43eme Congres Annuel de la Societe Francaise de Neuroradiologie

Novotel PARIS Tour Eiffel – 30 Mars – 1 avril 2016

RACHIS INTERVENTIONNEL - SPINE INTERVENTION

Mario Muto Chief Neuroradiology
Cardarelli Hosp. Naples Italy
Chairman Spine committee ESNR
Vice President AINR

AINR
Associazione Italiana di Neuroradiologia Diagnostica ed Interventistica

European Society of Neuroradiology
Diagnostic and Interventional
ESNR

What is spine intervention ?

- Treatment SPINE PAIN

What is spine intervention ?

- Treatment SPINE PAIN
- VCF due to osteoporosis, metastasis or primary benign spine tumors
- Percutaneous treatment of herniated disk and facet syndrome
- Percutaneous treatment of traumatic fracture
- New materials (osteconductive material)
- Percutaneous treatment spinal stenosis
- Percutaneous vertebral and sacral fusion ?

Diagnostic algorithm

spine pain

↓

Standard X-Ray (flexion and extension)

↓

MR (STIR or FAT SUPP T2)

(HNP, DDD,Spinal Stenosis)

Diagnostic algorithm

spine pain

↓

Standard X-Ray (flexion and extension)

MR (STIR or FAT SUPP T2)
(HNP, DDD,Spinal Stenosis)

spongious oedema
primary tumor
traumatic frac (CT)

VP KP

normal

↓

no VP

metastasis

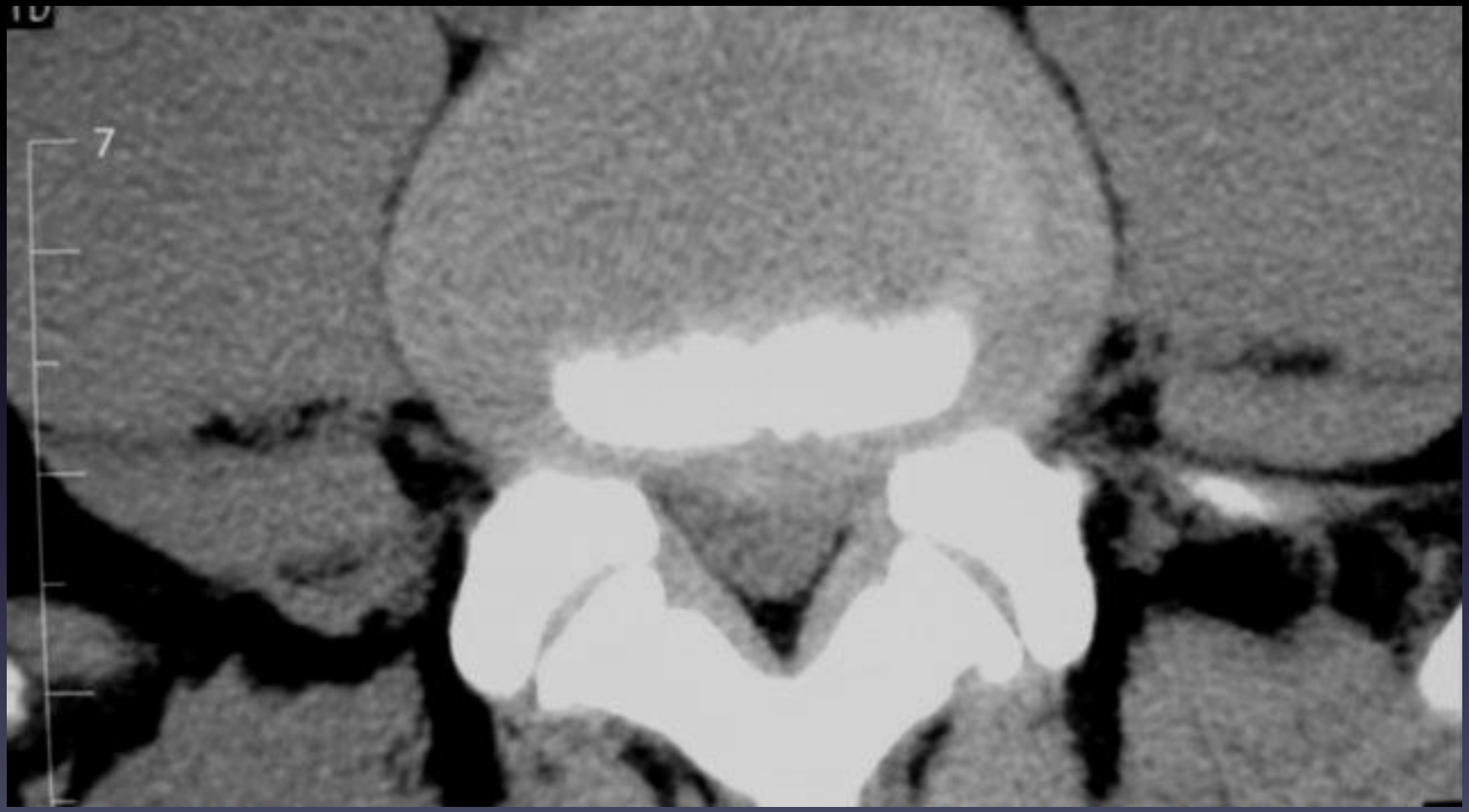
↓

NM CT

↓

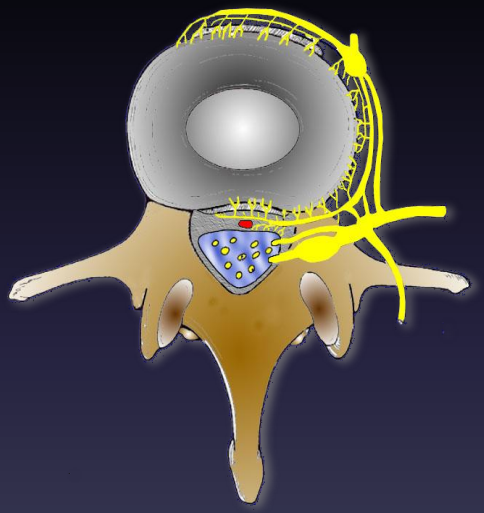
VP KP

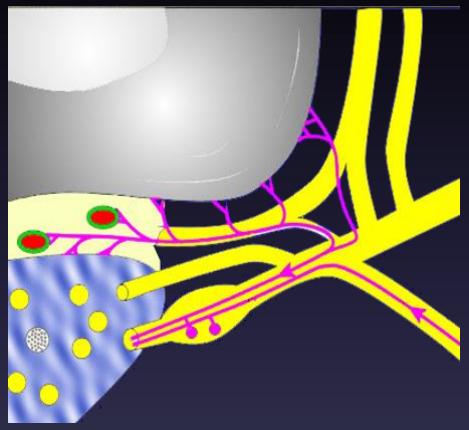
Left or right sciatica or low back pain ?

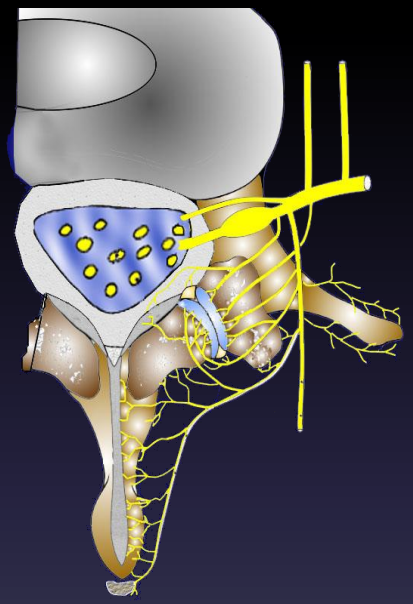


Radicular pain is related to mechanical and inflammatory factors

Ganglium = station of control







Spinal **pain**.
Izzo R, Popolizio T, D'Aprile P, **Muto M**.
Eur J Radiol. 2015 Feb 13.

- DEGENERATIVE SPINE DISEASE

- ESI
- Disk treatment
- Facet infiltration and RF

Percutaneous treatment for herniated disk

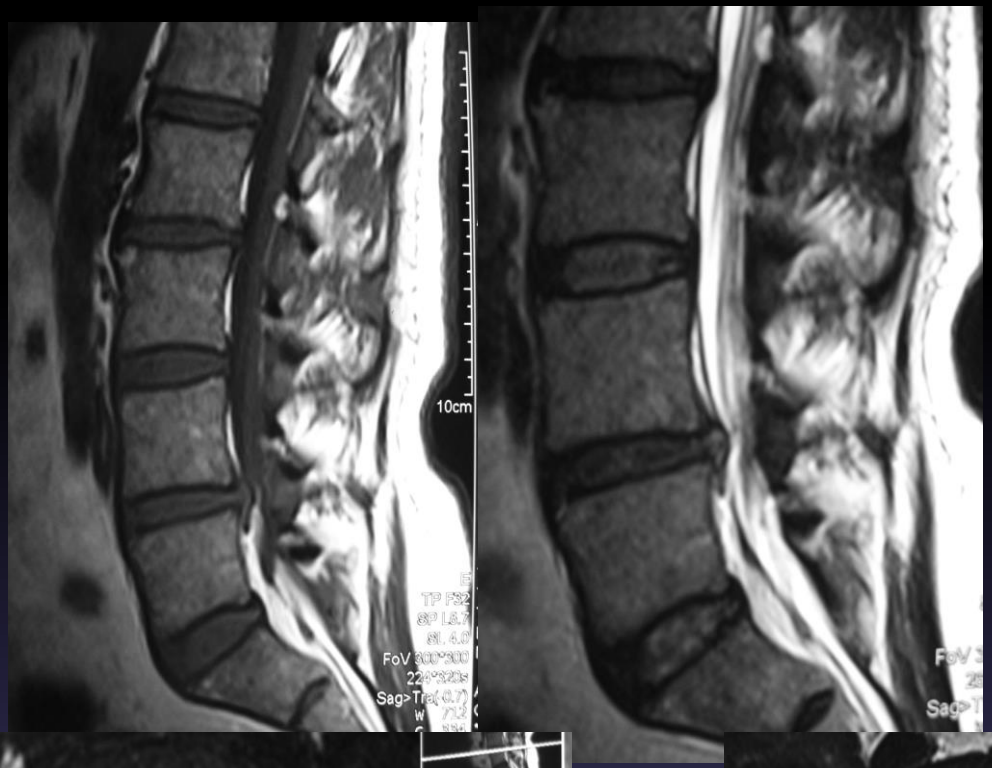
- Nucleoplasty (75%)
- Dekompressor (75%)
- Oxygen-ozone therapy (75--80%)
- Gelified Ethanol - discogel (75-80%)

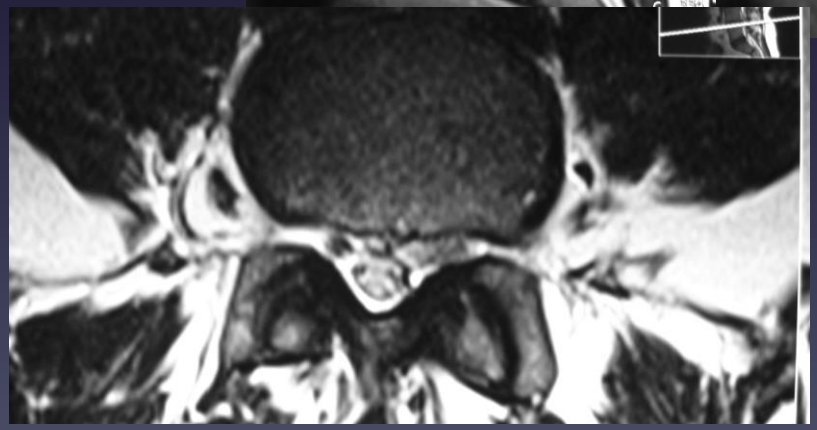
Who we should not treat?

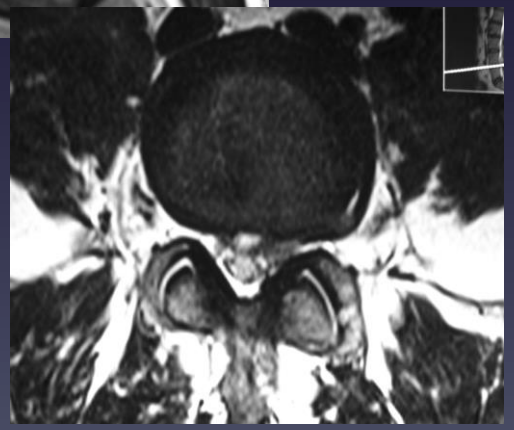
- Hyperalgic-paralyzing sciatica
- Cono-Cauda syndrome
- Patients with progressive foot droop

- Are we sure to do not treat extruded disk?
- Clinical more important than imaging findings

