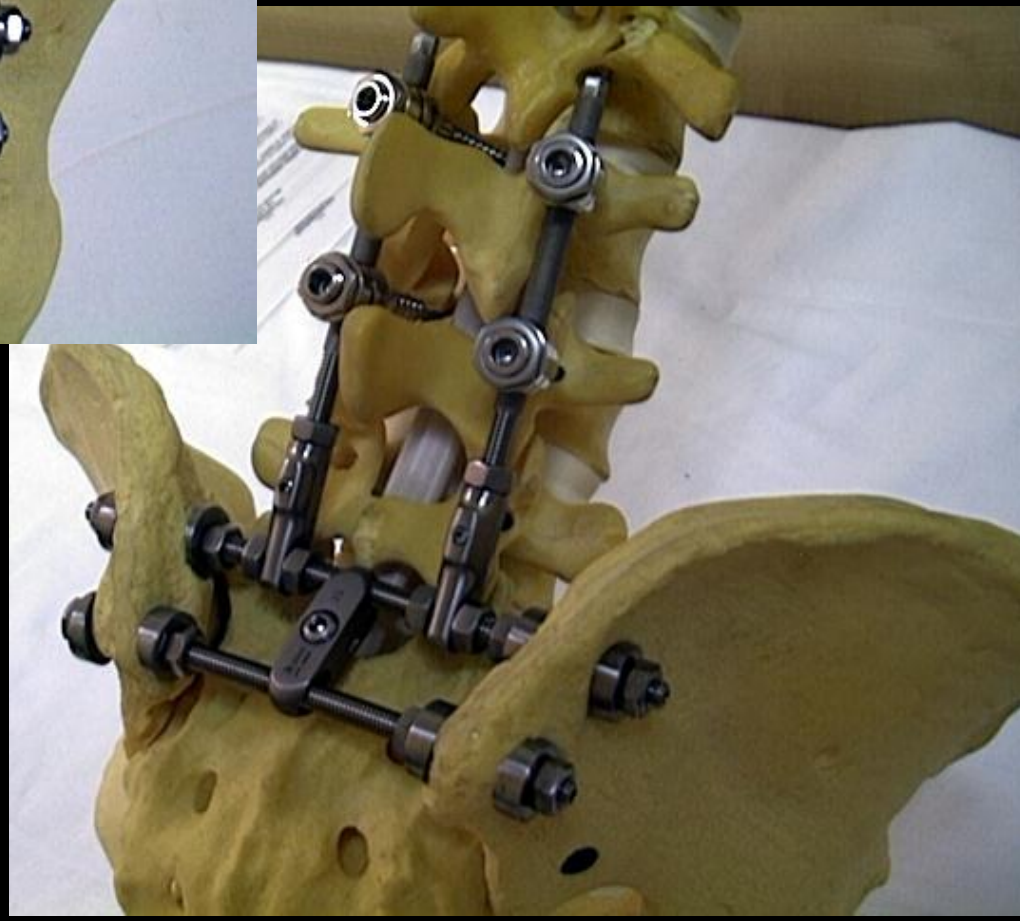




Lumbopelvic stabilization system

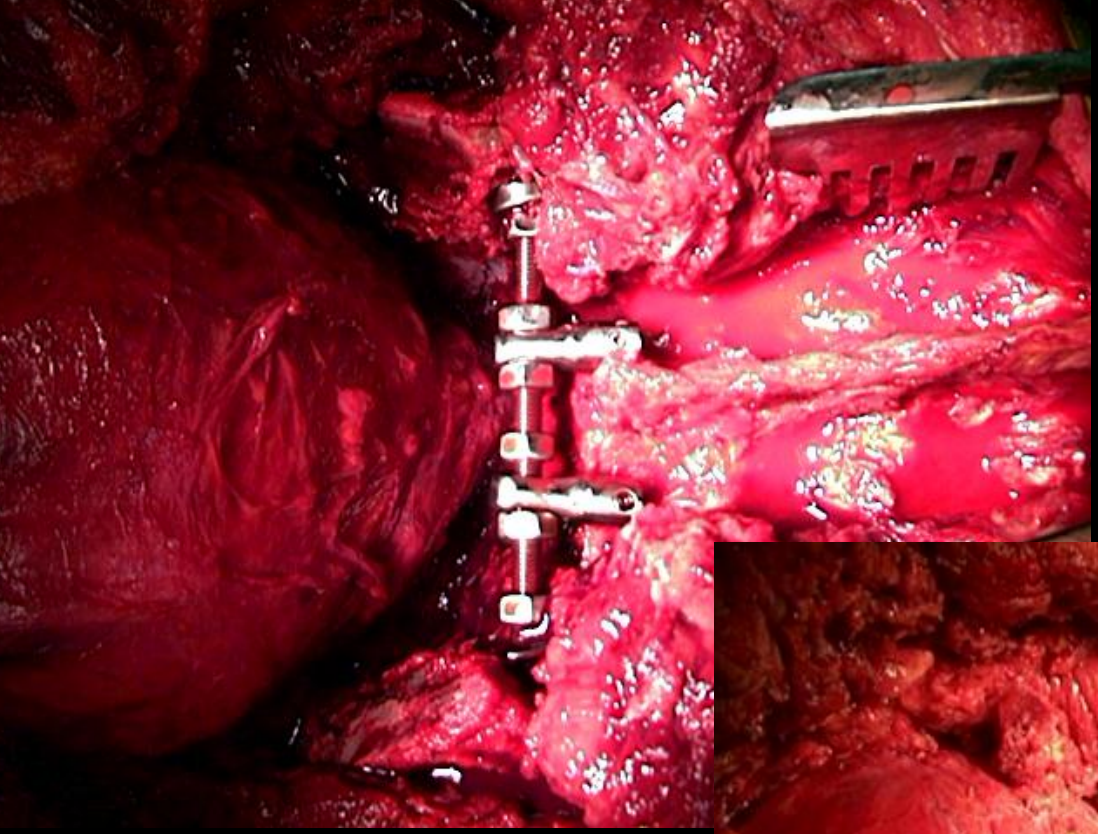
Case 2

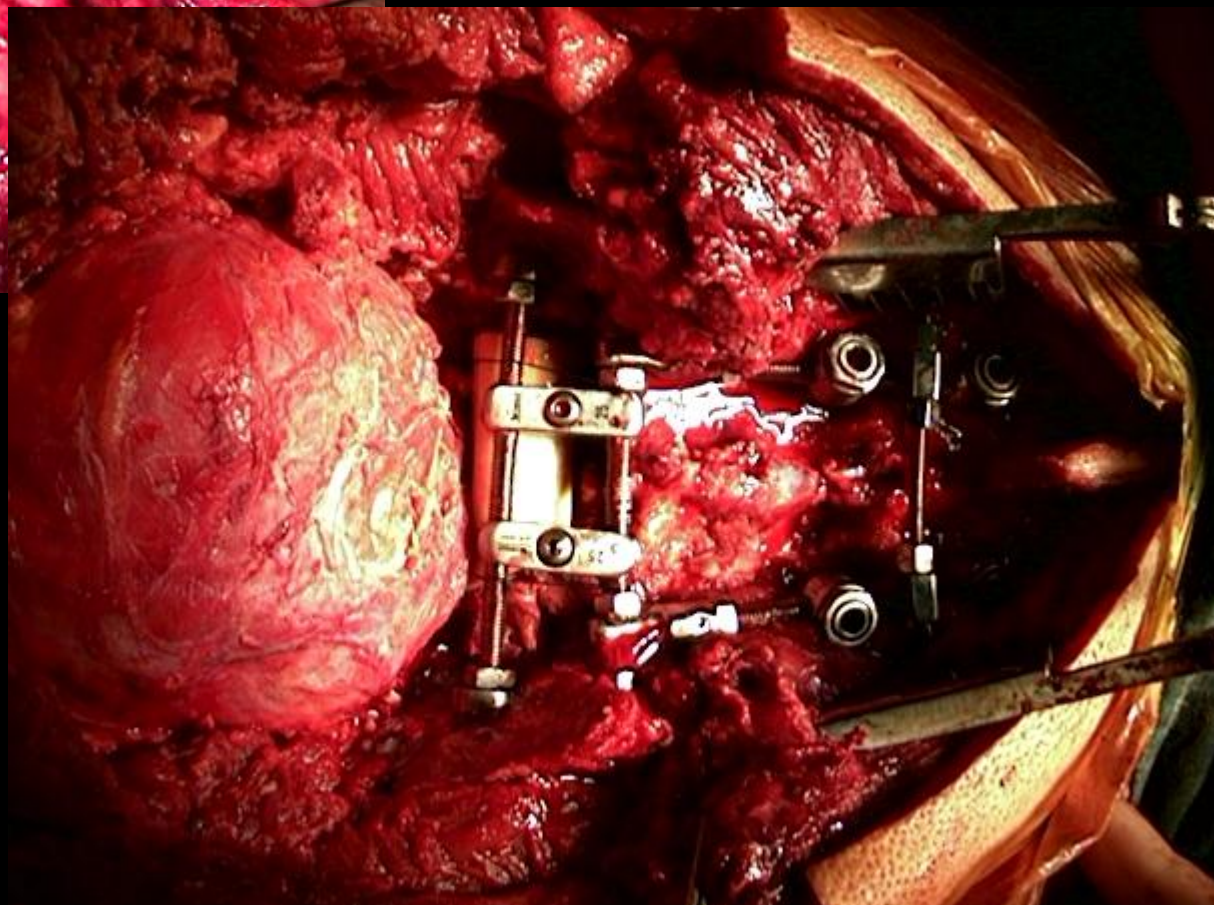
Two lateral bars (threaded) connecting both iliac wings
Sagittal rods are connected to the transvers rods.