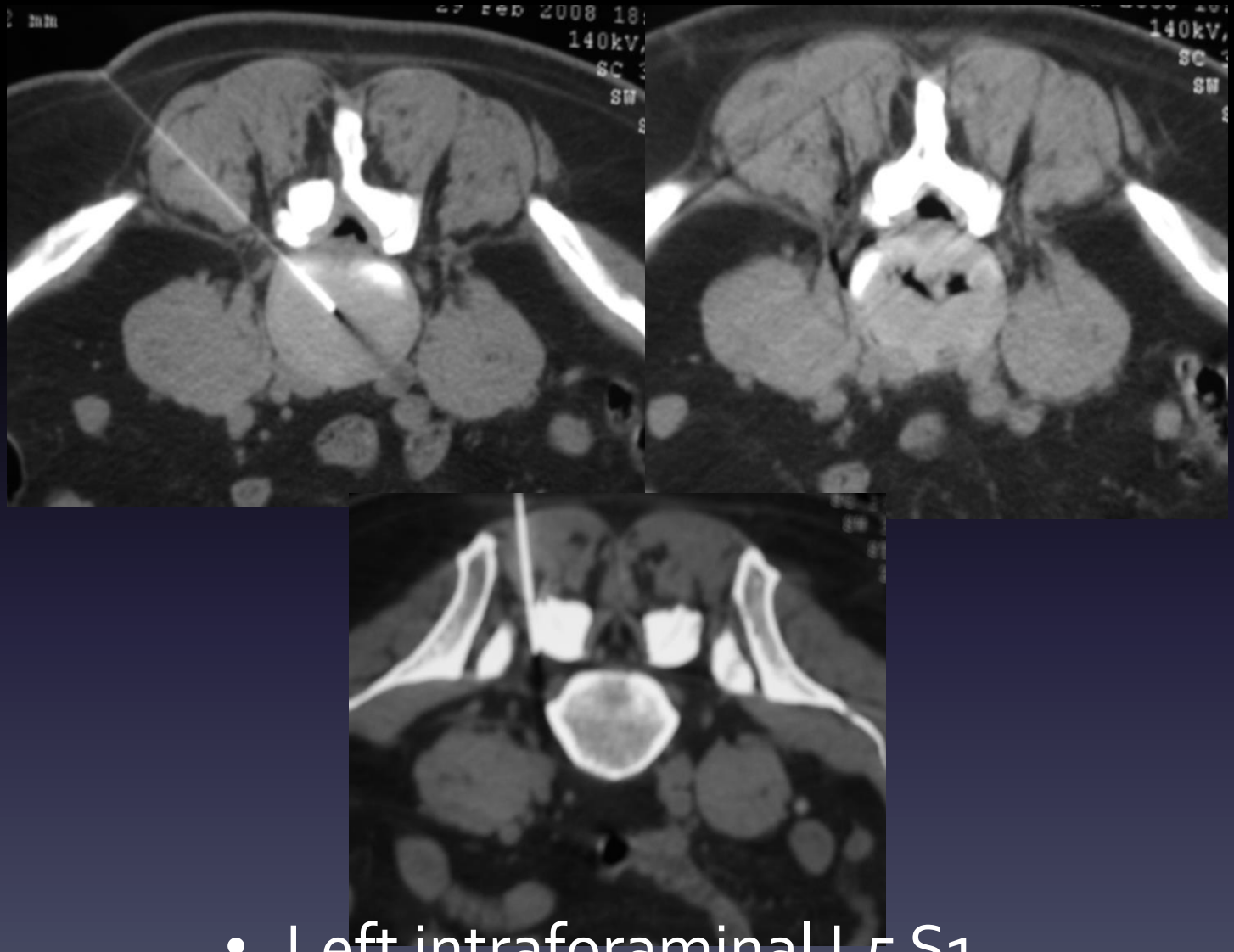
Typical case to treat





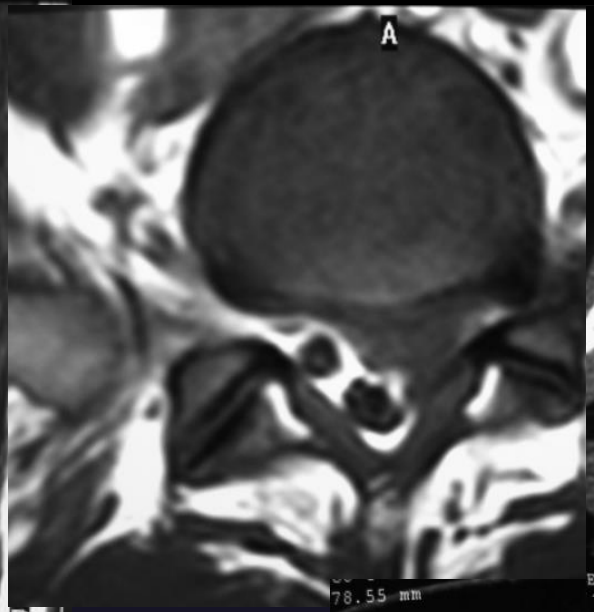


Intradiscal L4 L5



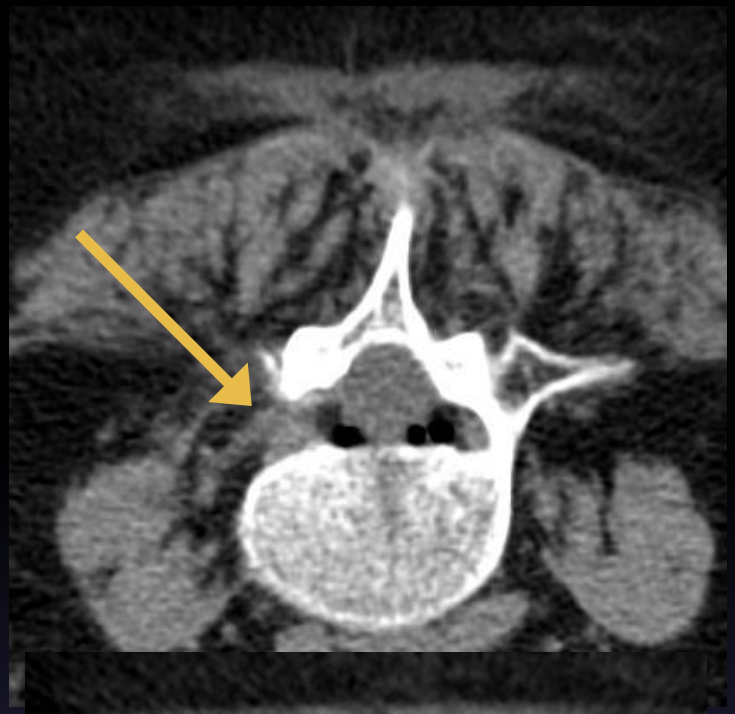
- Left intraforaminal L5 S1


Sc 2
TSE/M
ST 5
H
P

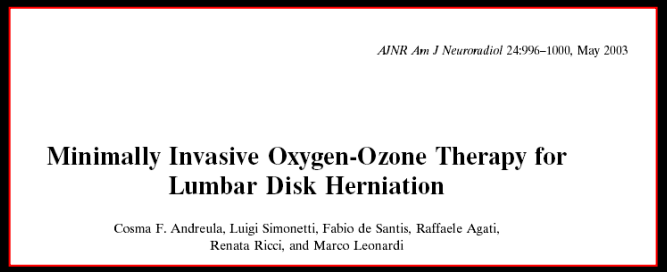

A


P
A. CARDA


78.55 mm
SC 300
P




The intradiscal oxygen-ozone in the treatment
of low back pain and sciatica
M. Muto et coll
Radiol Med June 2008



Intraforaminal 02 –03 versus periradicular steroidal infiltrations in lower back pain: a randomized study.
Bonetti M. et coll, AJNR may 2005

Sciatica: treatment with intradiscal and intraforaminal injections of steroid and oxygen-ozone vs steroid only.
Gallucci M et al. Radiology march 2007

Meta-analisys of effectiveness and safety of ozone treatment for HNP Steppan J, Murphy K, Muto M and coll J Vasc Interv Radiology 2010

Treatment of Contained Herniated Lumbar Discs With Ozone and Corticosteroid: A Pilot Clinical Study. K. Murphy,**M Muto**, J Steppan, T.Meaders, C Boxley .
Canadian Association of Radiologists Journal 66 (2015) 377-384

Vertebral compression fracture

- **Porotic lesions**
- **Trauma**
- **Metastatis**
- **Multiple myeloma**
- **Primary tumors**

- acute , subacute and chronic clinical symptomatology.

- ***VP and KP as PAIN THERAPY to improve life quality.***

- ***Asymptomatic patient with VCF fracture is not an indication to the treatment.***

Target of Assisted Technique

1) Vertebral height restoration to reduce kyphotic angle

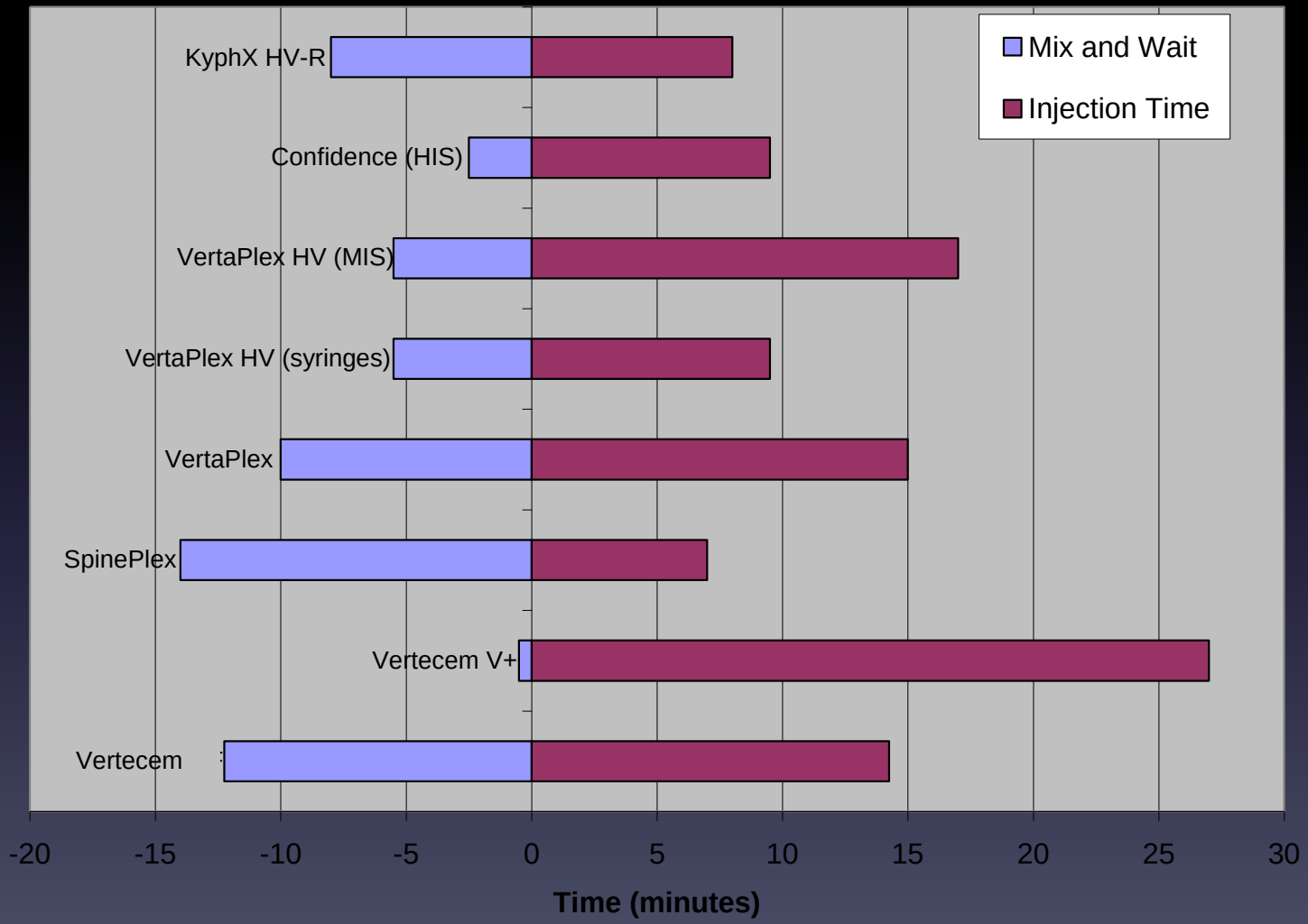
2) Reduce rates of complications, less disk and venous leakage

Assisted techniques for vertebral cementoplasty: Why should we do it?
Muto M, Marcia S, Guarnieri G, Pereira V.
Eur J Radiol. 2015 May;84(5):783-8

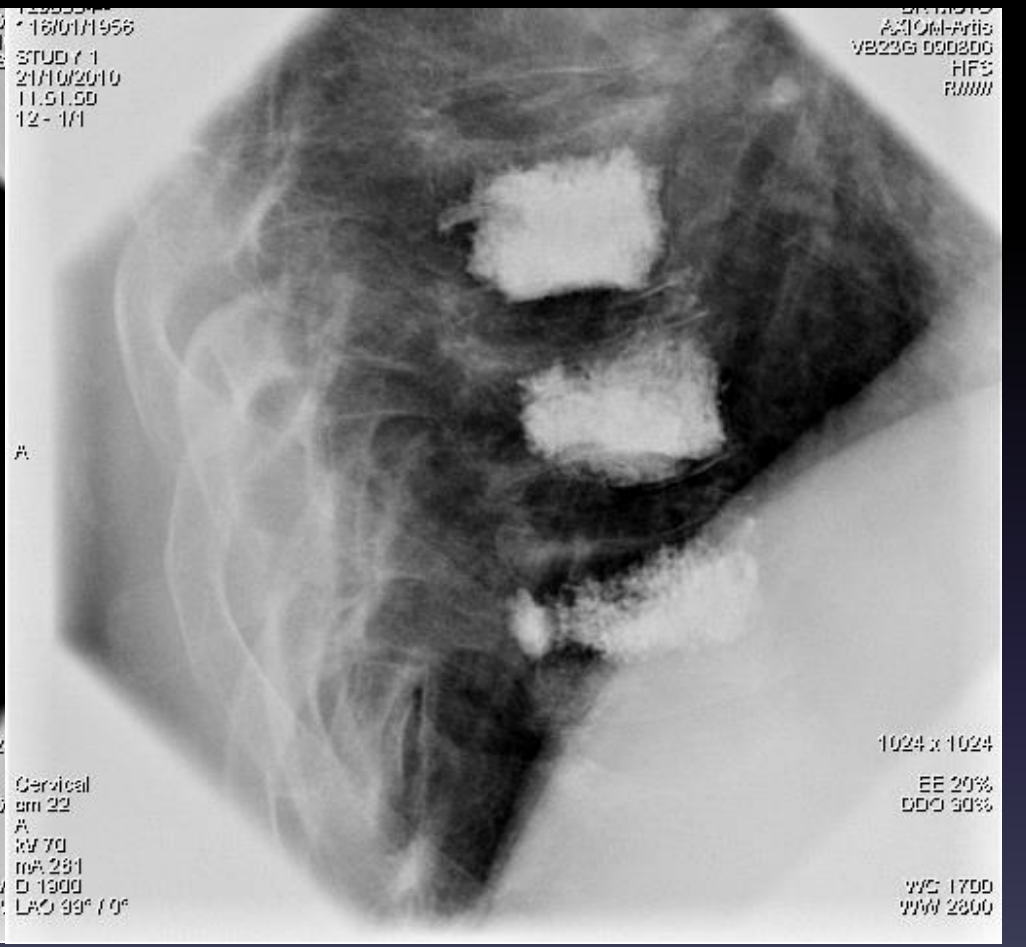
Why new cement?

To reduce venous and disk leakage (increase of cement viscosity)

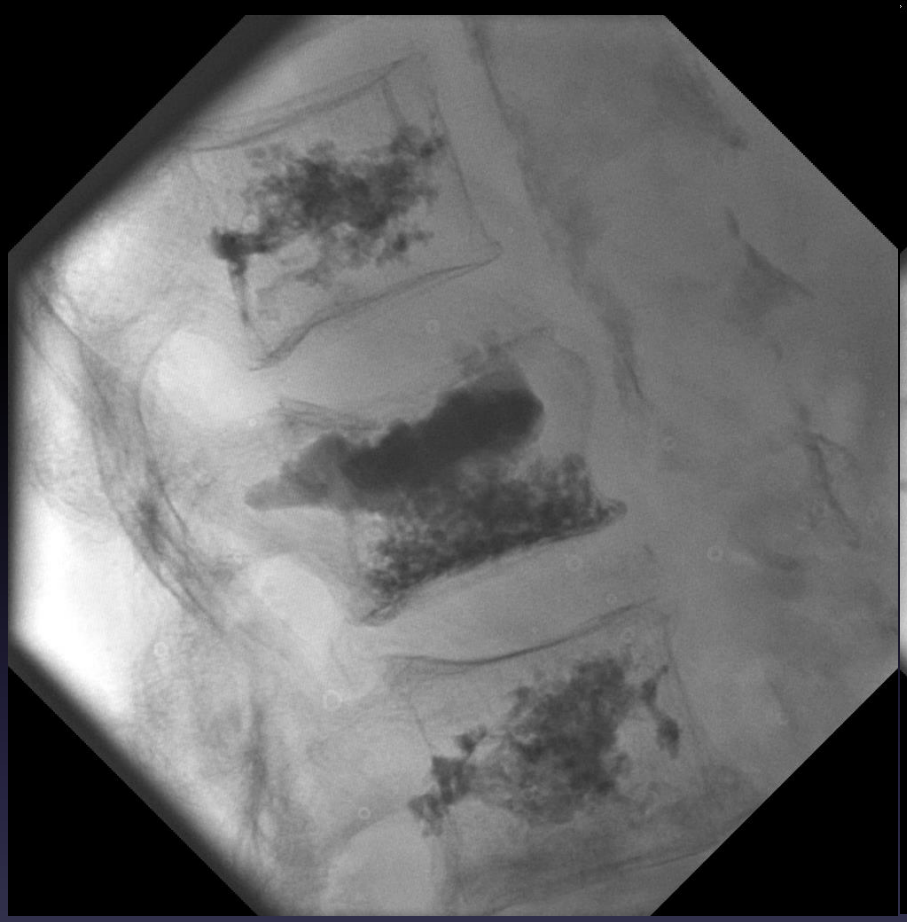
To increase working time


KyphX HV-R
Confidence (HIS)
VertaPlex HV (MIS)
VertaPlex HV (syringes)
VertaPlex
SpinePlex
Vertecem V+
Vertecem
Mix and Wait
Injection Time
-20
-15
-10
-5
0
5
10
15
20
25
30
Time (minutes)


16/01/1956
STUD / 1
21/10/2010
11.51.31
11 - 1/1
Cervical
cm 22
A
kV 70
mA 479
D 2819
LAO 2° / 0°


16/01/1956
STUD / 1
21/10/2010
11.51.50
12 - 1/1
1024 x 1024
Cervical
cm 22
A
kV 70
mA 281
D 1900
LAO 99° / 0°
EE 20%
DDO 30%
WC 1700
WW 2800