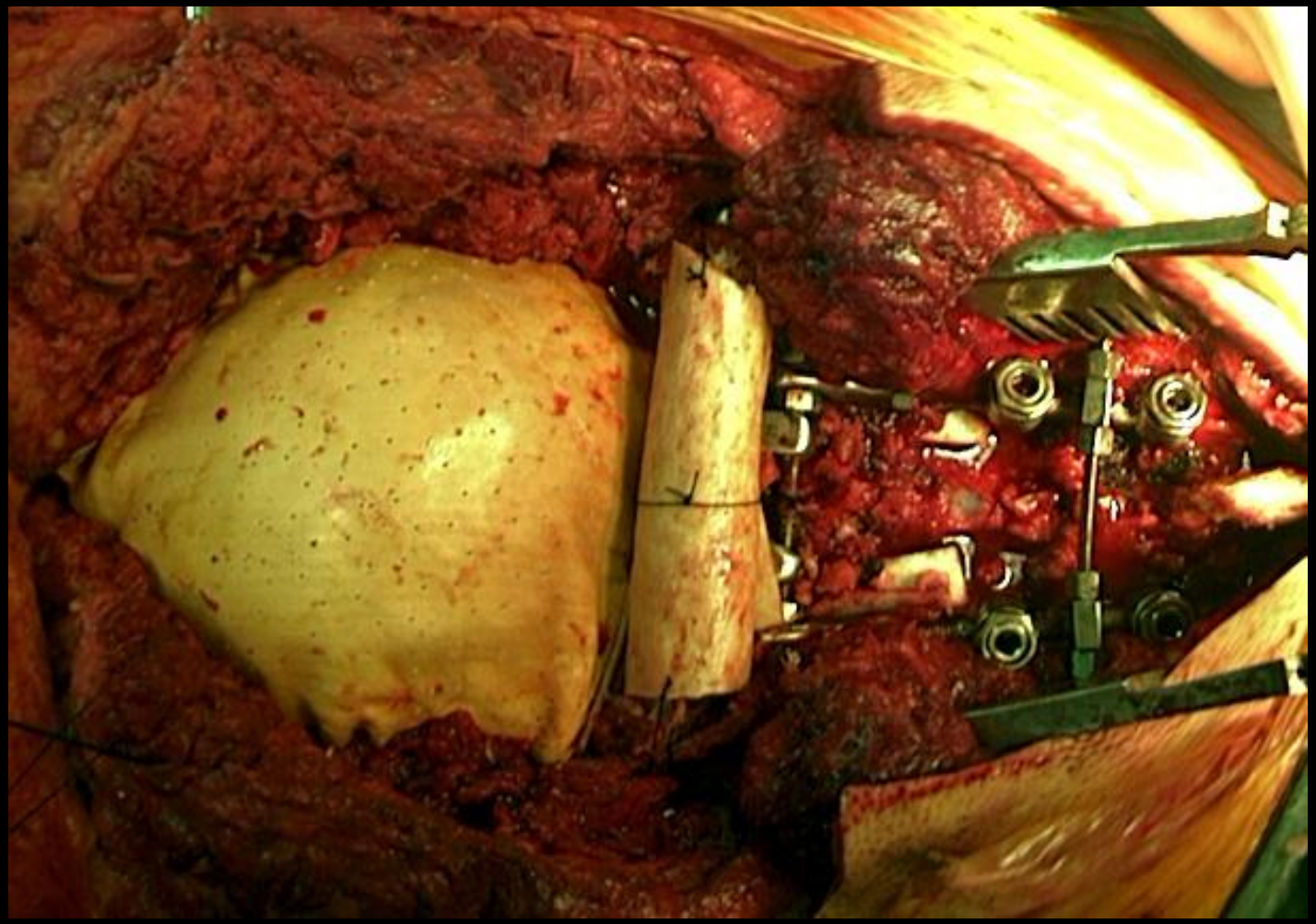
Case 2

Lumbopelvic stabilization
at the same session
L3-L4 pedicular screws,
two iliac bars, femoral allograft
ventral and dorsal to iliac bars,
supported with autografts and DBM

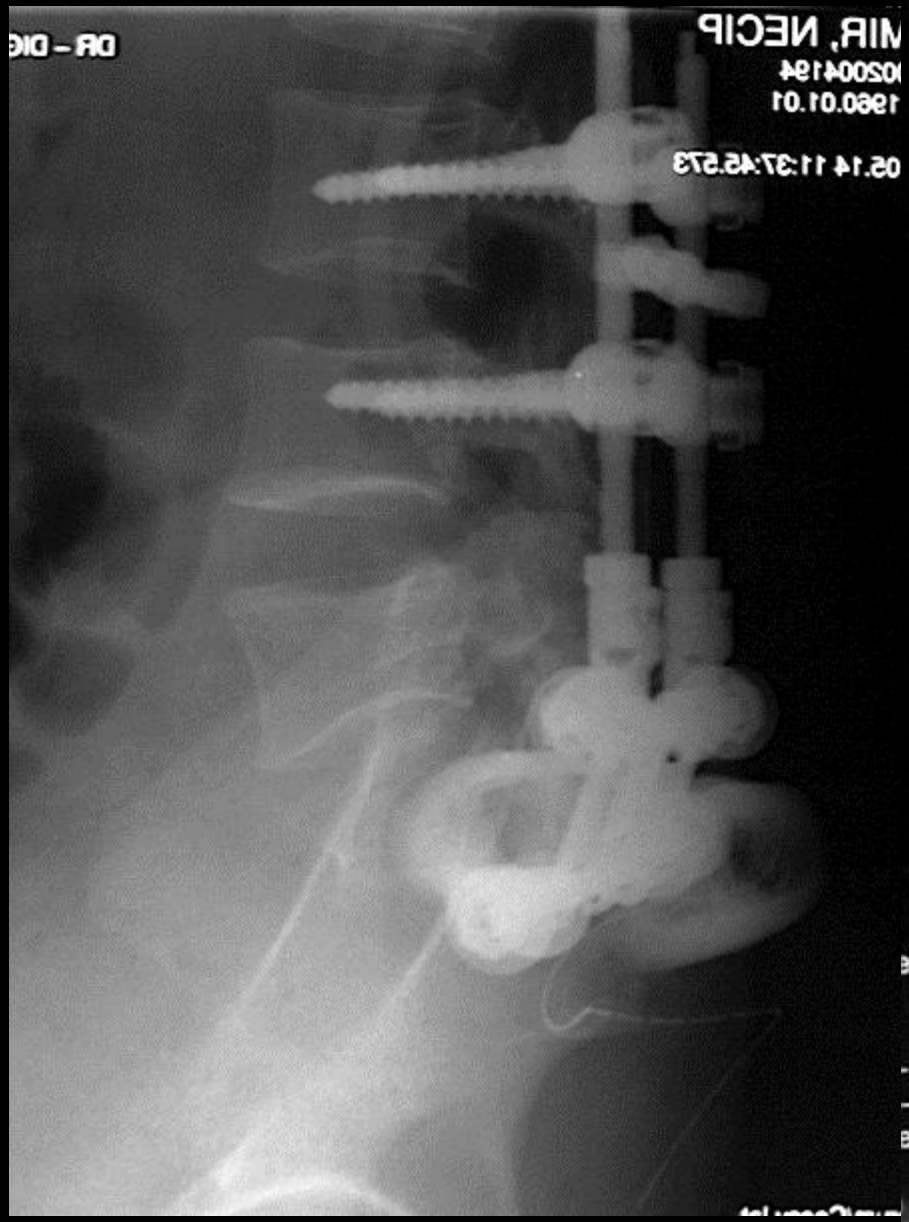


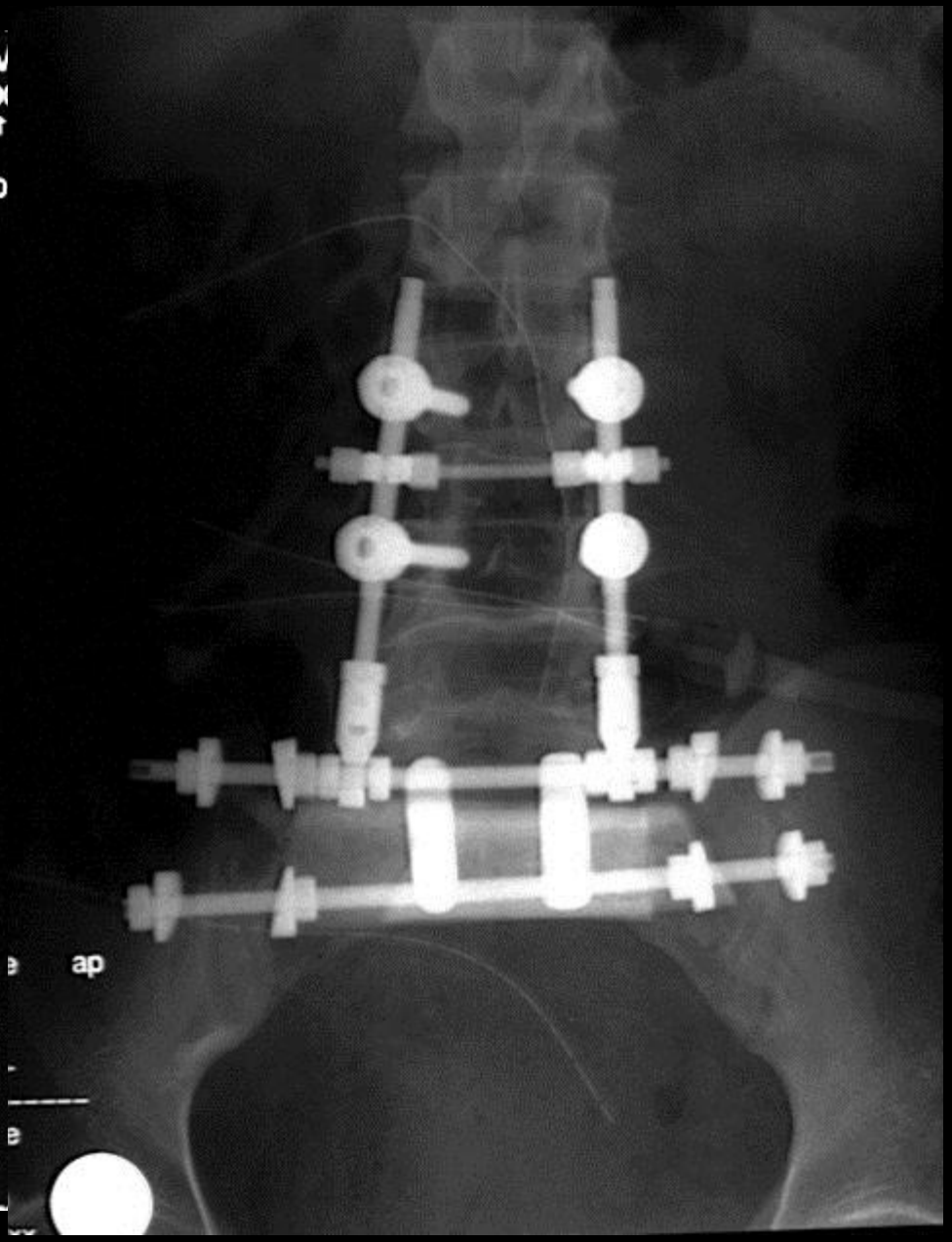


Mesh covering rectum, grafts posterior to the transvers bars.

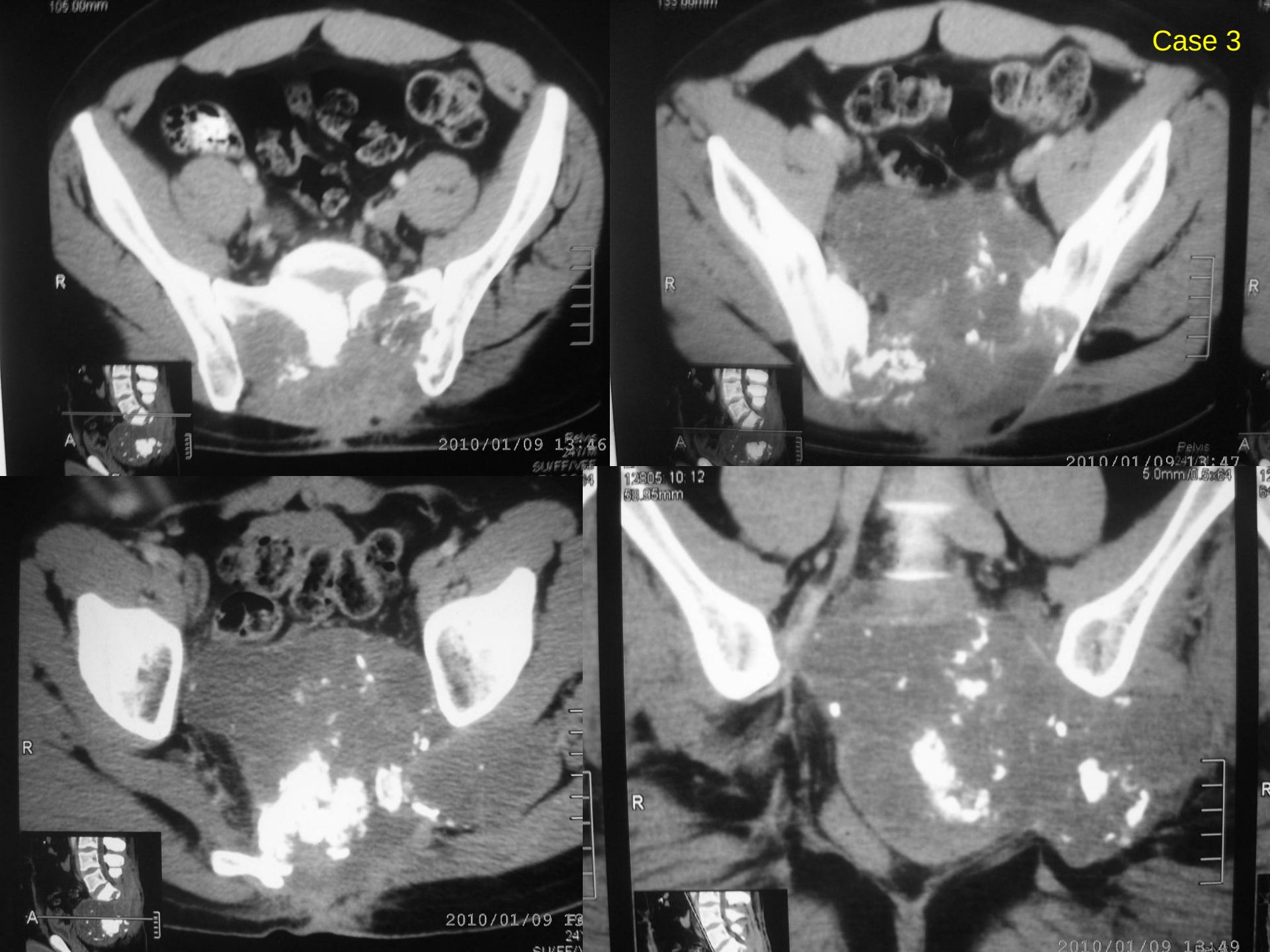


Case 2





28 y.o.Male. Chondrosarcoma, 2 previous surgeries.


Case 3
R
A
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Pelvis
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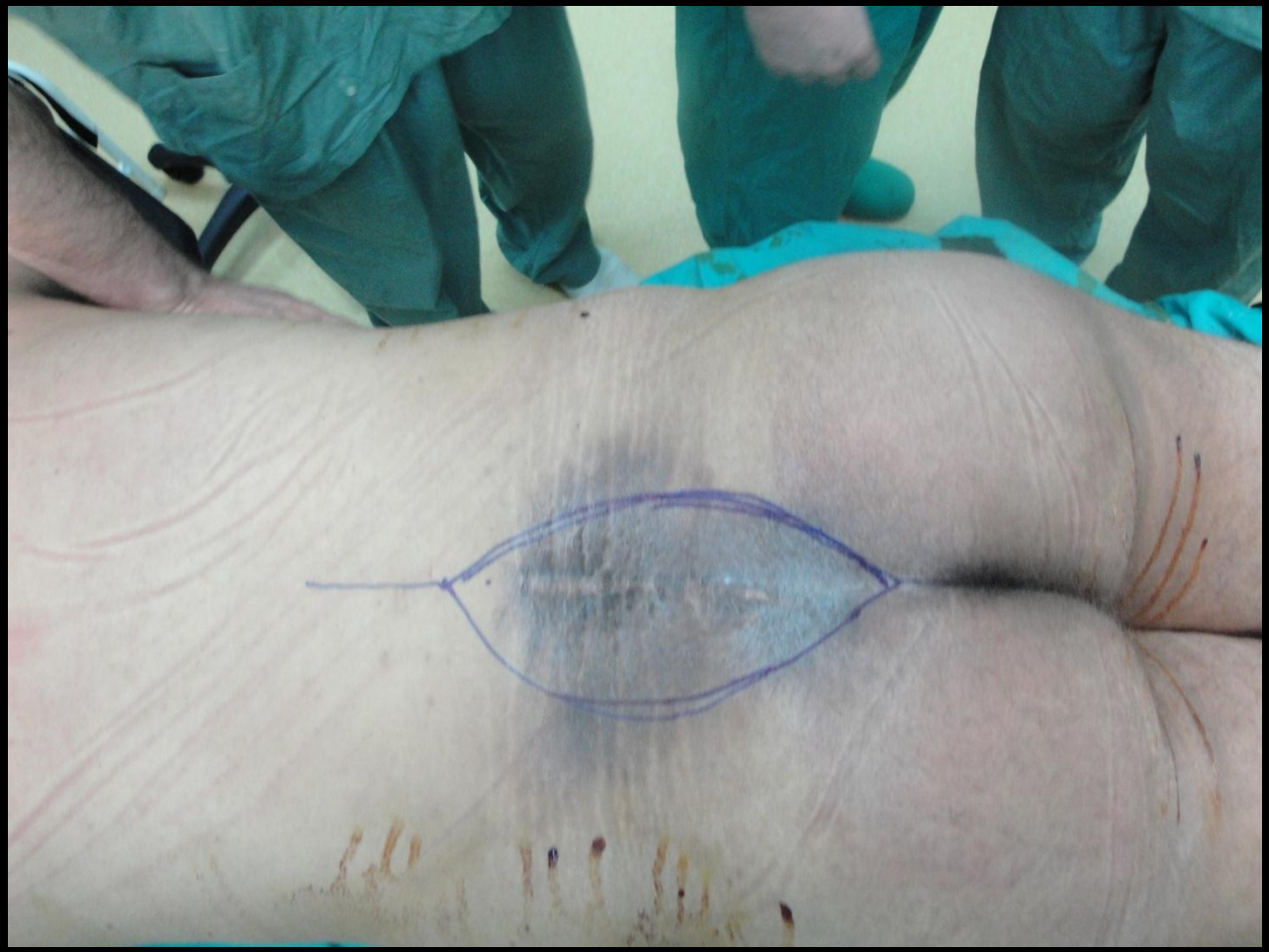
2010/01/09 13:49