Preventive VP in osteoporosis

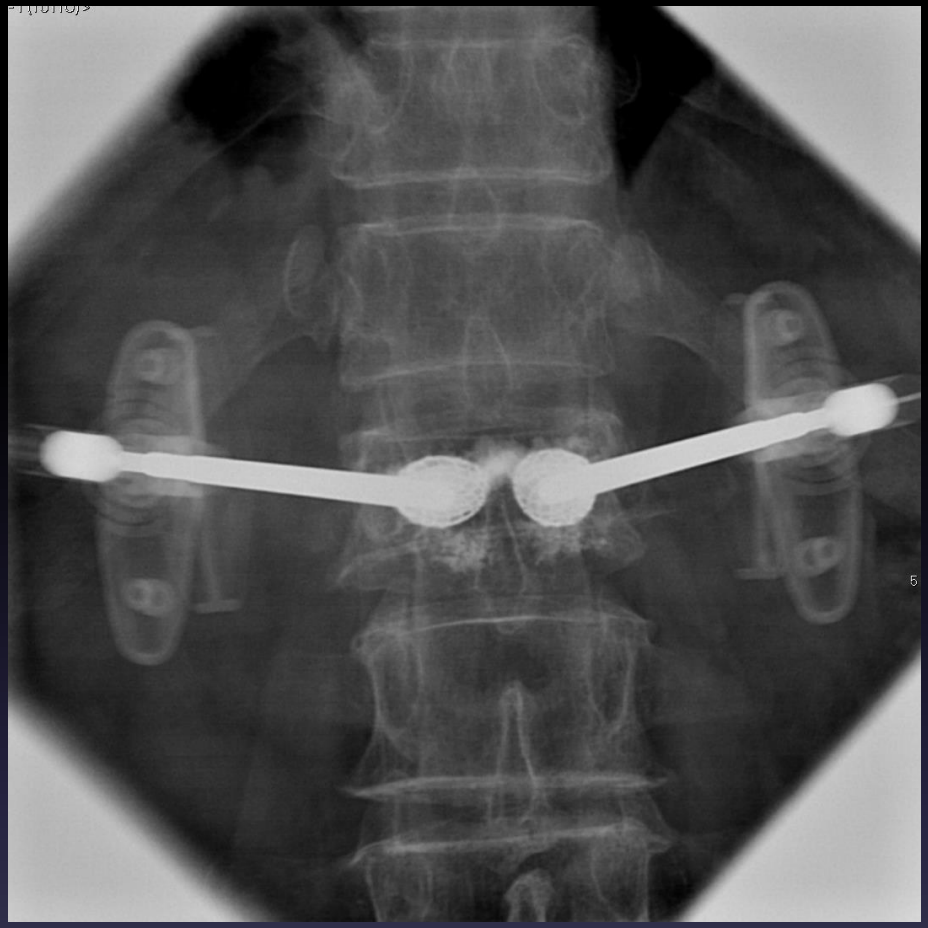


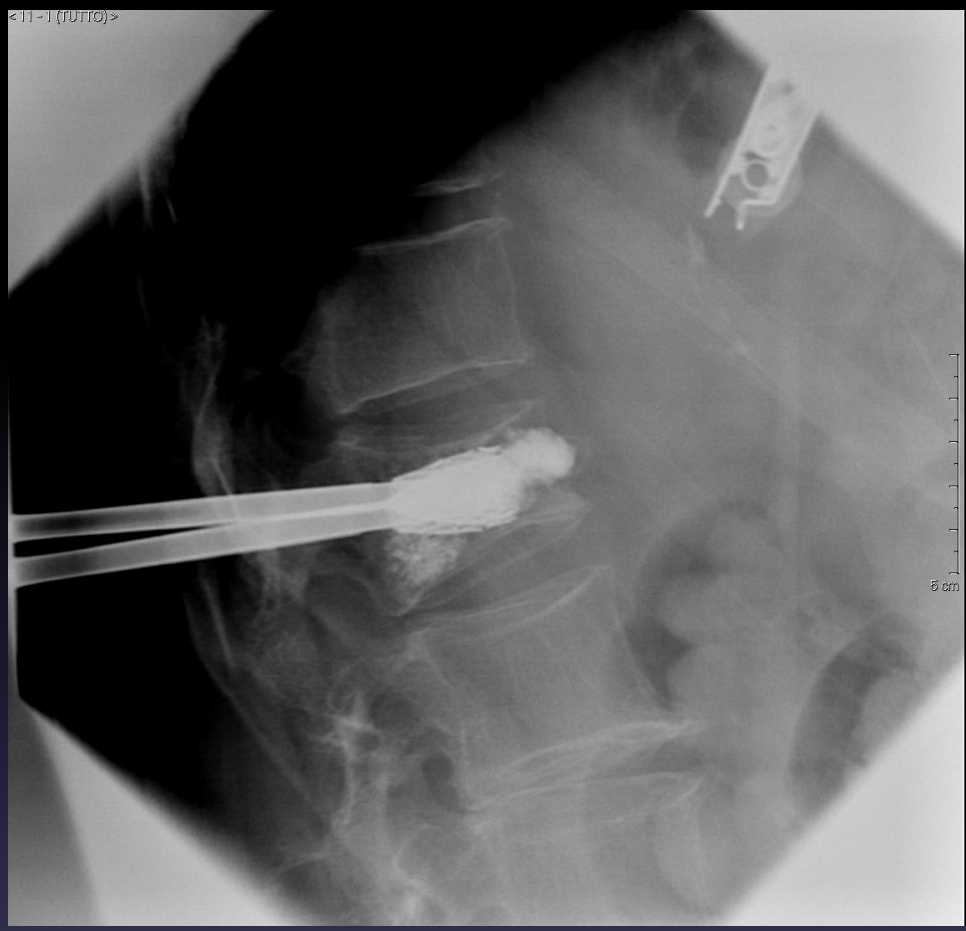
Safety, effectiveness and predictors for early reoperation in therapeutic and prophylactic VP: short term results of a prospective case series of patients with porotic fractures.
Diel P and coll Eur Spine J 2012 , 21, S792-799

Preventive vertebroplasty for adjacent vertebral bodies: a good solution to reduce adjacent vertebral fracture after VP.
Yen CH and coll
AJNR may 2012 , 33, 826-832

How many KP and KP like devices ?

- Around 20 company are present on the market
- Spine jack
- Stent
- Kiwa
- etc





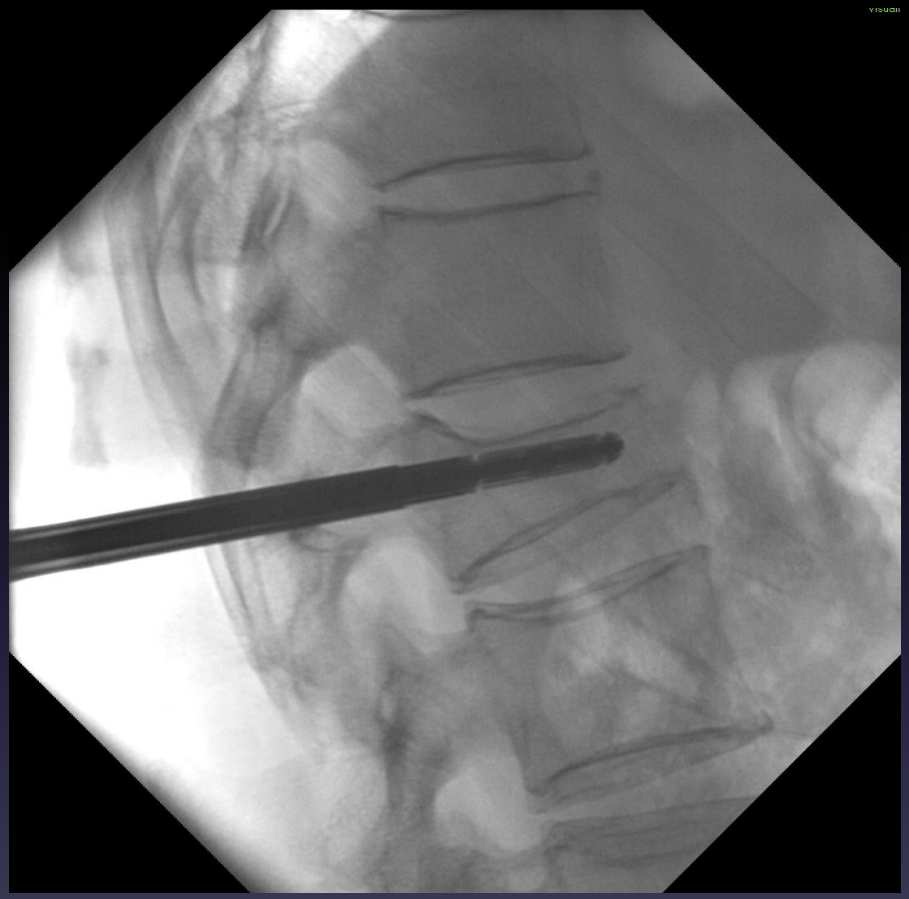
Stentoplasty effectiveness and safety for the treatment of osteoporotic vertebral fractures: A systematic review.
Martín-López JE, and coll
Orthop Traumatol Surg Res. 2015 Sep;101(5):627-32

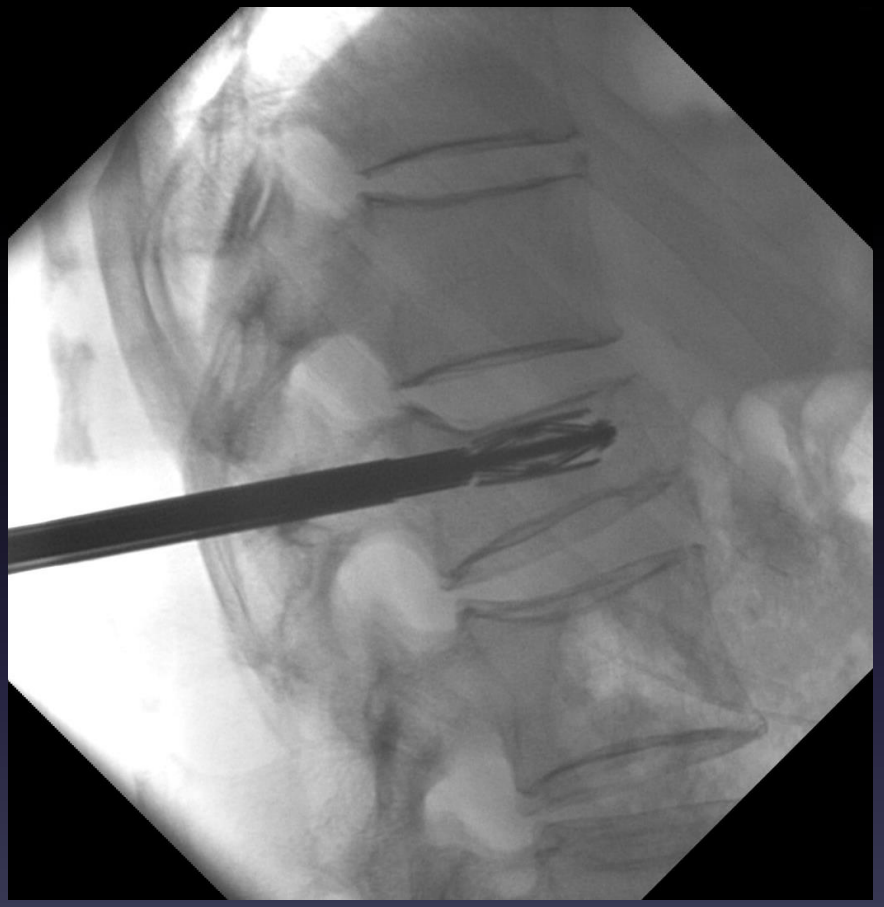
TRAUMATIC PATHOLOGY

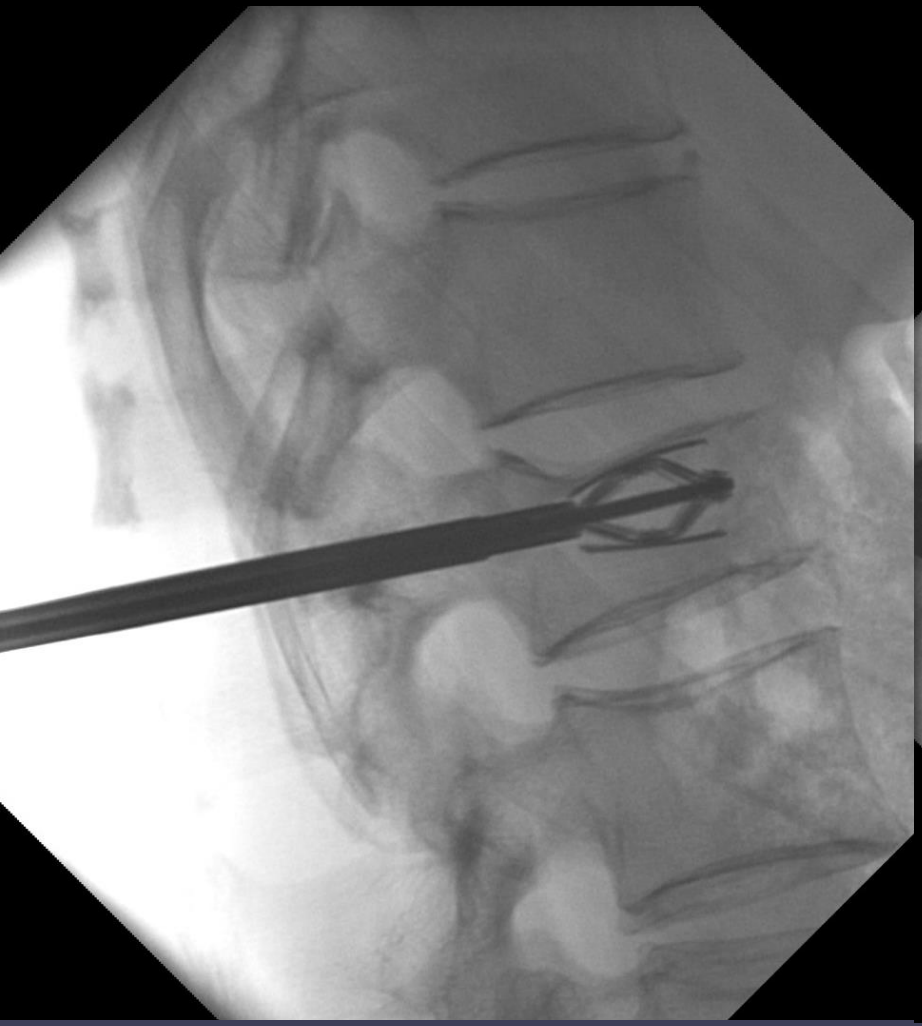
Height restoration of osteoporotic vertebral compression fractures using different intravertebral reduction devices: a cadaveric study. Krüger A et al. Spine J. 2013 Nov 4. pii: S1529-9430(13)01216-3.

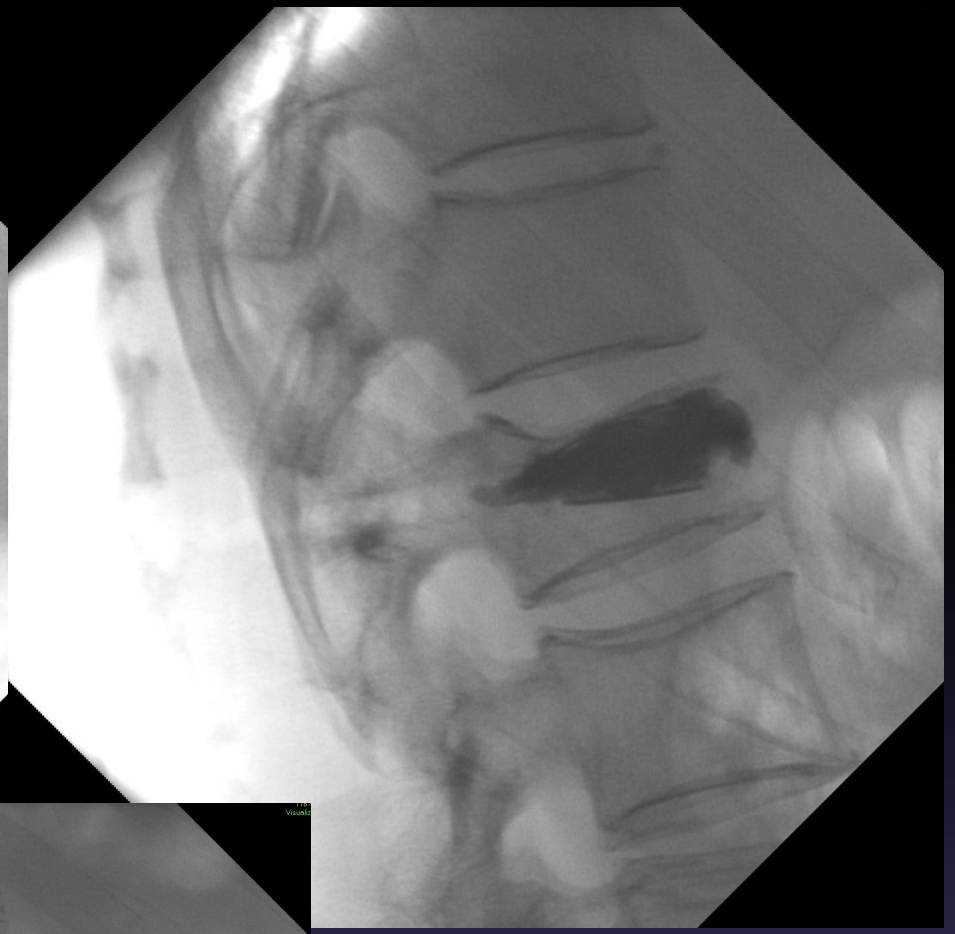
CONCLUSION: The protocols for creating wedge fractures and using the instrumentation under a constant preload of 100 N led to reproducible results and effects. The study showed that **height restoration was significantly better in the SpineJack group compared with the balloon kyphoplasty group**. The clinical implications include a better restoration of the sagittal balance of the spine and a reduction of the kyphotic deformity, which may relate to clinical outcome and the biological healing process.