Case 3



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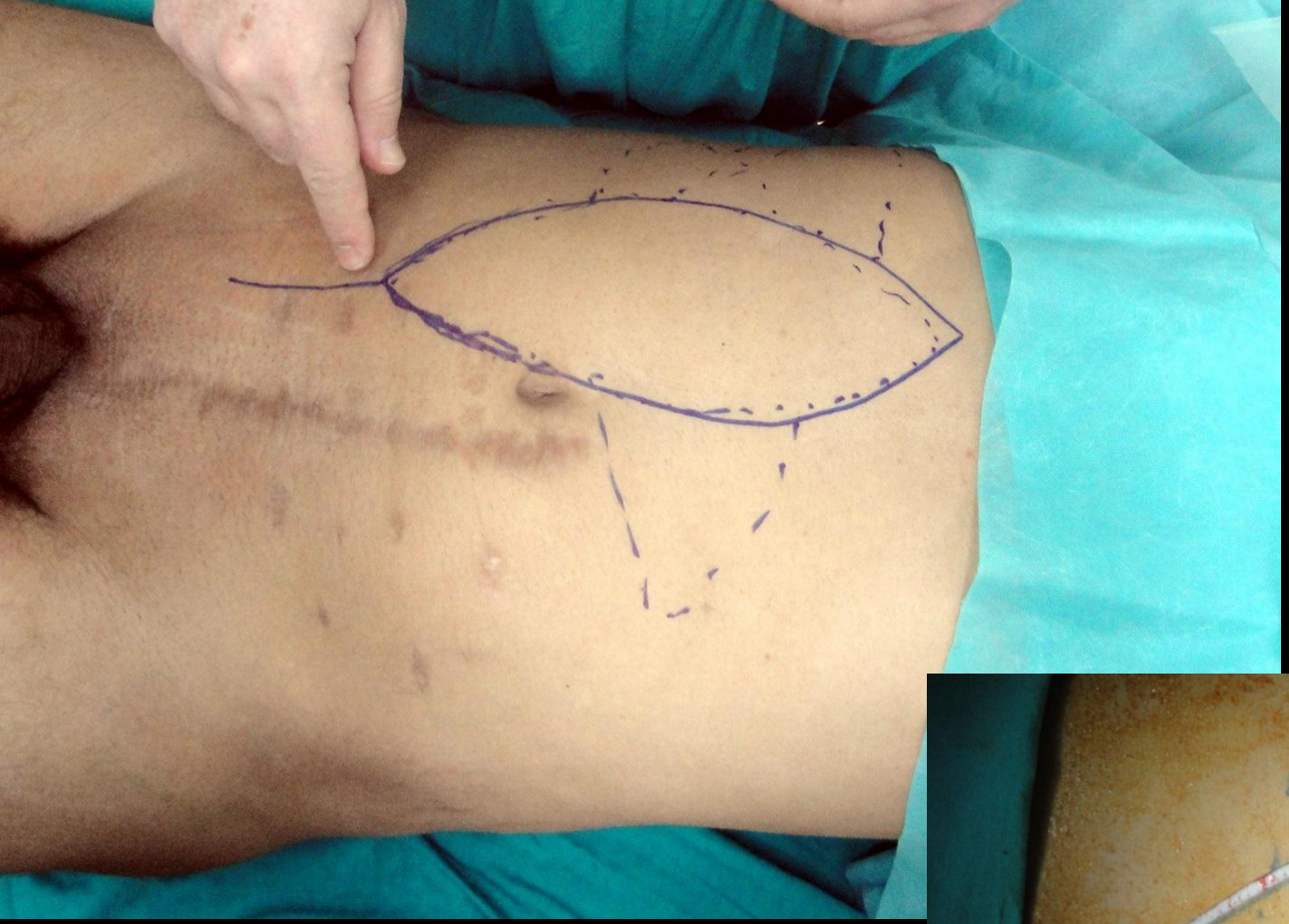

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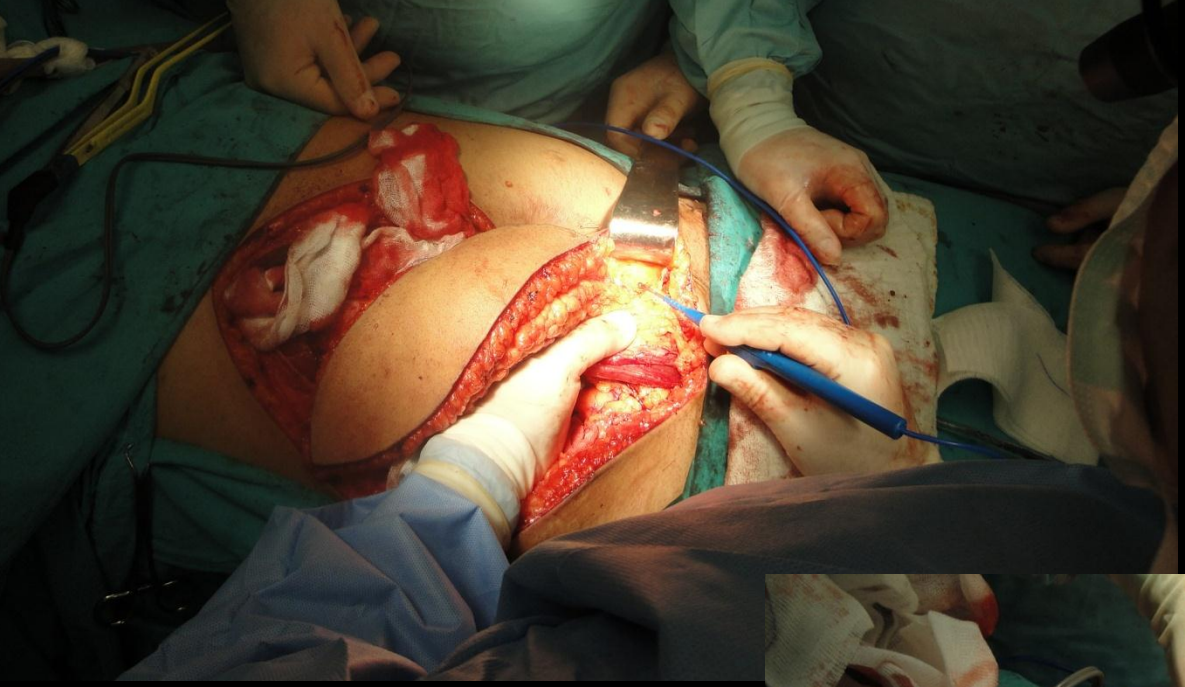

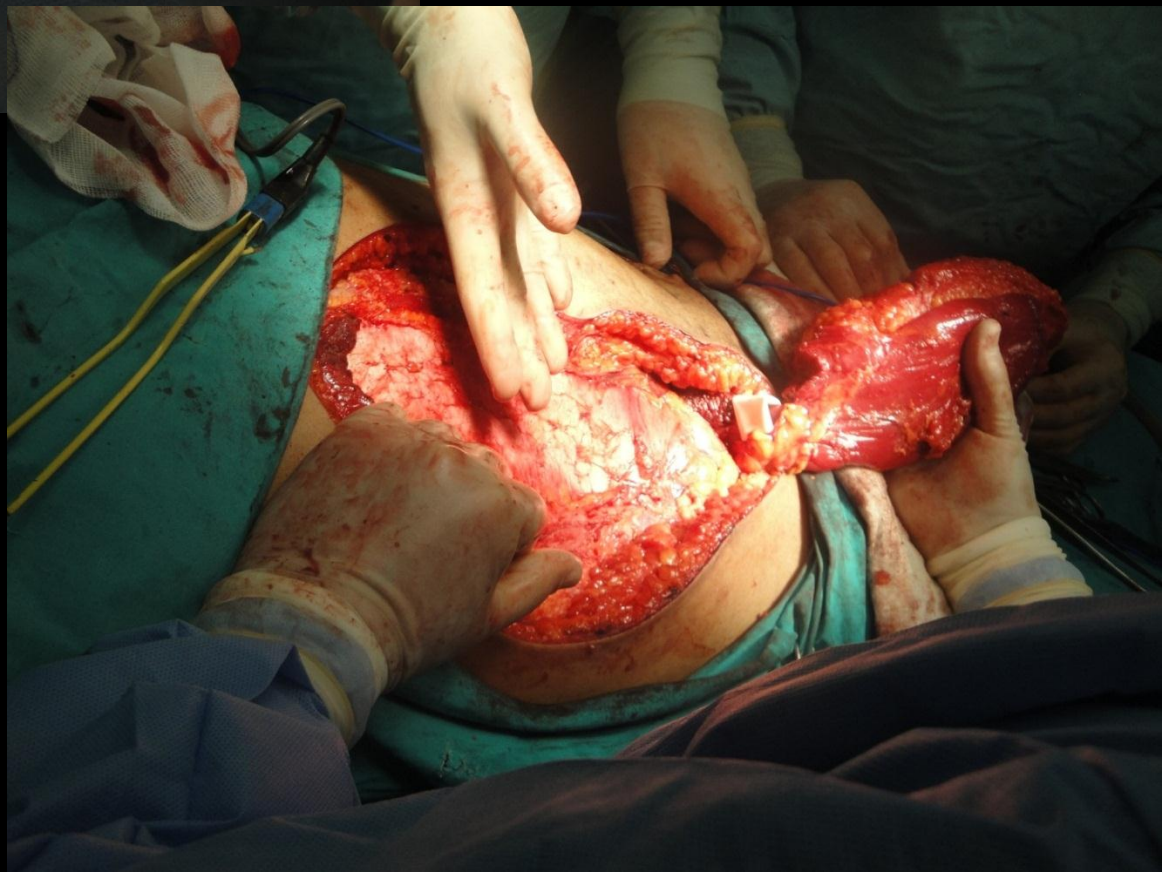

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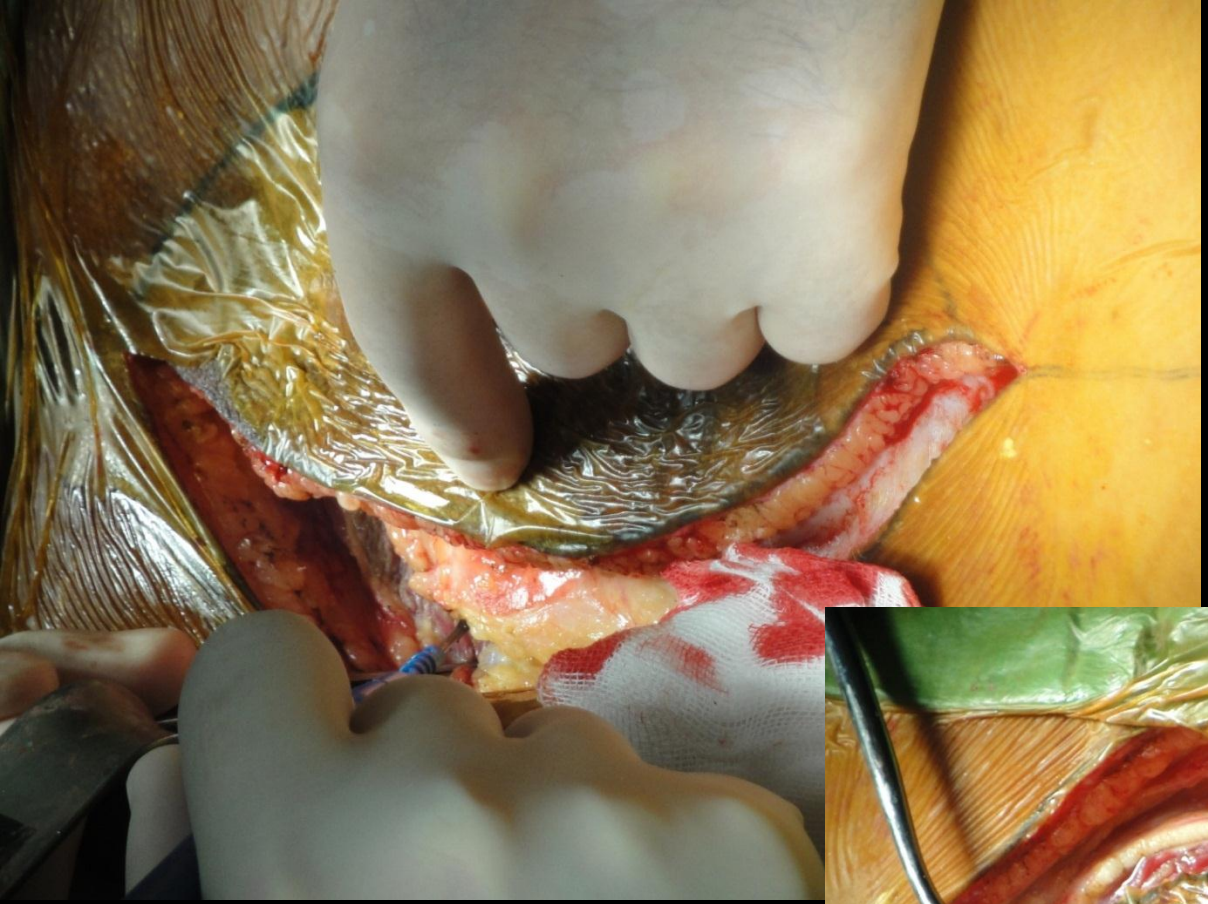