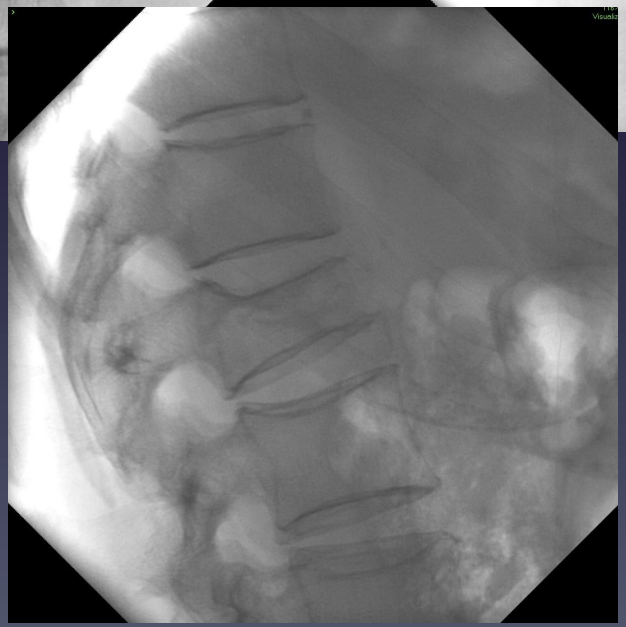
Spine Jack







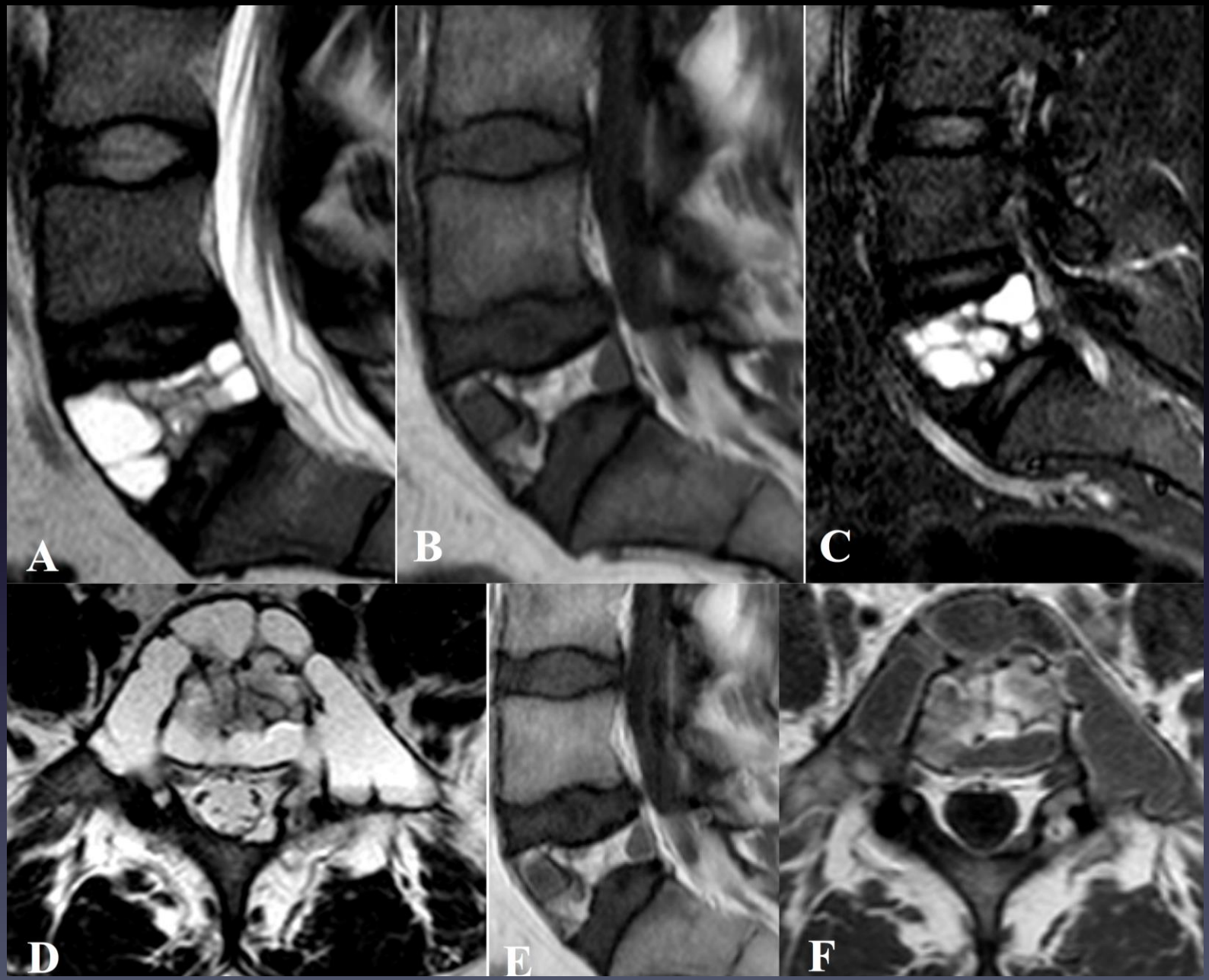


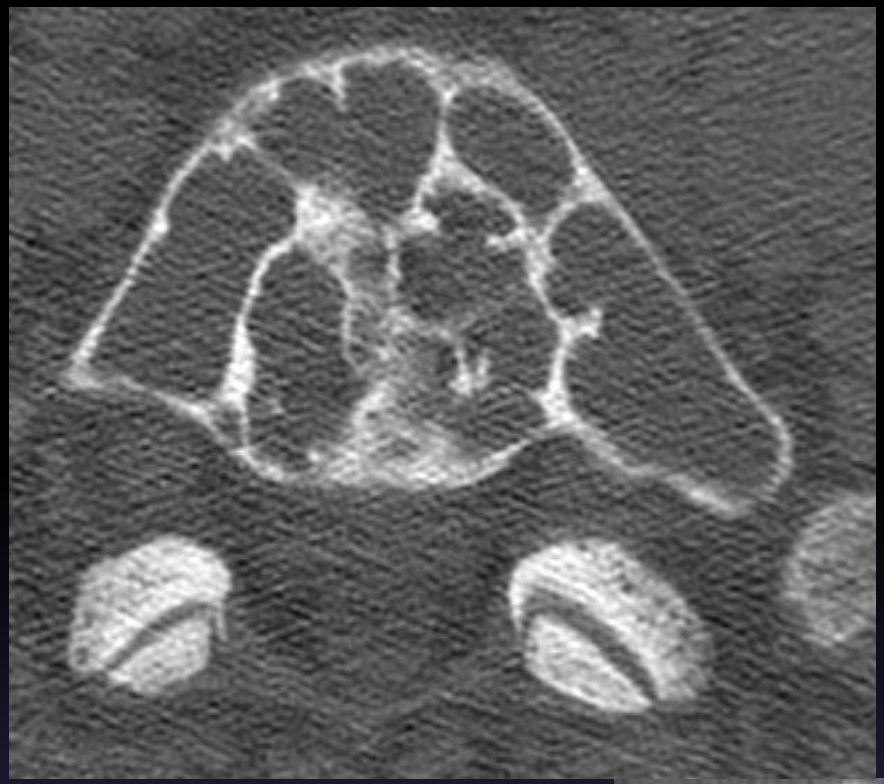


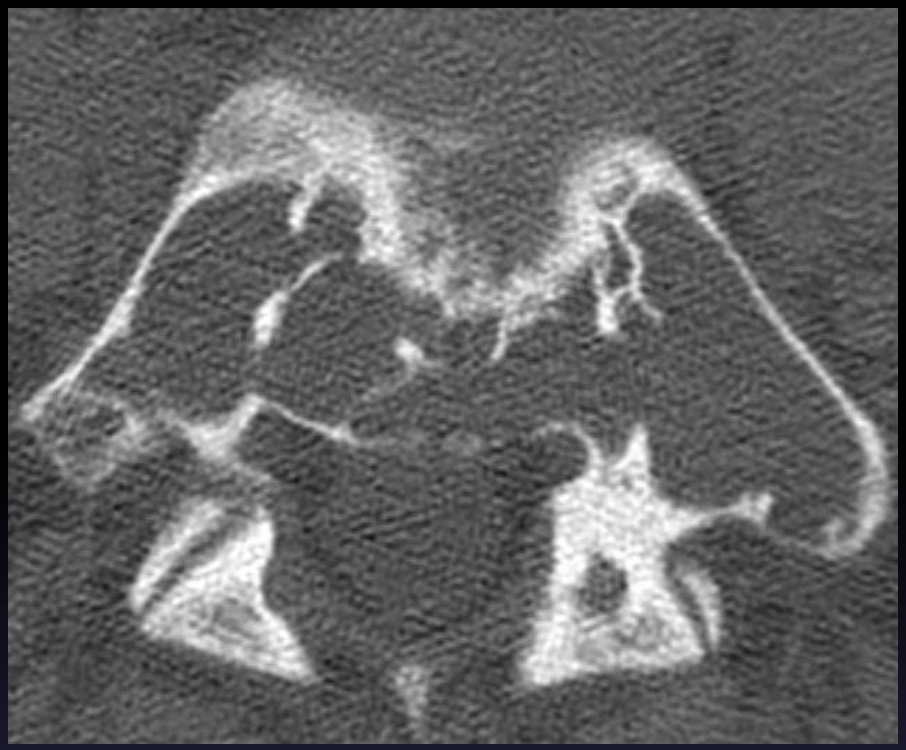
- PRIMARY BENIGN SPINE BONE PATHOLOGY

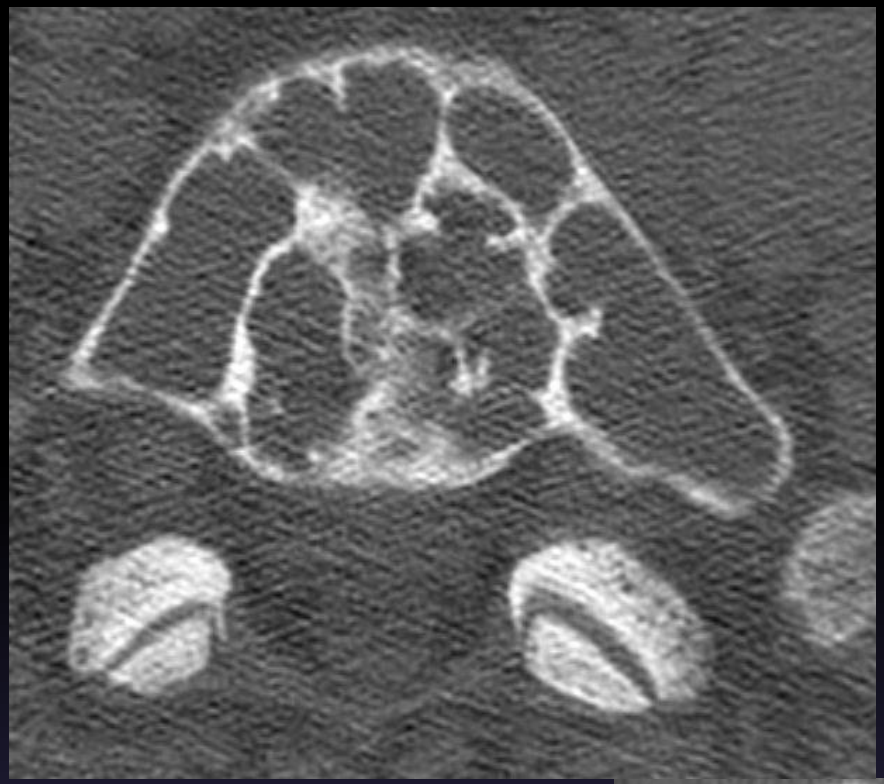
- ABC
- VERTEBRAL HEMANGIOMA
- OSTEOID OSTEOMA

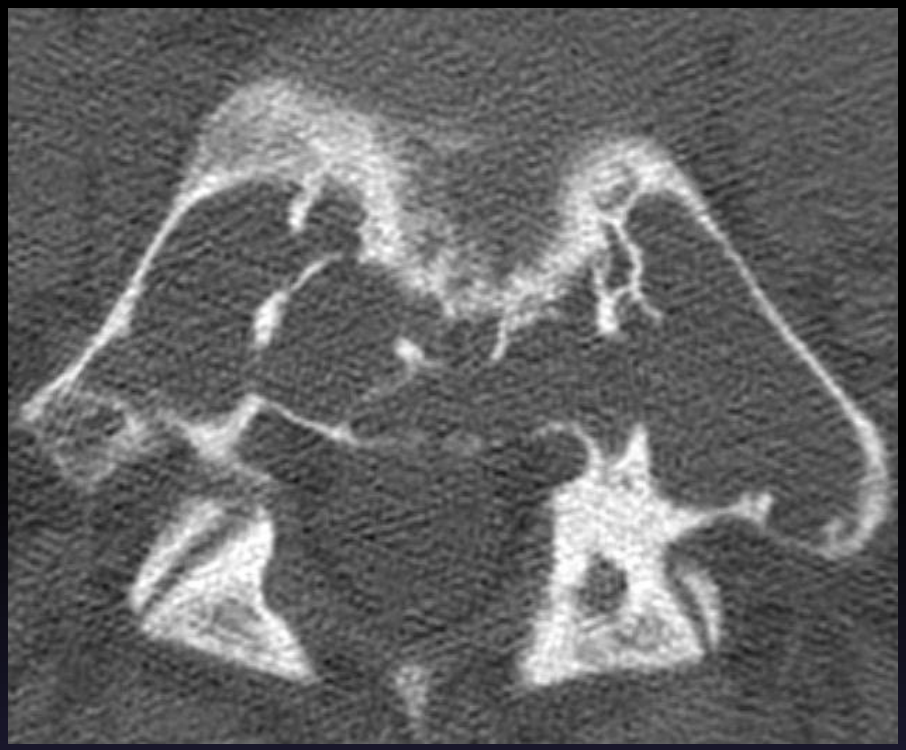
F, 33y.o. suffering of back pain for several months, resistant to M.T.