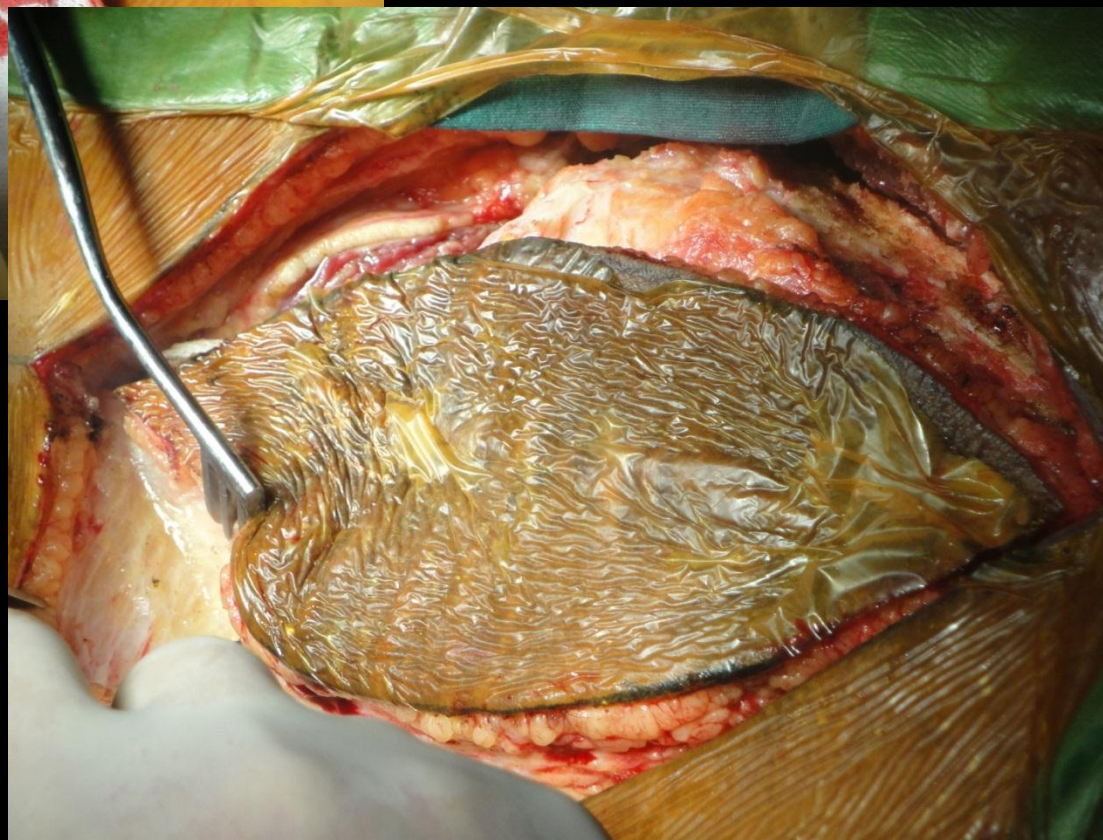
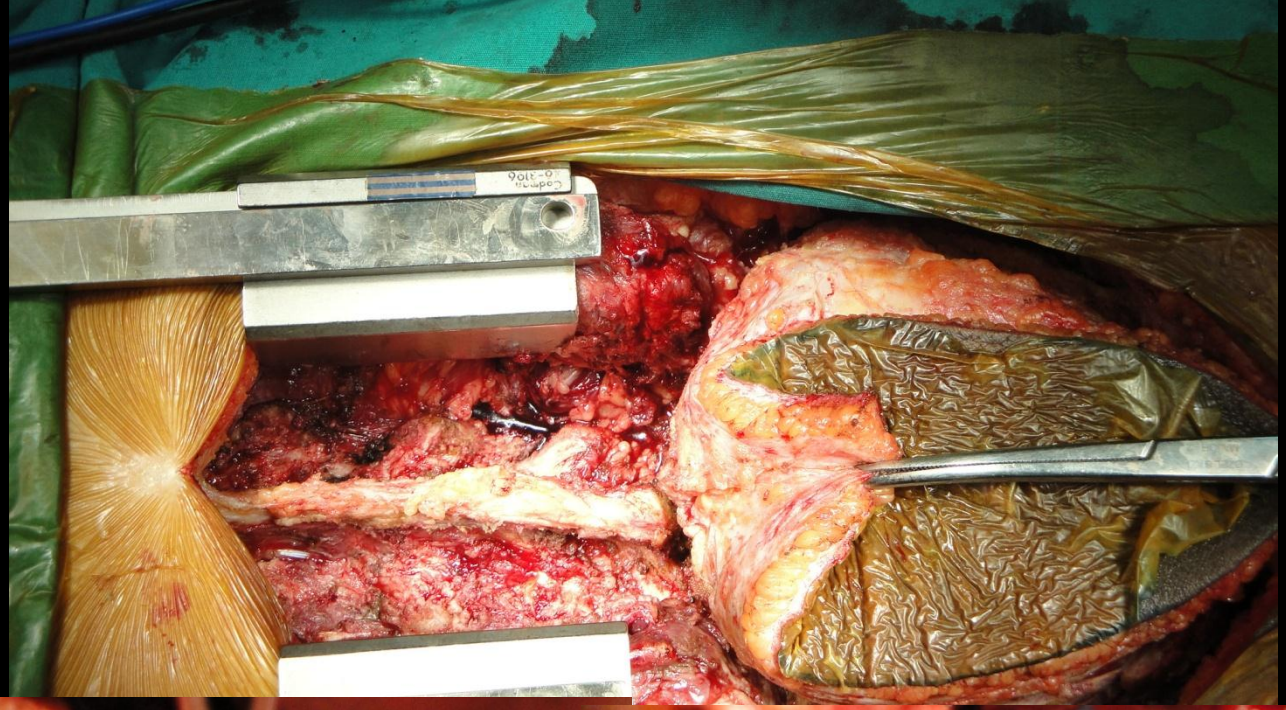
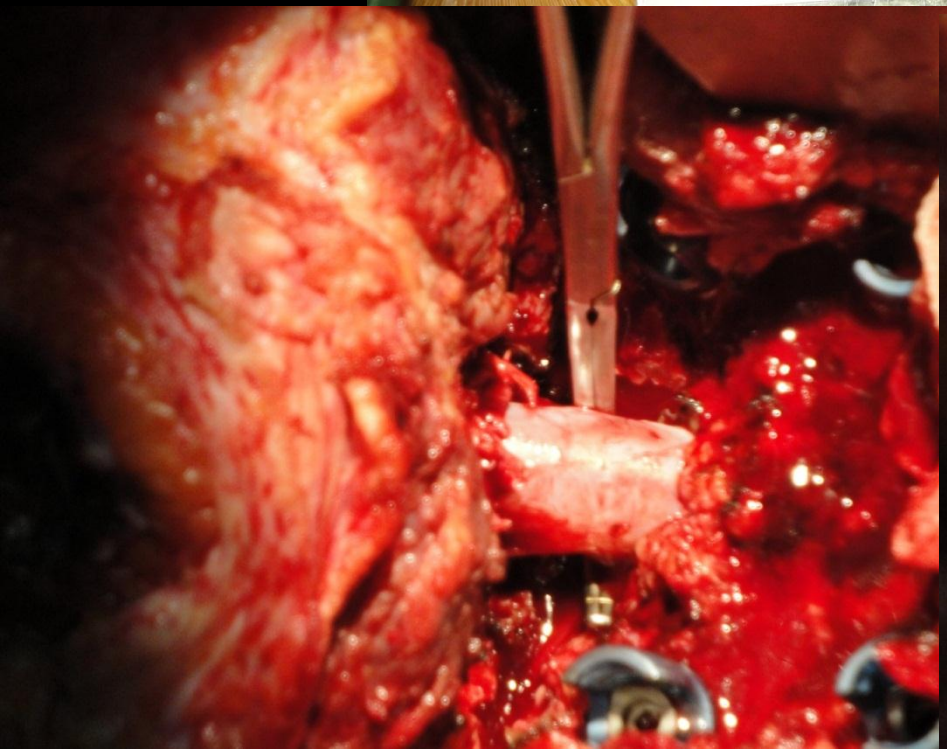
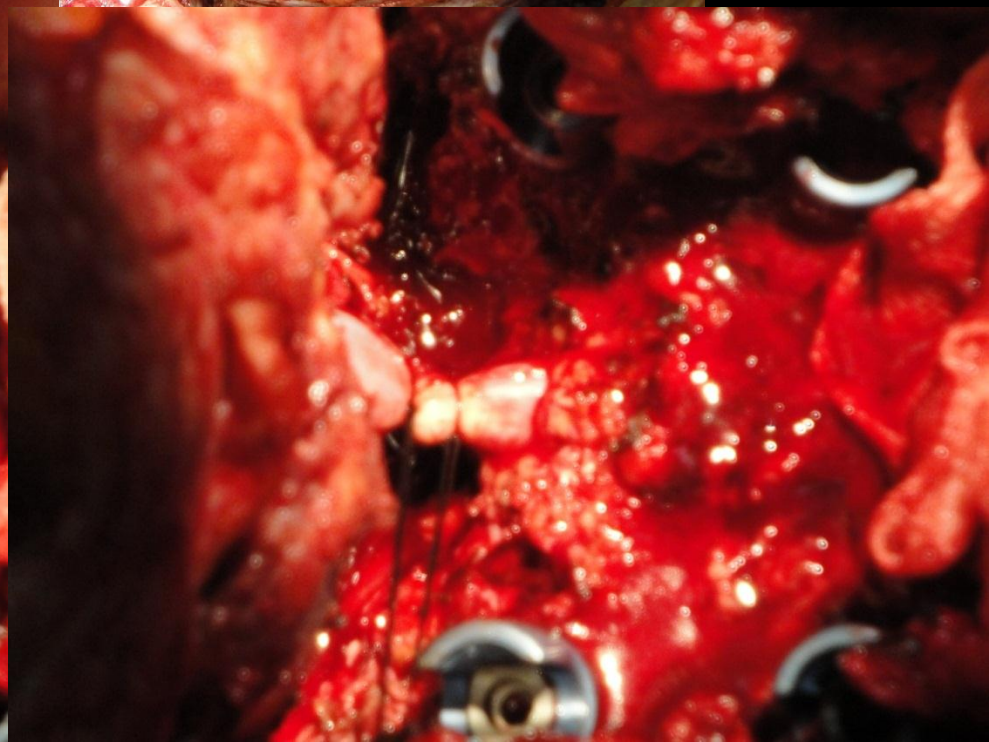