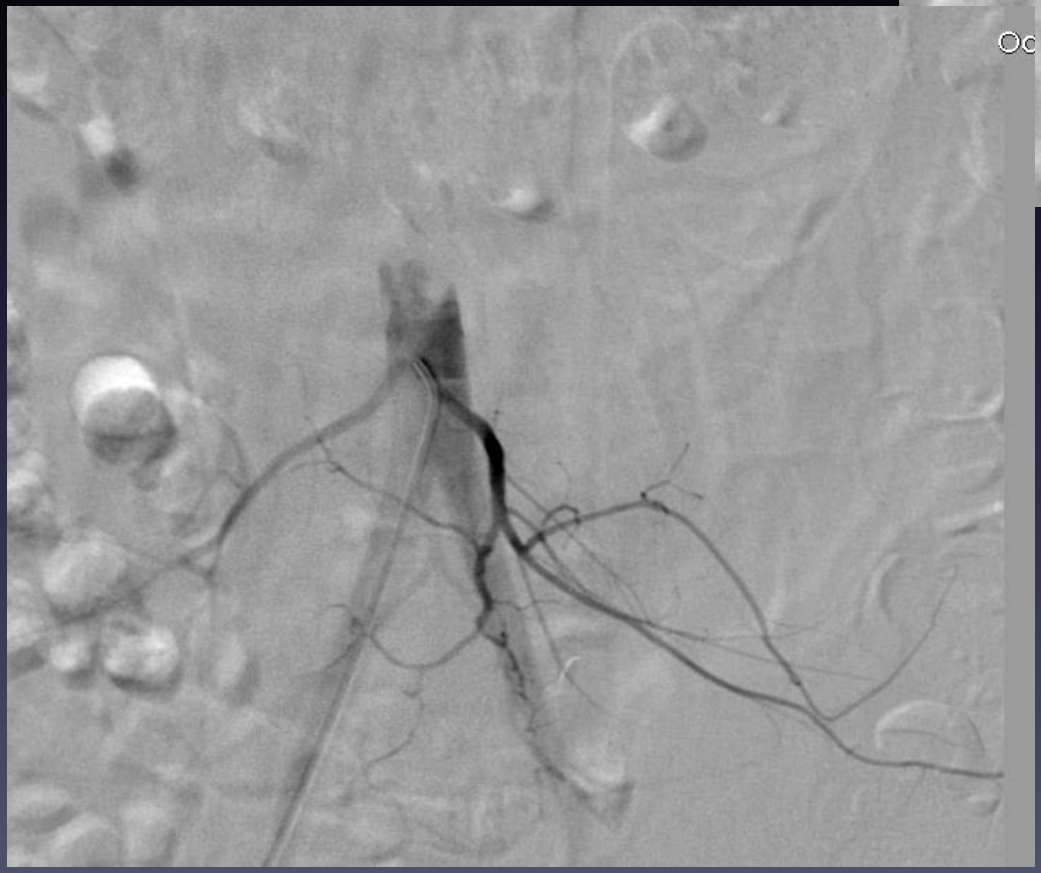






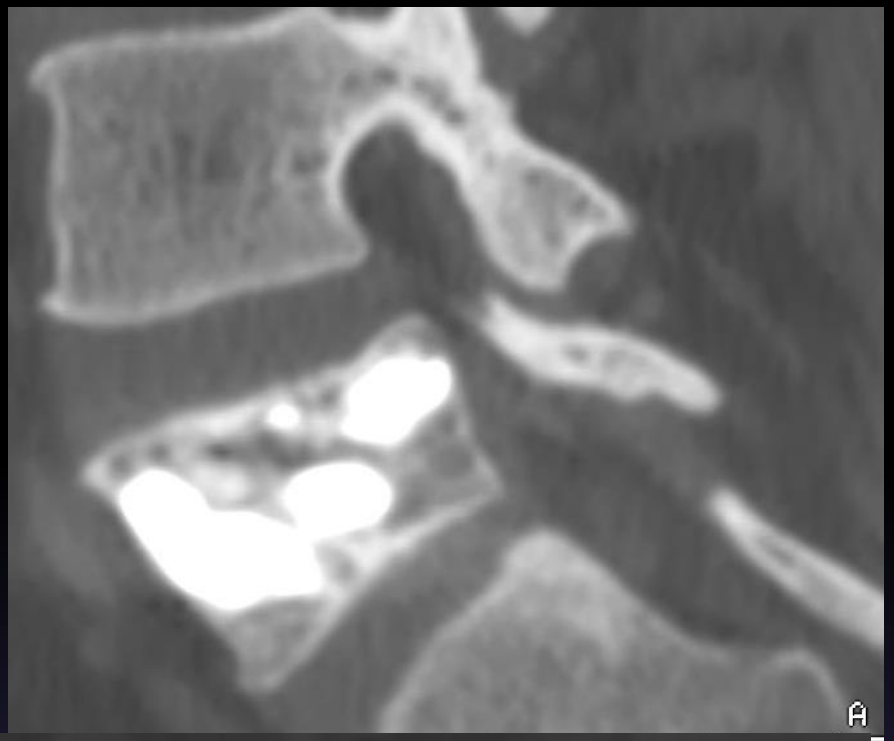


Aneurysmal Bone Cyst



Injection
Osteoconductive Material (cerament)
Bilateral approach
8 ml


S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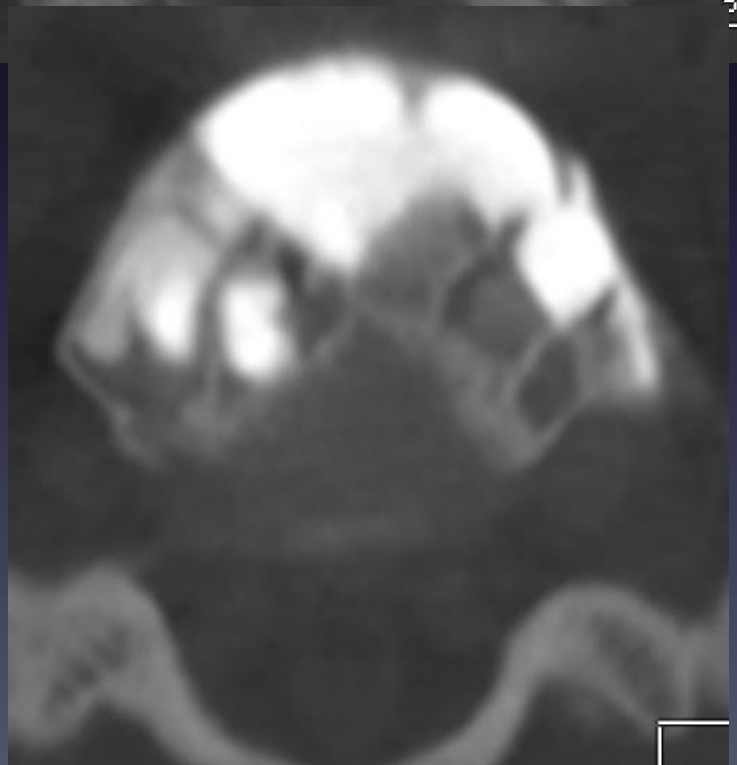

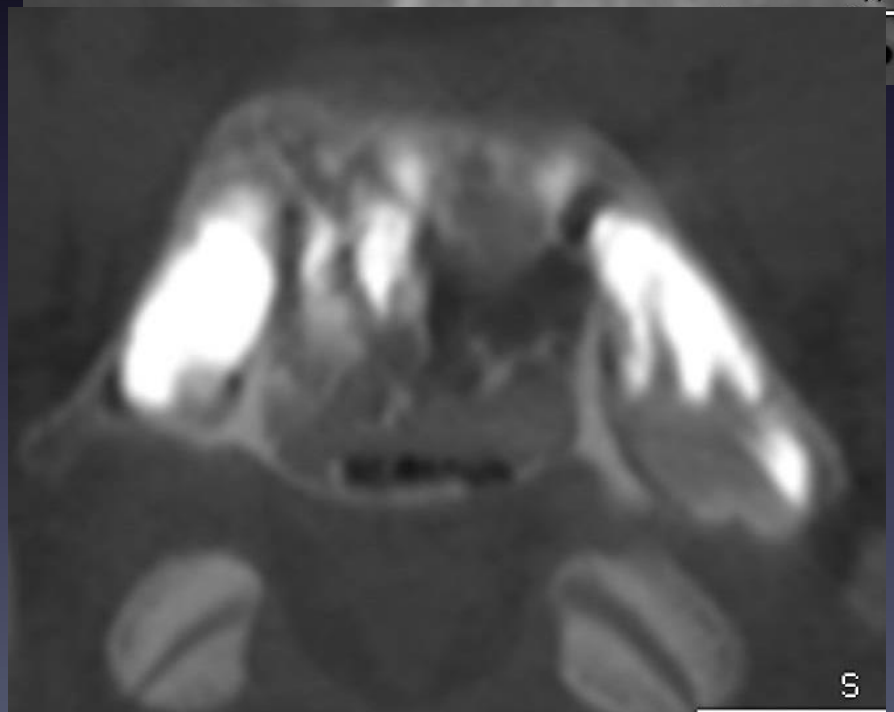
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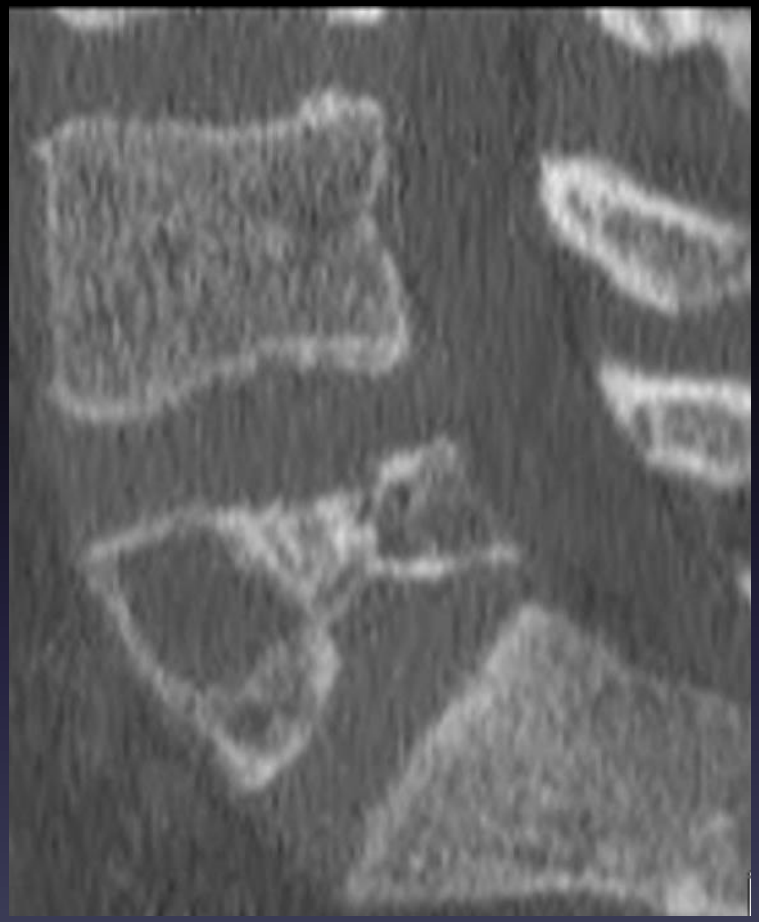
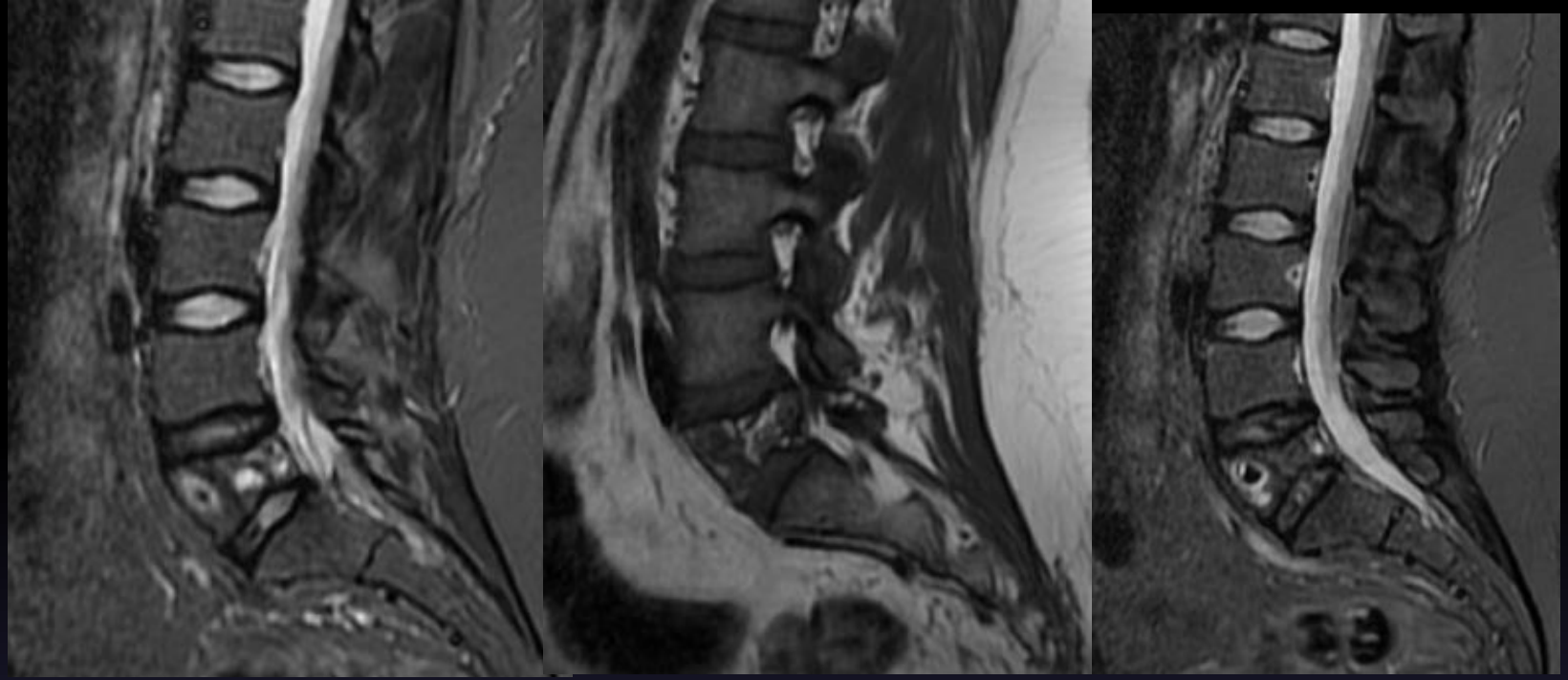
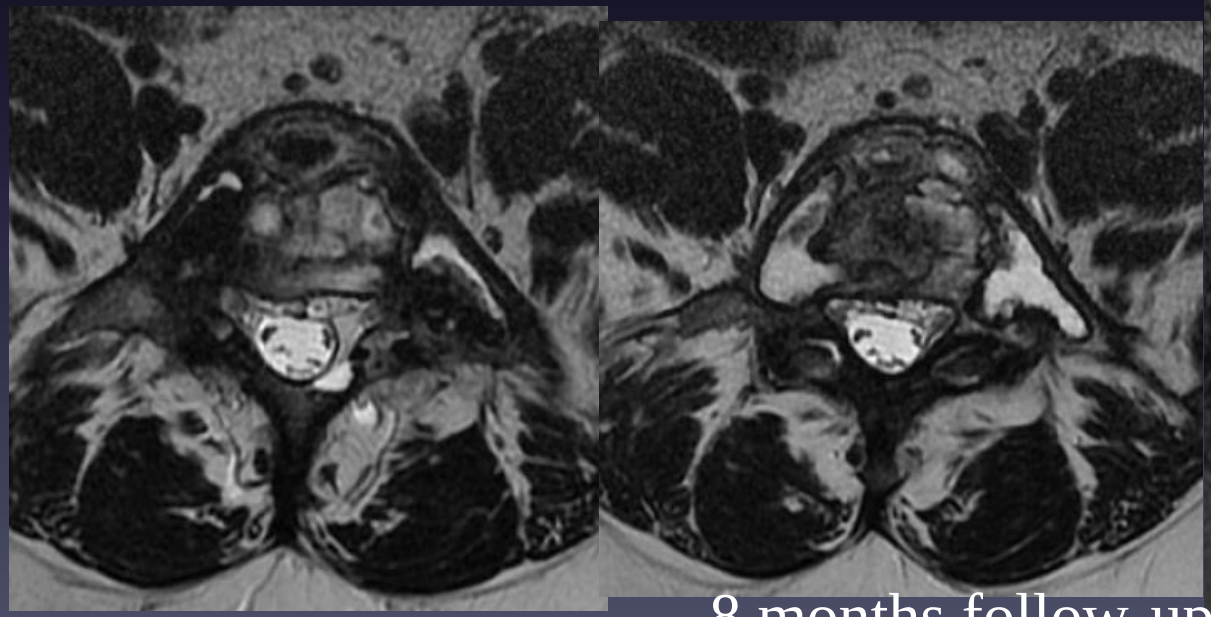
2 months follow-up