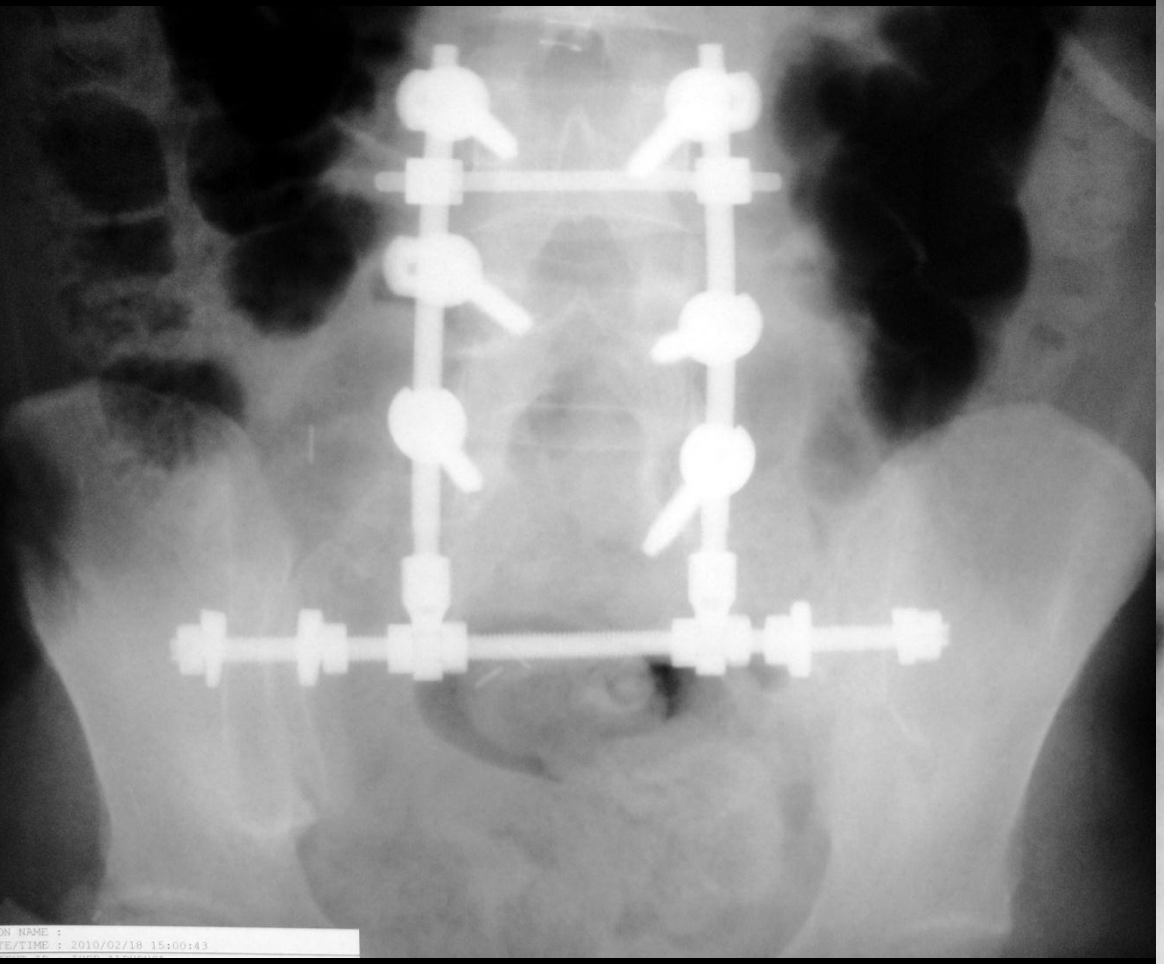
Case 3

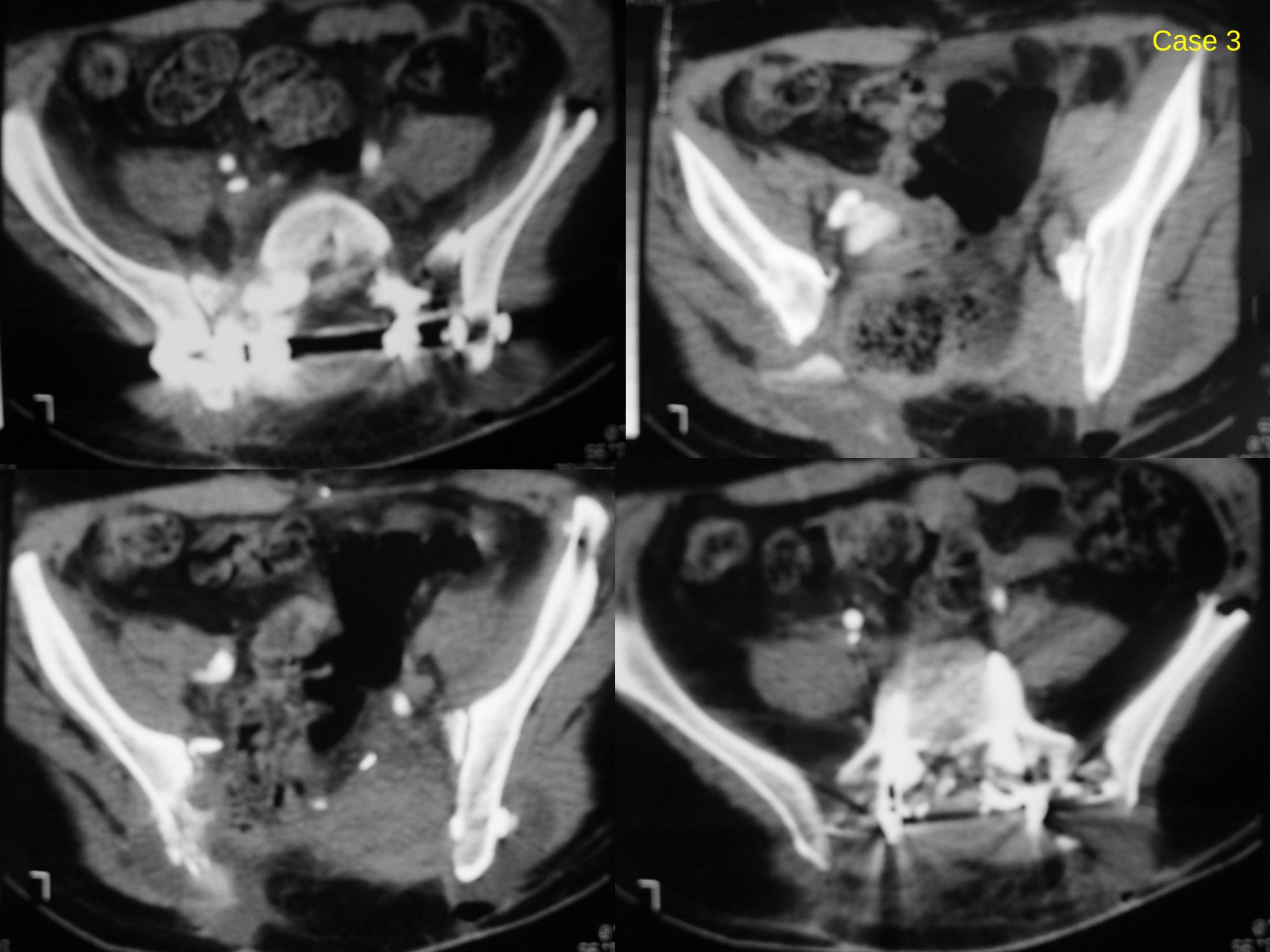






Case 3




Case 3

Sacrectomy: Complications

Duration of surgery 6-22 hours (mean 13.4 ± 4.4)

Blood loss 2400-5250 ml (mean 4518 ± 1773)

Vascular injury		none
Early postoperative death (1st month)		3
Fat emboli	1	
Rectum perforation	2	
Motor deficits (foot drop)		3
Infection, wound problems		5
Dural tears, CSF fistulae		1

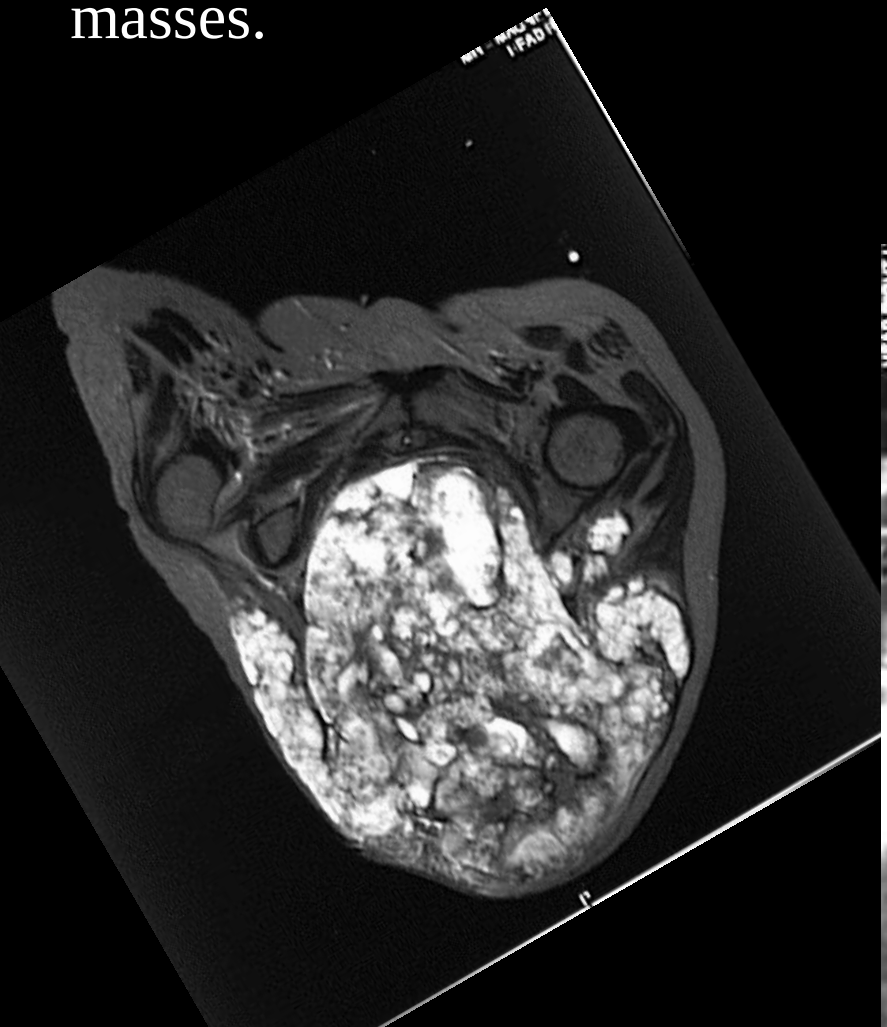
Sacrectomy Results

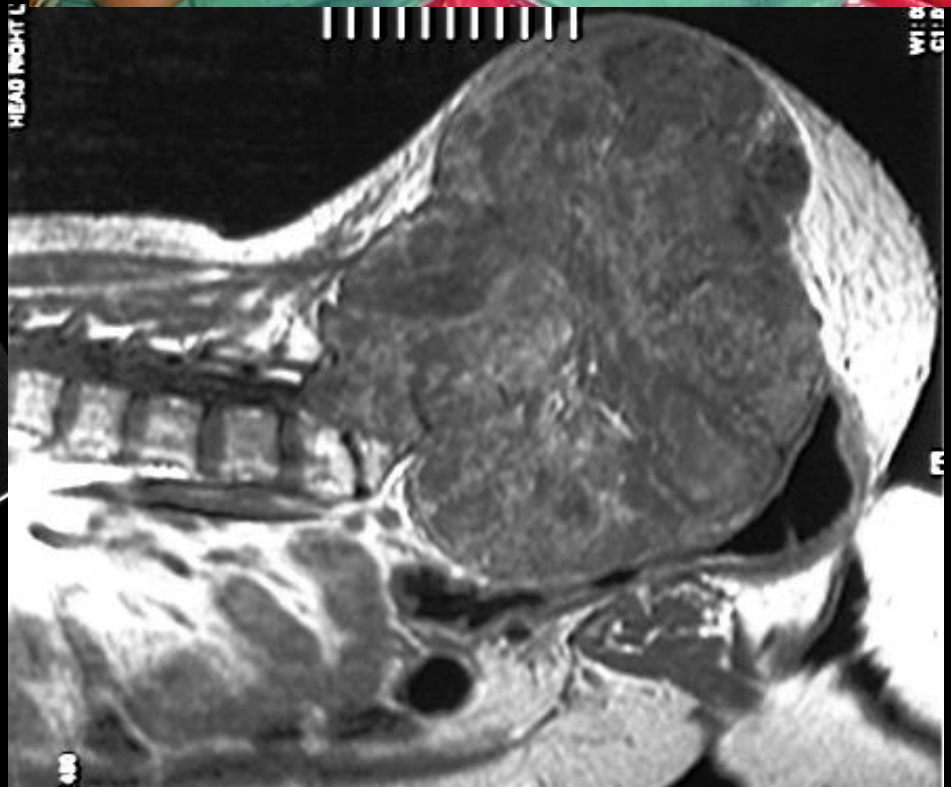
The mean follow-up 5,1 year (± 2,7) (range 1 - 8 yrs)

Death on follow-up (13 mths & 5 yrs survival)	**2**
Alive with recurrence	**1**
Alive with metastasis, w/o recurrence	**2**
Alive with no recurrence	**6**

(1 – 8 yrs; mean survival 4.8 year ± 3.1)

Sacrum tumors may remain w/o symptoms for long periods, they reach big dimensions at the time of diagnosis.
Significant blood loss during intralesional resection of big masses.