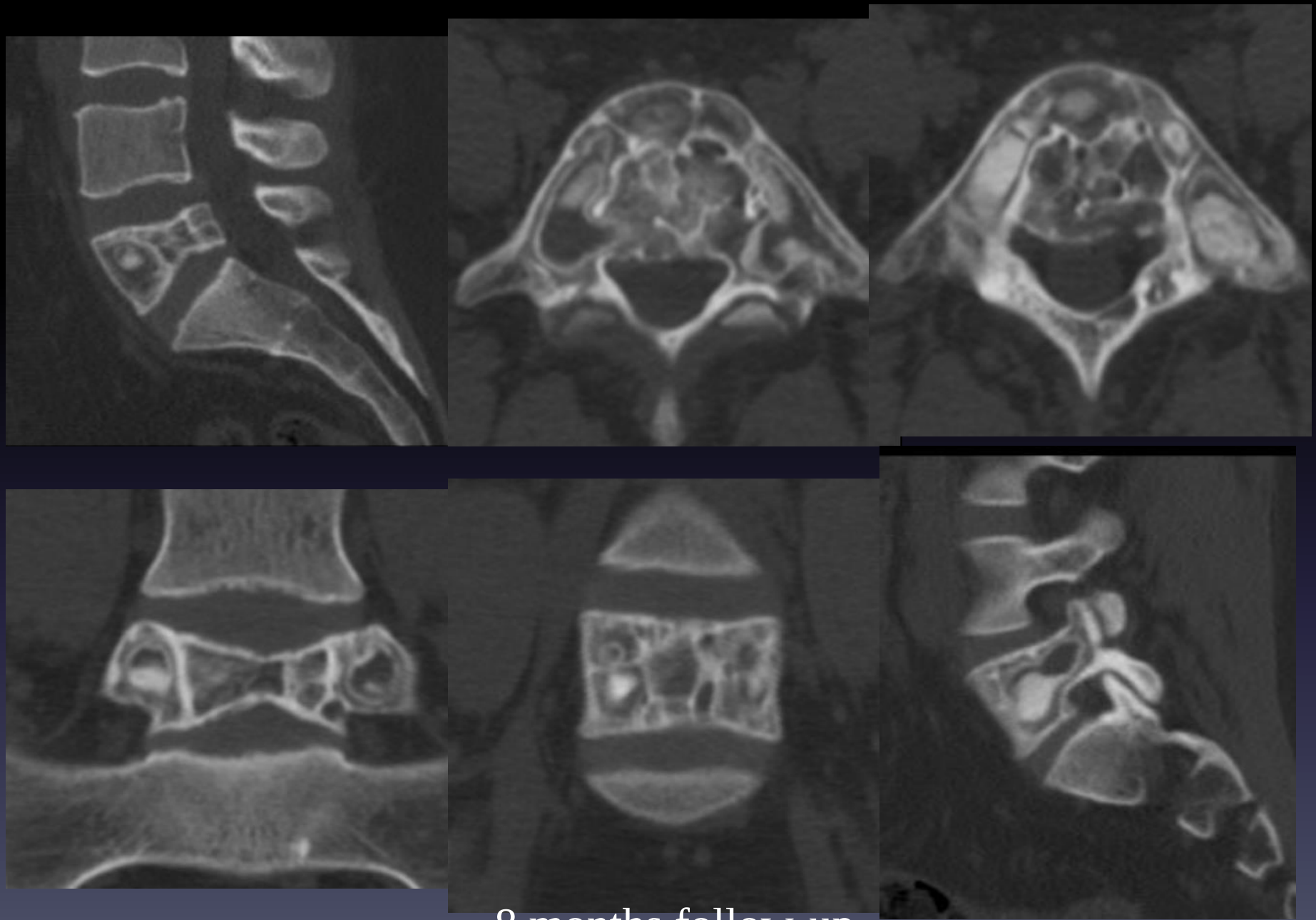


G Guarnieri P Vassallo, M Muto, **M Muto** J Neurointerv Surg. 2013 Nov 8. Percutaneous treatment of symptomatic aneurysmal bone cyst of L5 by percutaneous injectionof osteoconductive material (Cerament)





8 months follow-up



8 months follow-up

HEMANGIOMA

Most common vertebral tumor: 12% in adults
Multiple lesions in 25-30% of cases, expecially thoracic
capillar venous **cavernoma.**
mature vascular space between bone stroma and fatty tissue
Hypodense at CT , hyperintensity with MR
Posterior elements in 10-15%

Interventional approach

Target : pain reduction, stabilize
reduce vascularization (pre-surgical)
or as only treatment

1) VP- venous embolization- overfill

2) Endovascular

Vertebroplasty in the treatment of osteoangioma. Guarnieri G, Muto M. And coll Neuroradiology July 51, 7, 471-476 2009

Int J Radiat Oncol Biol Phys. 2012 Feb 1;82(2)

Radiotherapy of painful vertebral hemangiomas: the single center retrospective analysis of 137 cases.

Miszczyk L1, Tukiendorf A.

the gold standard remains 36–40 Gy delivered in 2 Gy fractions.

Table 1. Percentages of patients using different of analgesics before RT and during consecutive control examinations

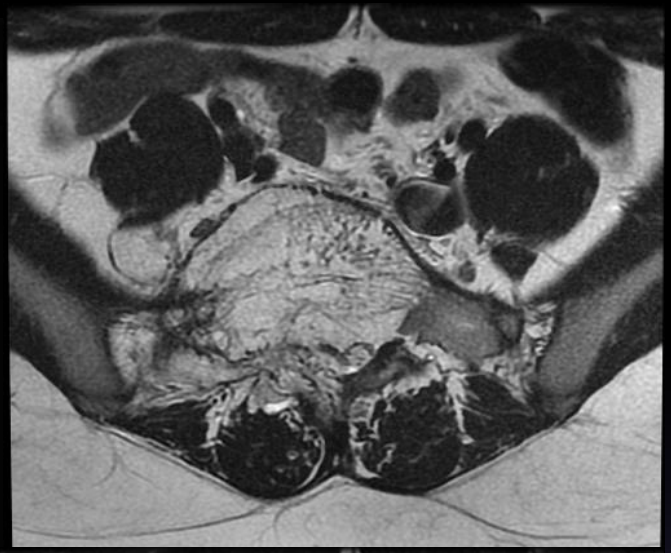
Type of analgesics dispensed	Before RT	1 month after RT	6 months after RT	12 months after RT	18 months after RT	The final control*
No need for analgesics uptake	21.5%	39%	40%	44%	57%	46%
Nonsteroidal anti-inflammatory drugs	47%	40.5%	43%	32%	31.5%	38%
Tramadol	31.5%	20.5%	17%	24%	11.5%	14%
Opioids	0%	0%	0%	0%	0%	2%

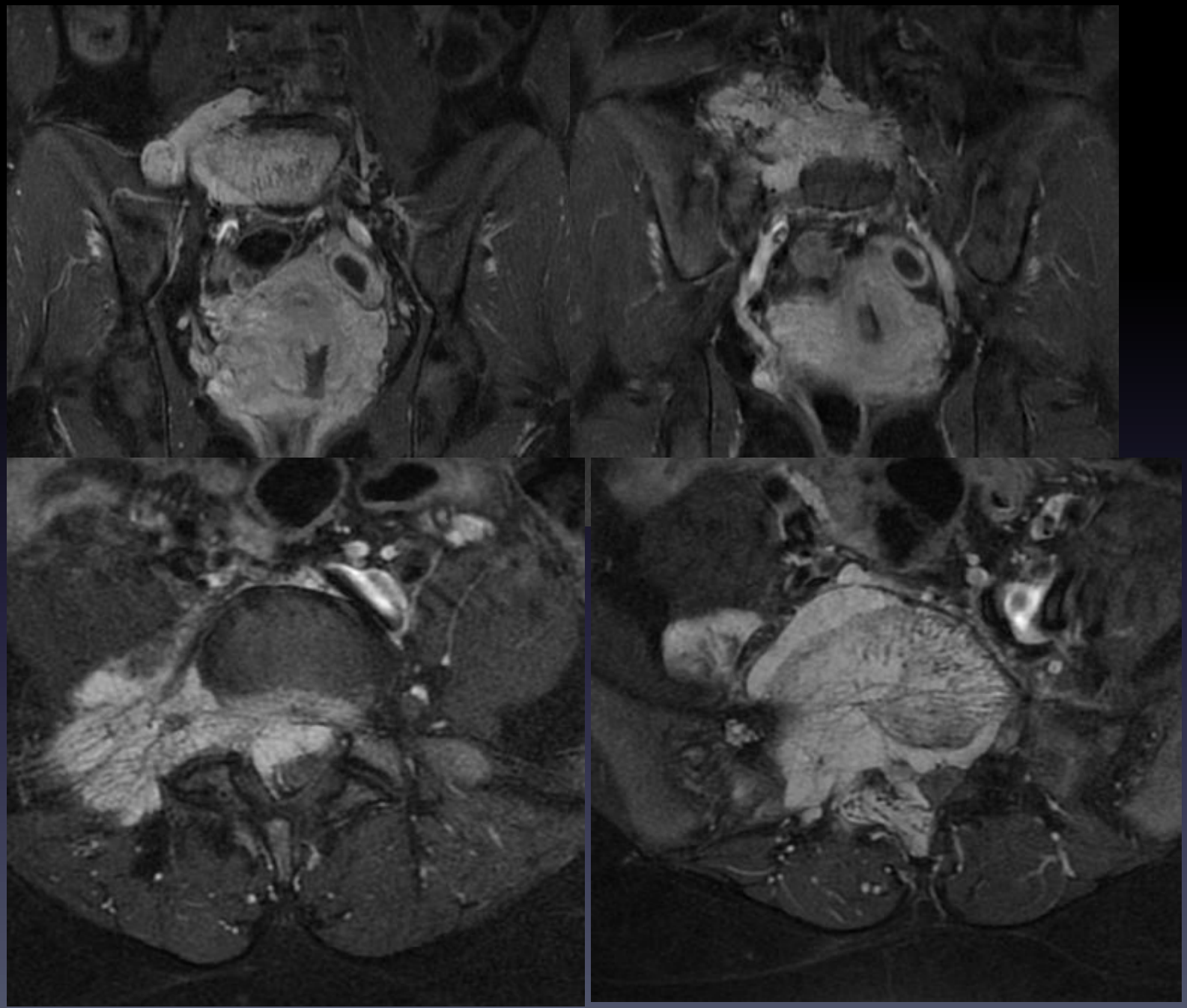
Table 2. The percent of cases presenting partial reossification or fatty conversion of hemangioma during consecutive control examinations

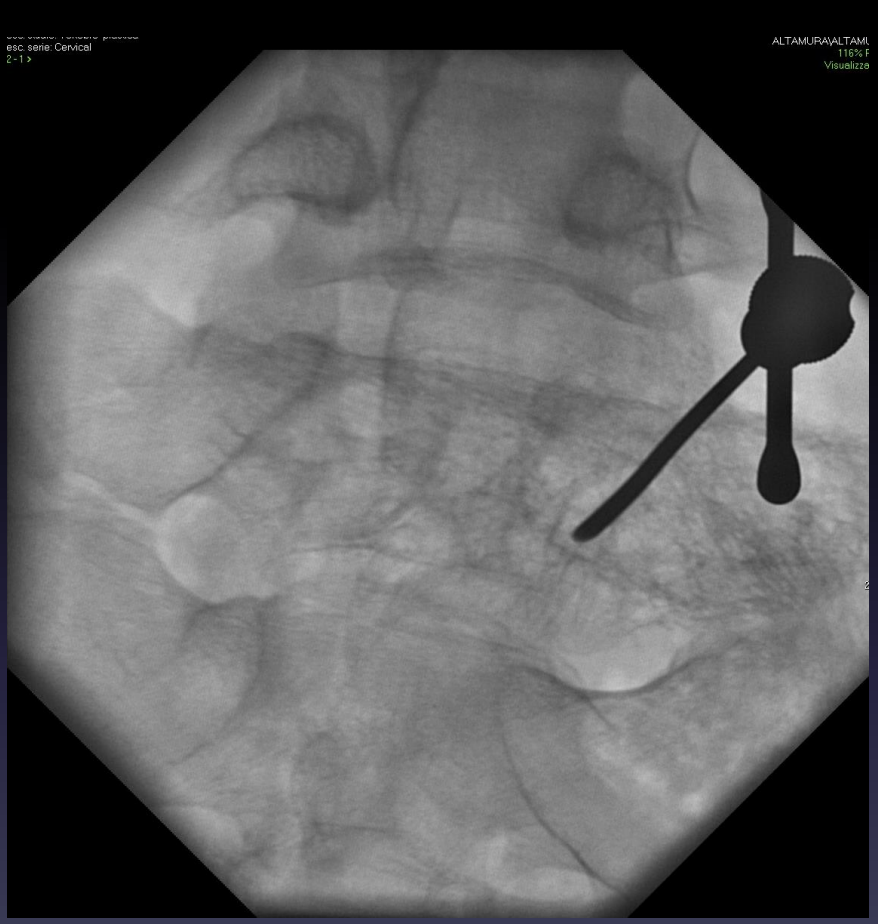
	1 month after RT	6 months after RT	12 months after RT	18 months after RT	The final control*
Reossification or fatty conversion	20%	28%	33.3%	28.5%	33%

Int. J. Radiation Oncology Biol. Phys., Vol. 82, No. 2, 173–e180, 2012



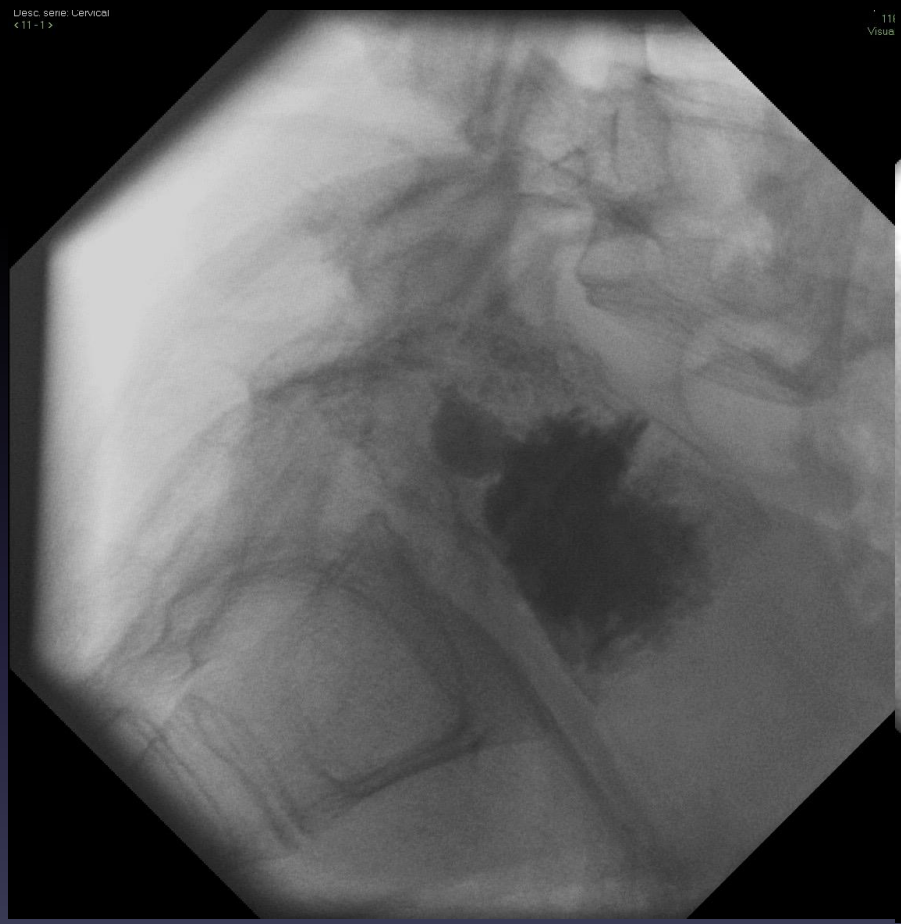



esc. serie: Cervical
2-1 >
ALTAMURA\ALTAM
116% F
Visualizza


1 >
116%
Visualiz


Desc. studio: Vertebro plastica
Desc. serie: Cervical
< 10 - 1 >
122k
ALTAMURA\ALTAMUR
116% Pix
Visualizzato