Bleeding Control
by balloon occlusion of the aorta

- Intralesional surgery for giant sacral tumors necessitates good bleeding control
- Transient occlusion of aorta controls bleeding
- This method has been introduced in 2005 from China in 3 patients

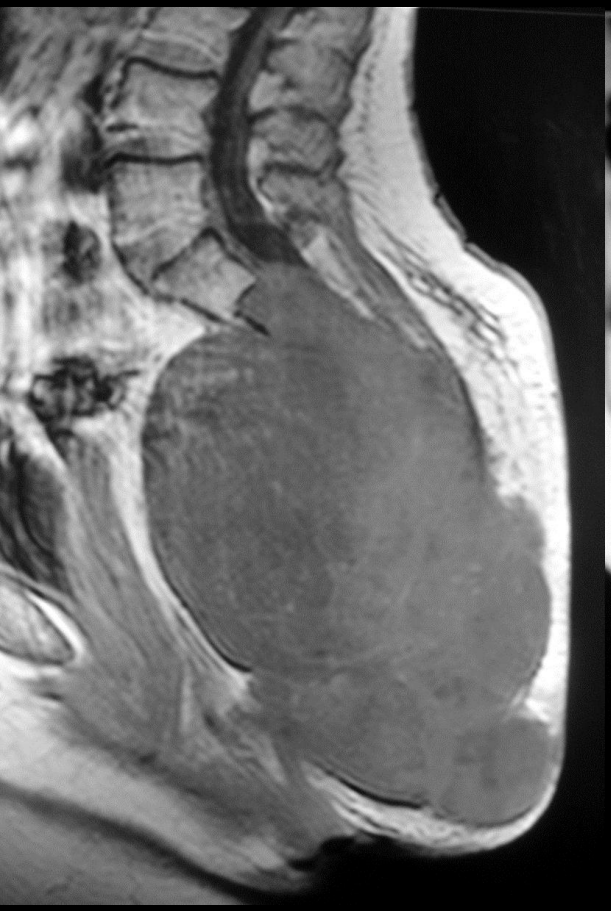
SPINE Volume 30, Number 20, pp E614–E616

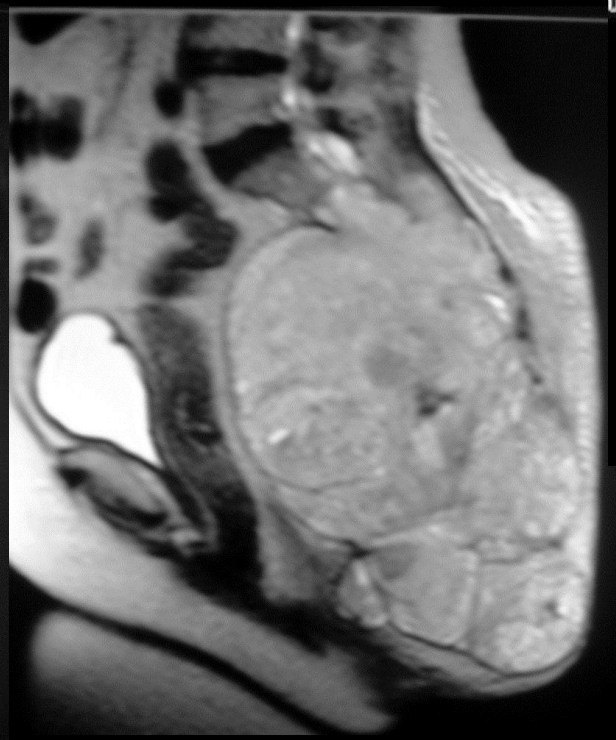
Surgical Excision of Sacral Tumors Assisted by Occluding the Abdominal Aorta with a Balloon Dilation Catheter: A Report of 3 Cases

Chuan Mi, MD, Hailin Lu, MD, and Hong Liu, MD

52 y.o. Female patient. Local pain on sacrum, difficulty in sitting, huge mass on buttocks. No sphincter disturbance. Constipation and urinary urgency due to mass effect

MRI and CT

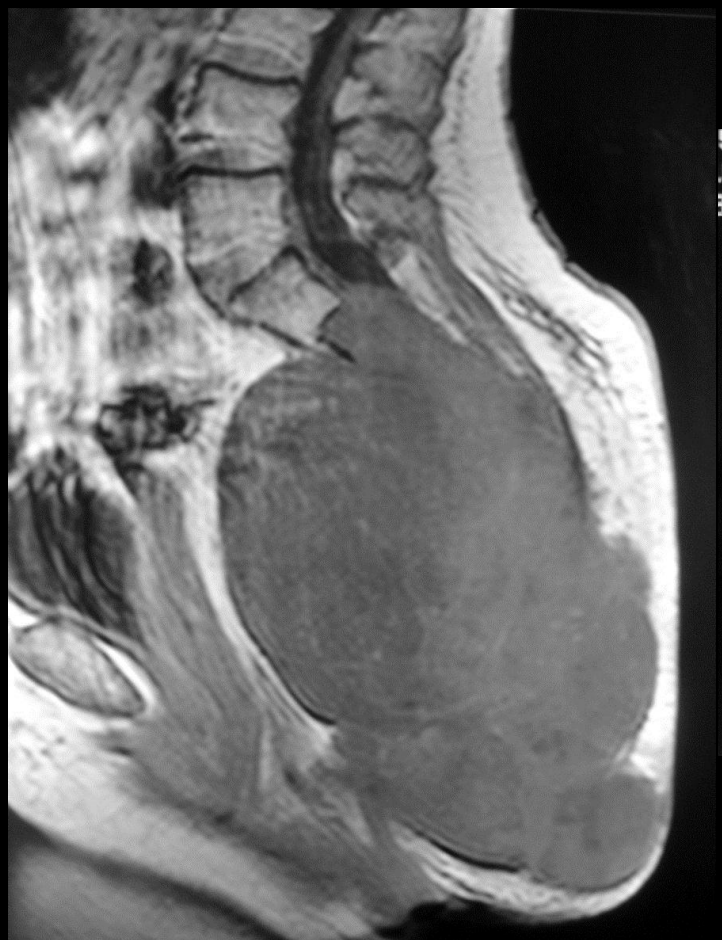




Diagnosis and Surgical Planning

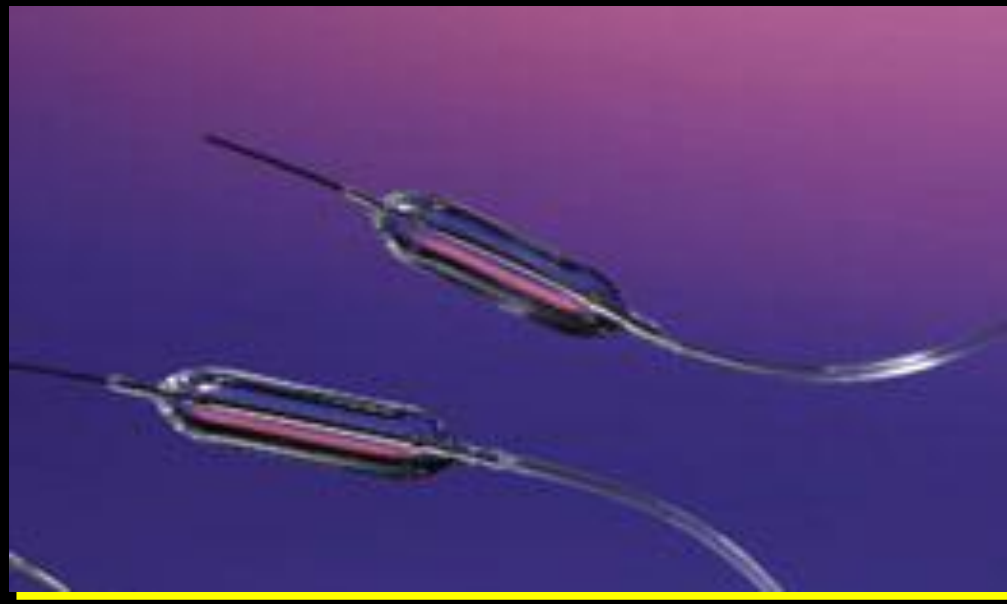
Pre-op true-cut biopsy: Chordoma

Surgical planning: We recommended total sacrectomy. She refused it due to possible sphincter disturbance. Then an intralesional resection is planned.



Surgery: 1st stage

- In the morning of surgery, patient is transferred to interventional radiology unit.
- Femoral artery is catheterised under local anesthesia.
- A 20F balloon dilatation catheter (Boston Scientific) is placed in abdominal aorta distal to bifurcation of renal arteries.



Inflated balloon in infrarenal aorta. Contrast injection into the aorta lumen after inflation confirmed total occlusion

Surgery: 2nd stage

Then the patient is transferred to operating theater. Under general anesthesia she was turned to prone position.
Huge mass tends to protrude from the skin.

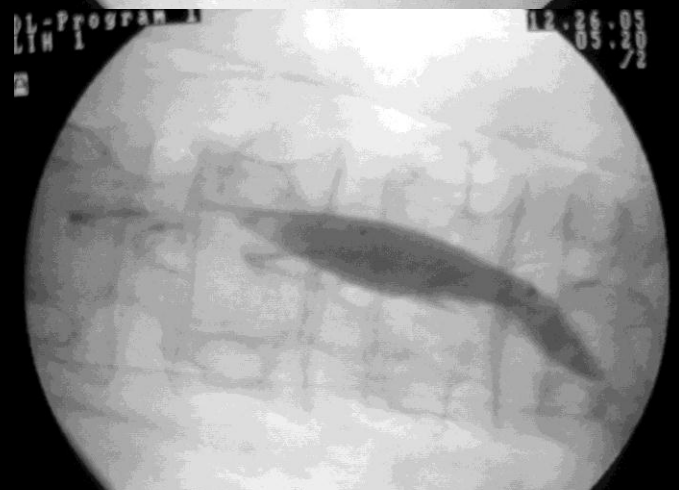
Femoral catheter on right side.

C-arm fluoro confirms the site of catheter.

Surgery: 3rd stage

After incision, and just before resection, balloon was inflated under AP fluoroscopy with 15 ml saline containing 5% omnipaque and istal aorta was occluded.

Intralesional resection is performed and approximately 80-90% of the tumor was removed in 40 minutes. Total loss of blood was 800 ml.



Surgical Management
Important Considerations

- Just before occlusion 5000 U heparine injection
- Blood pressure increases after occlusion / cooperation with anesthesia !
- After resection IV protamine

Conclusions

1-Radical surgery of the sacrum is possible with a colloborative team work. It is however a long and bloody operation.

2-The problems such as wound infection and stabilization needs to be solved.

3-Although the surgery of sacral tumors remains to be a challenge for the surgeon and oncologist, it is possible to perform a radical surgery with low mortality and acceptable morbidity

4-Key points in the management of primary sacral tumors are tumor biology, existing neurological damage and stabilization problems.

5-Extensive surgery -sacrectomy- should be preferred in selected primary sacral tumors.

Thank you