Desc. serie: Cervical
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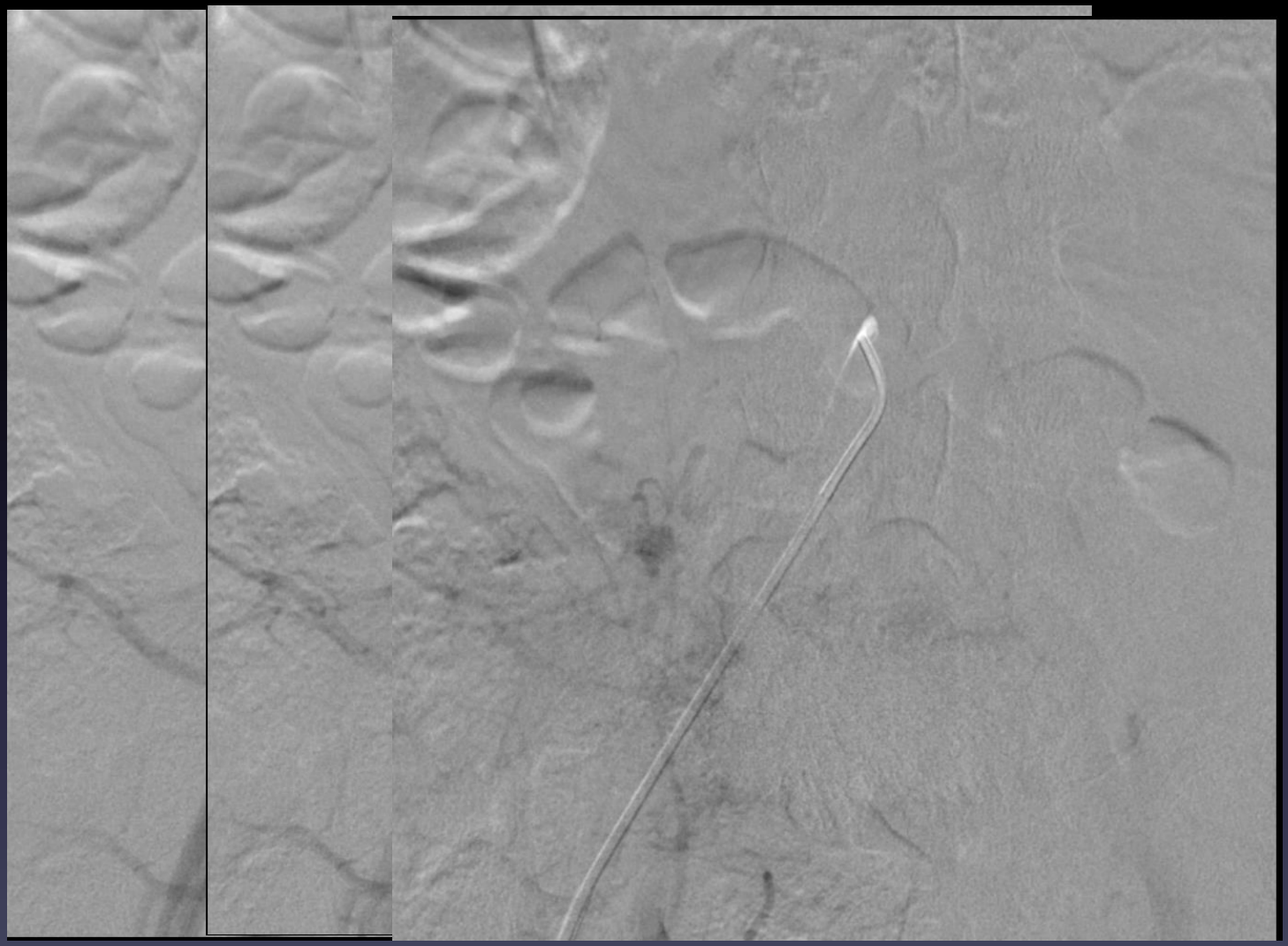
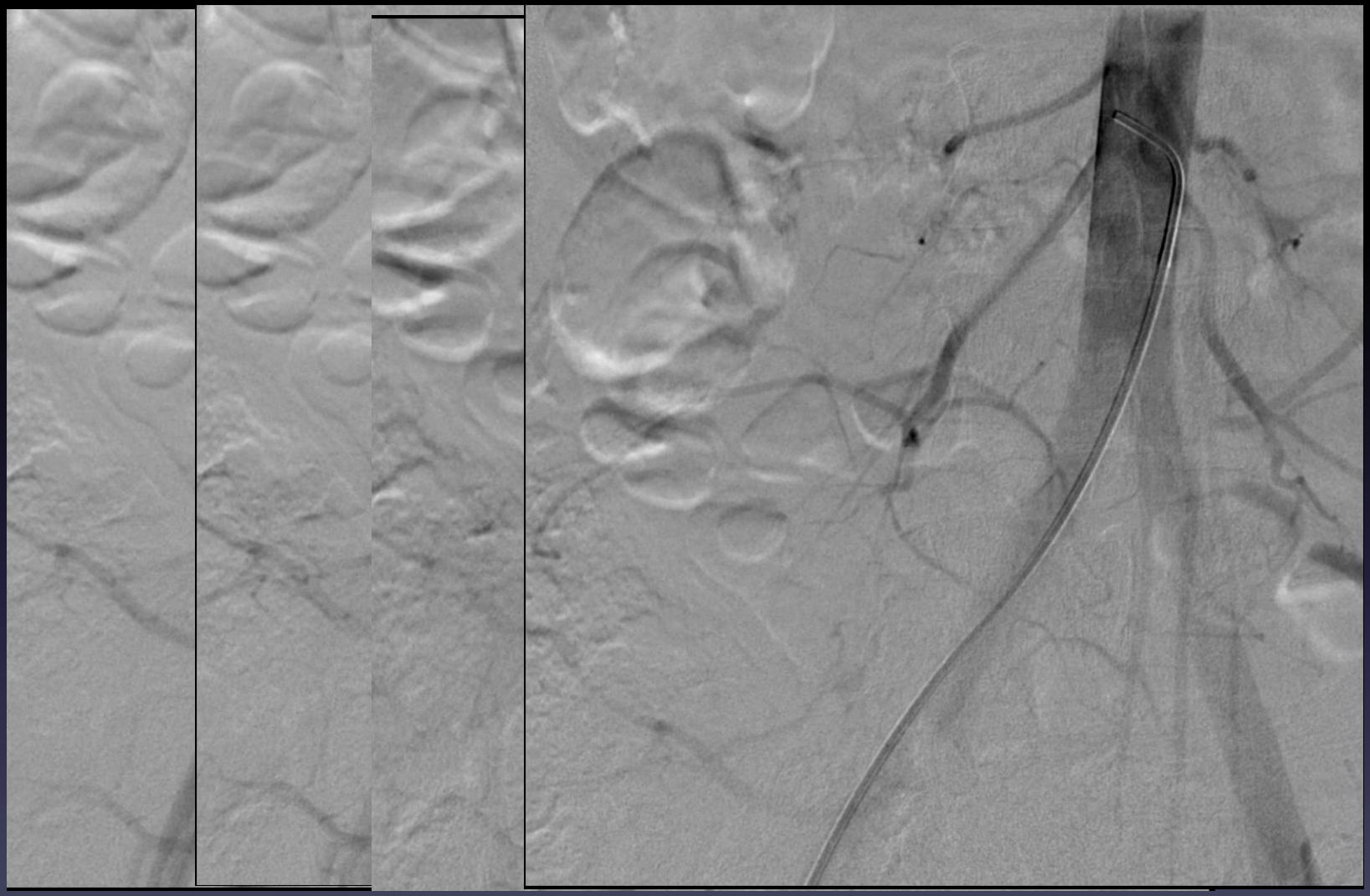
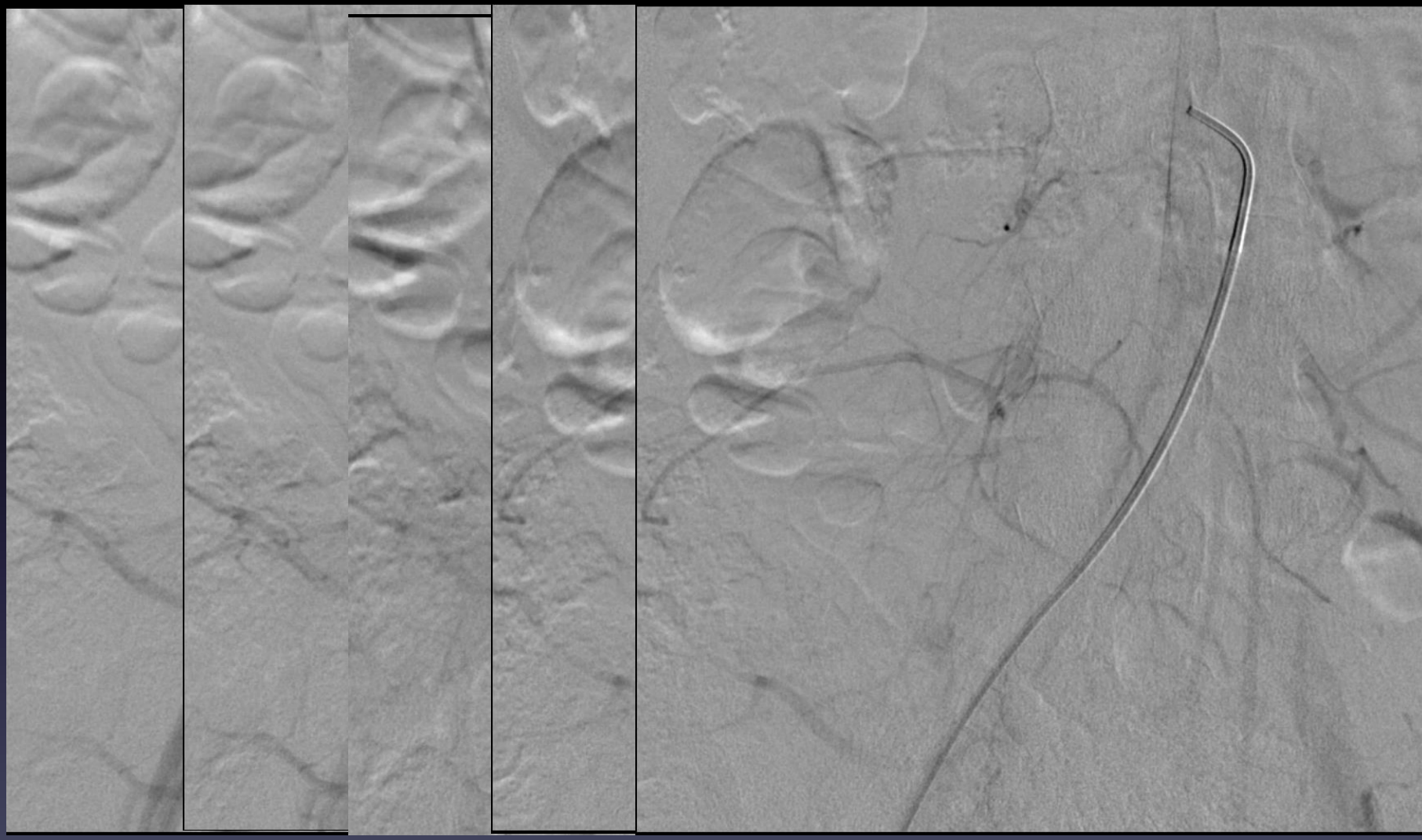
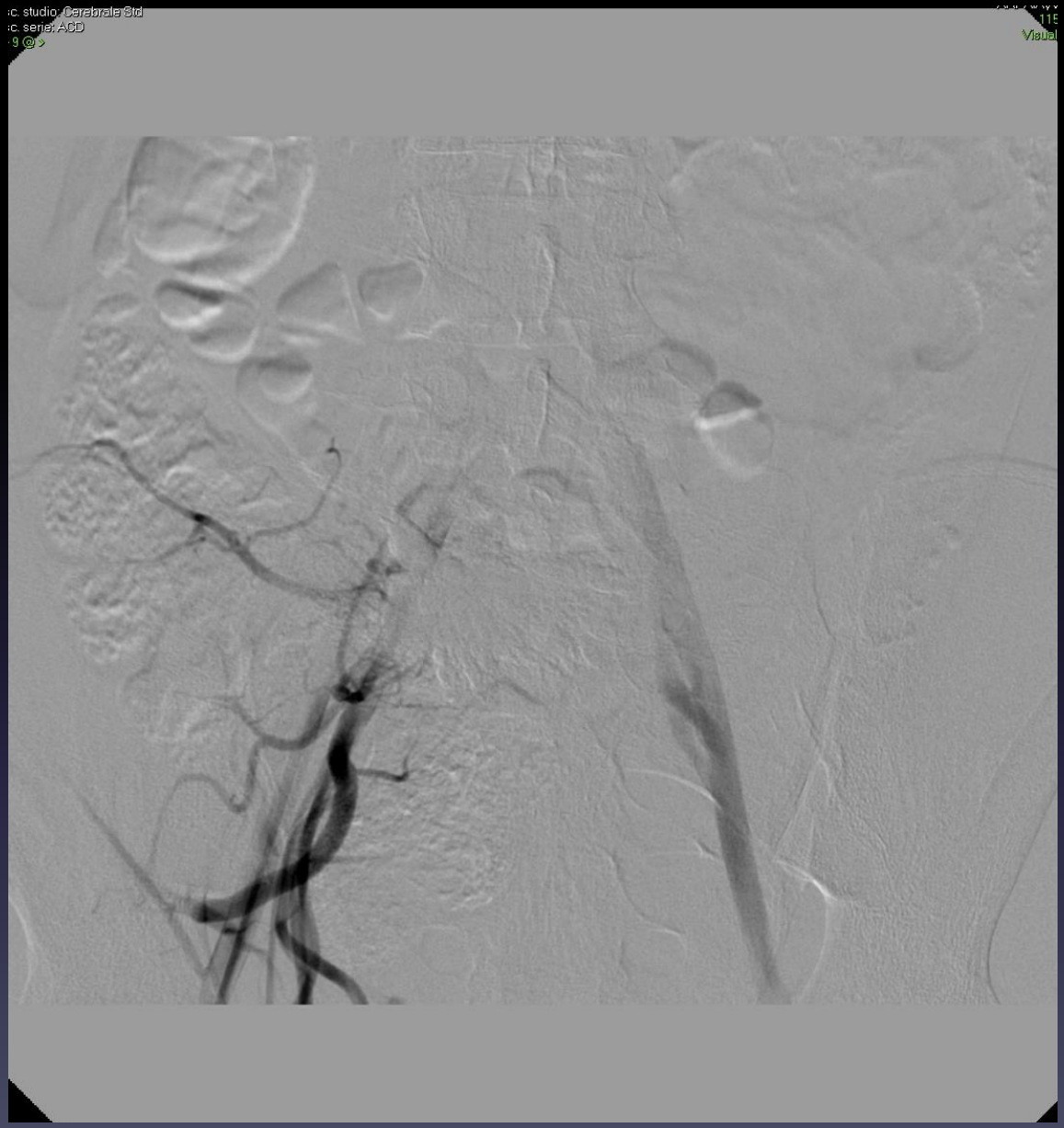
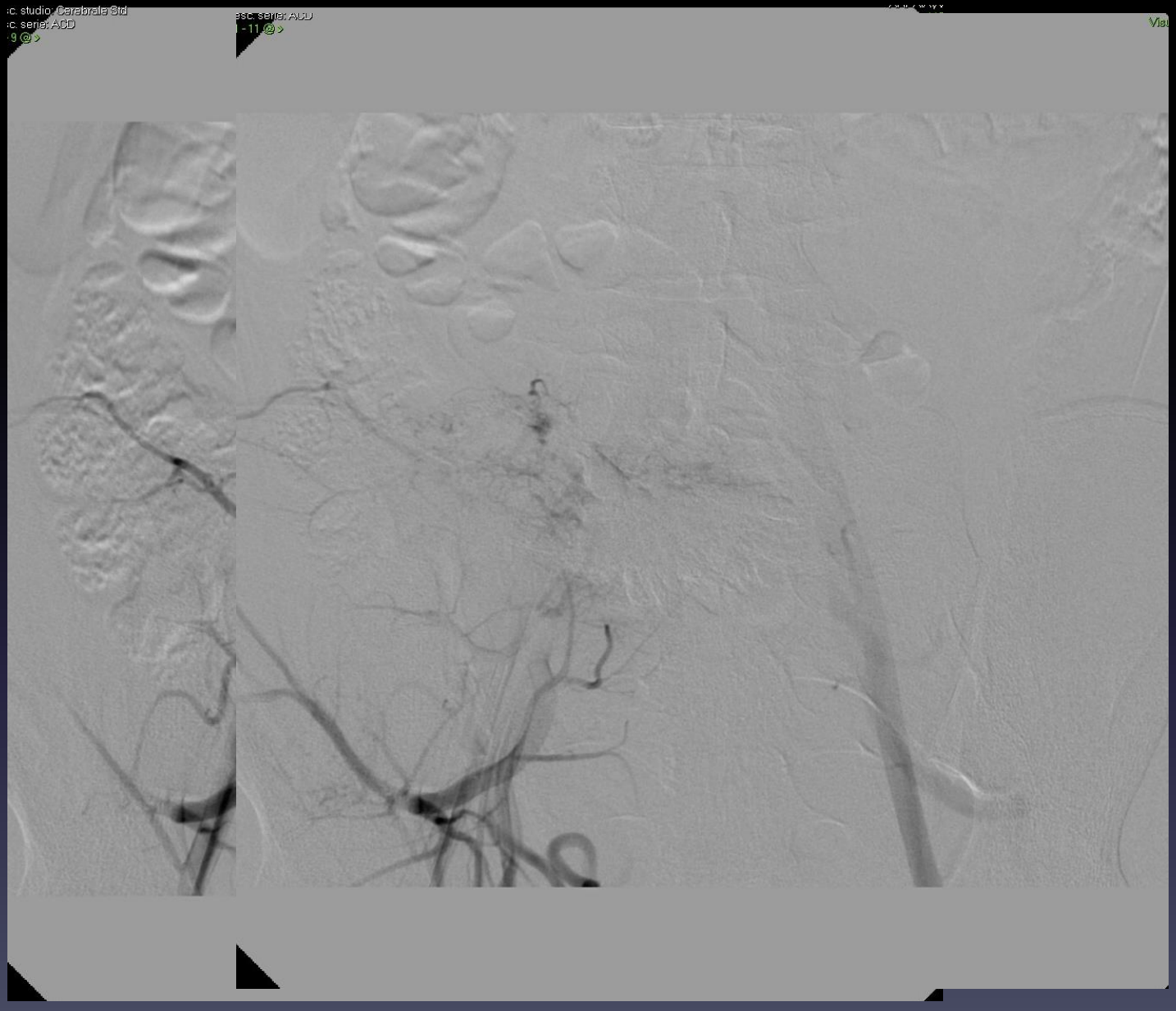
erie: Cervical
116% F
Visualizzat








c. studio: Cerebrale Std
c. serie: ACD
9 @ >
Visual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esc. serie: ACD
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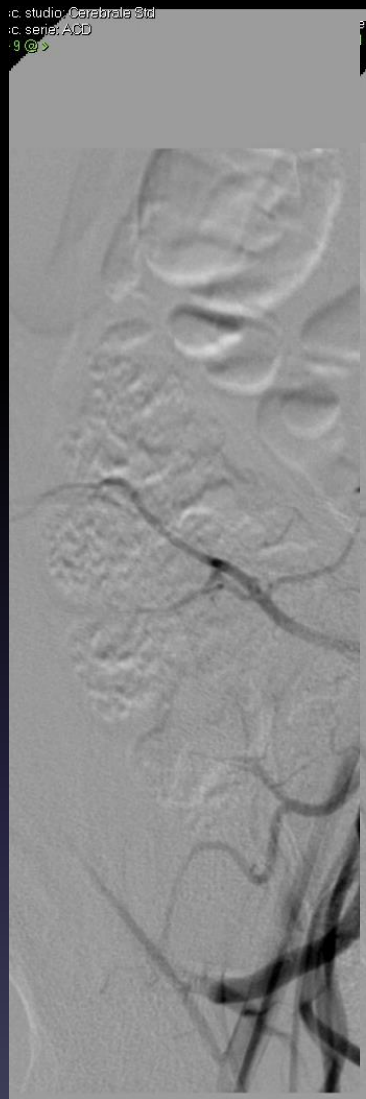
c. studio: Cerebrale Std
c. serie: ACD
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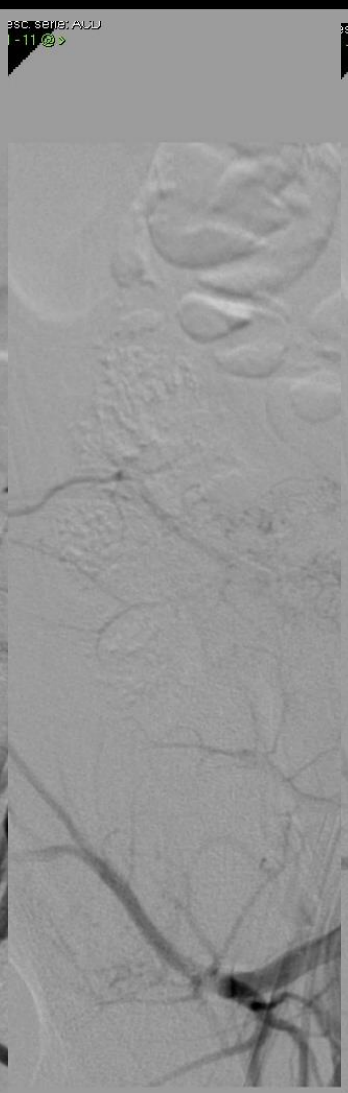
esc. serie: ACD
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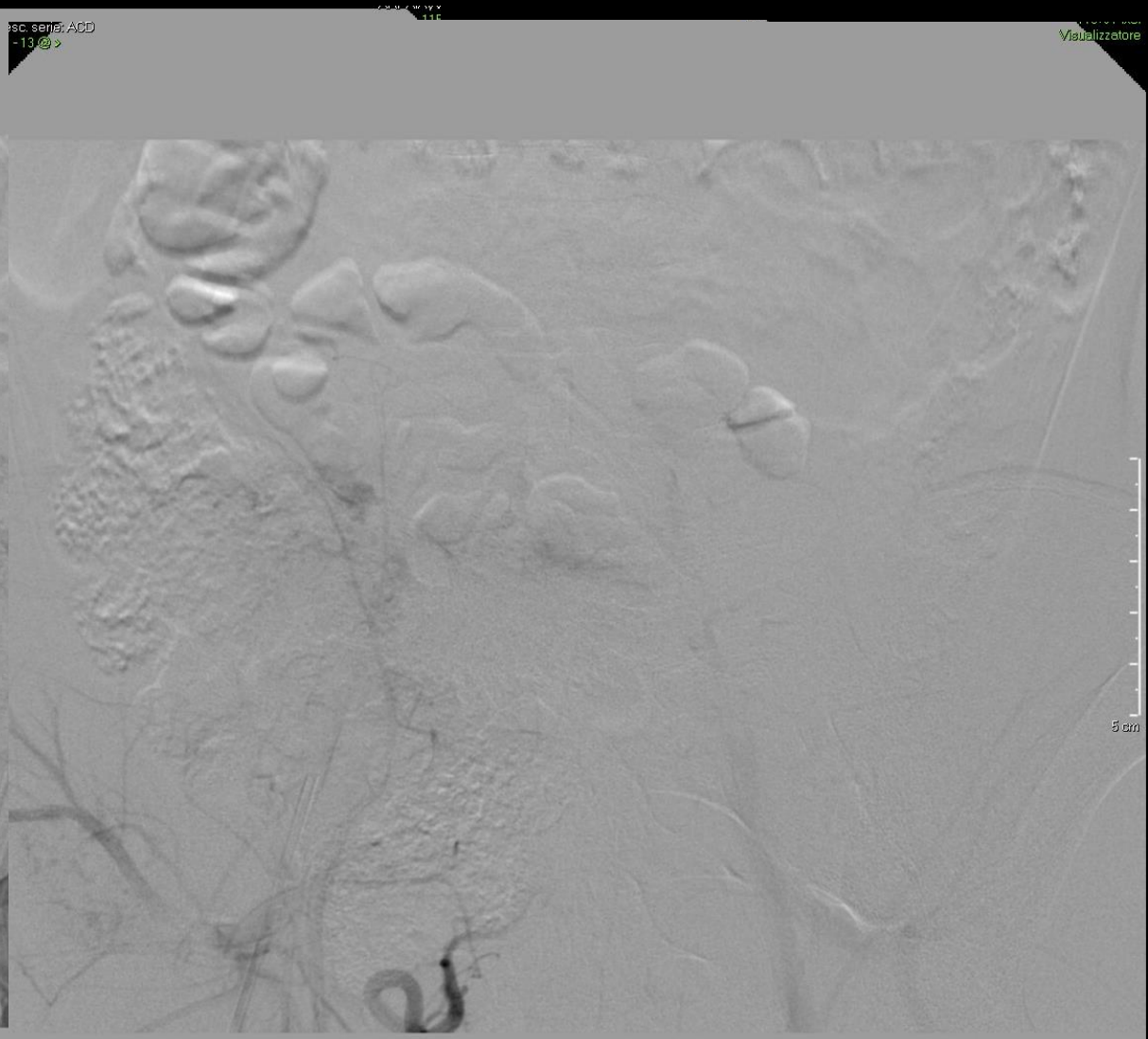

esc. serie: ACD
- 13 @ >
Visualizzatore
5 cm

J Neuroradiol. 2013 Feb 15.

Percutaneous ethanol embolization and cement augmentation of aggressive vertebral hemangiomas at two adjacent vertebral levels.

Cianfoni A1, Massari F, Dani G, Lena JR, Rumboldt Z, Vandergrift WA, Bonaldi G.

Cardiovasc Intervent Radiol. 2013 Dec 3.

Aggressive Vertebral Hemangioma Treated with Combination of Vertebroplasty and Sclerotherapy Through Transpedicular and Direct Approach.

Kelekis A1, Filippiadis DK, Martin JB, Kelekis NL.

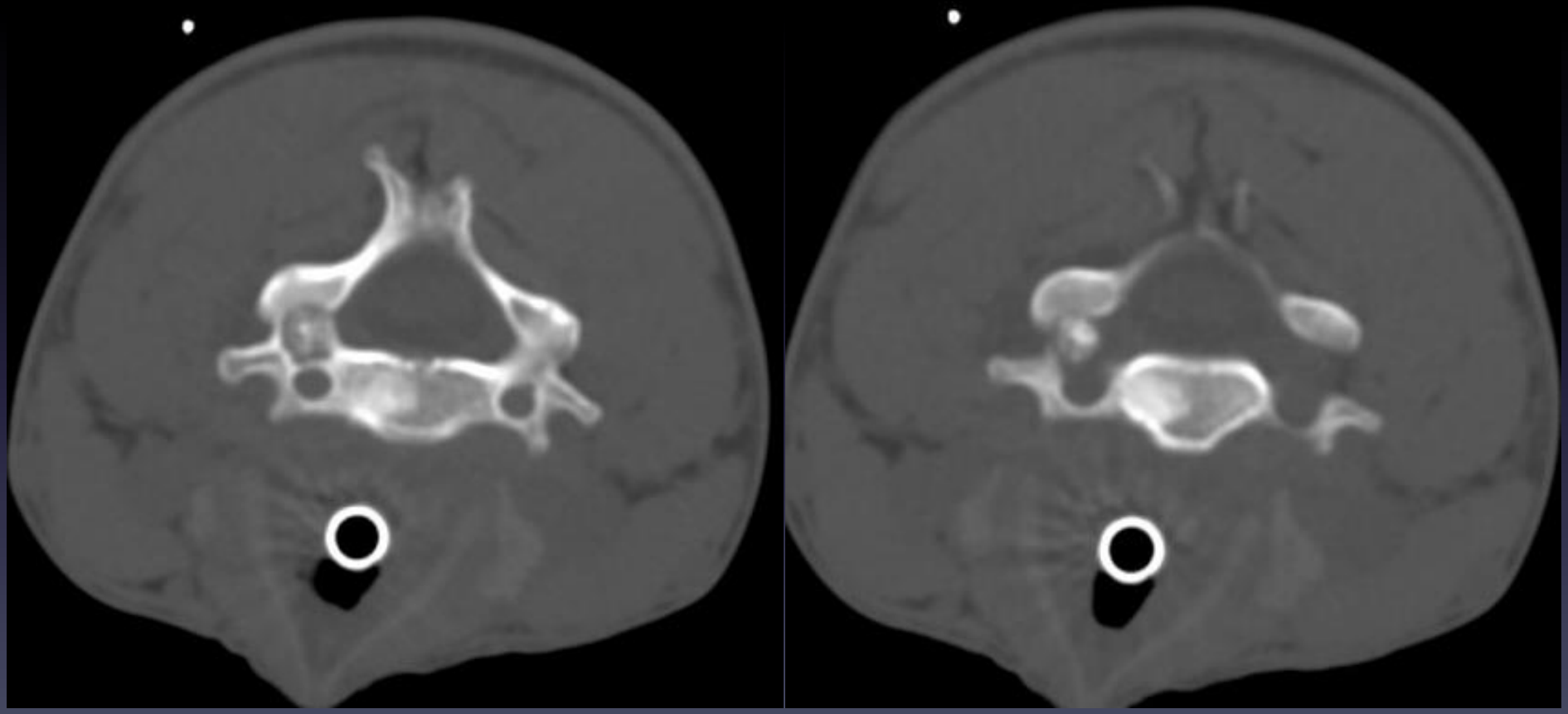
OSTEOID OSTEOMA

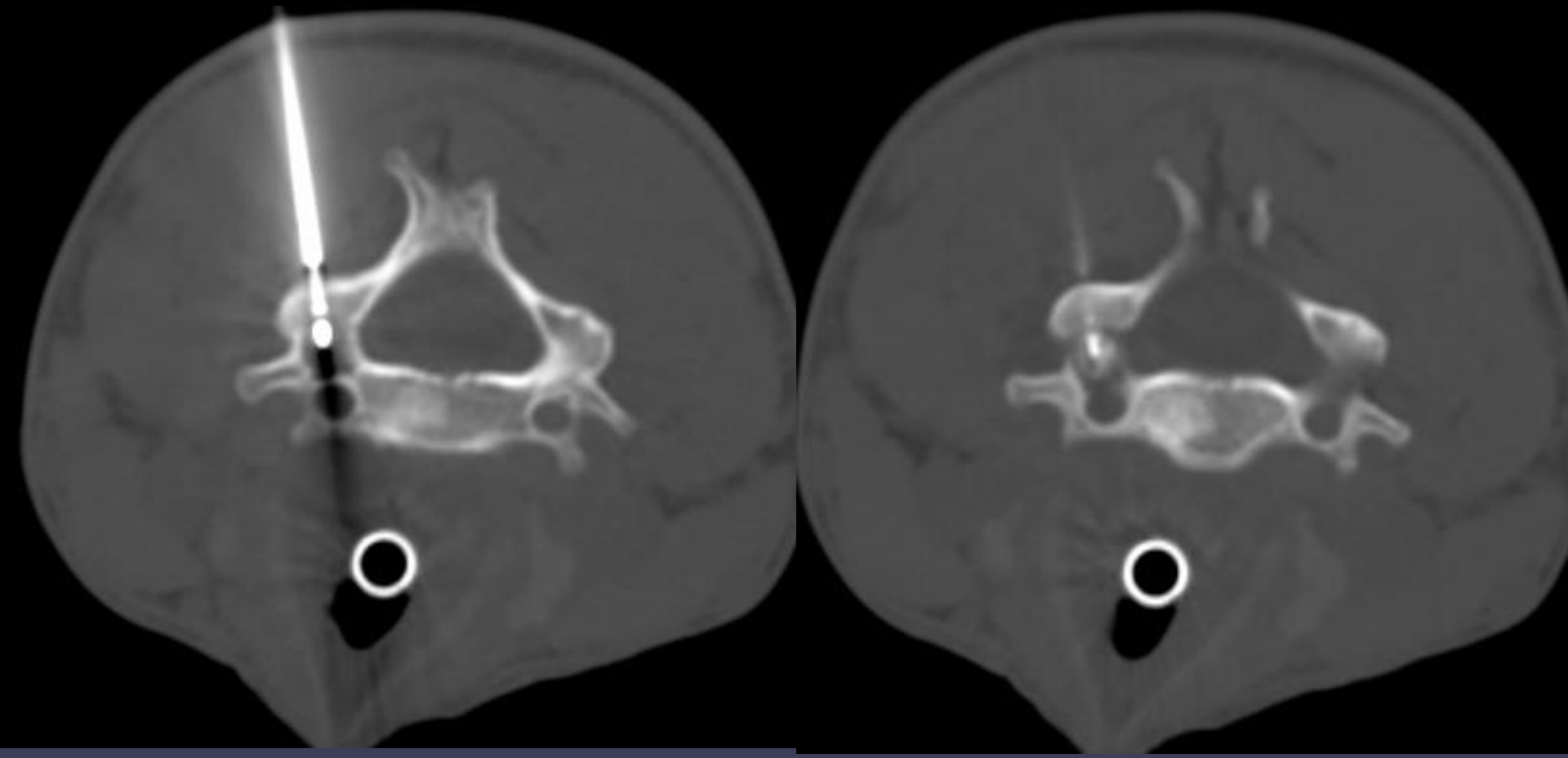
Osteoblastic benign tumor producing osteoid tissue
Radiological finding: radiolucent nidus <1,5 cm
surrondend by sclerotic rim
10% are vertebral almost all in posterior arch.

Focal painful scoliosis with concavity omolateral to the tumor.
High rate false negative with MR (volume averaging)
MR with contrast media inj more sensitive : nidus >> reactive area
CT >> MR

D.D: Osteoblastoma
stress fracture/ unilateral spondilolysis
sclerotic metastasis

OSTEOID OSTEOMA - CERVICAL



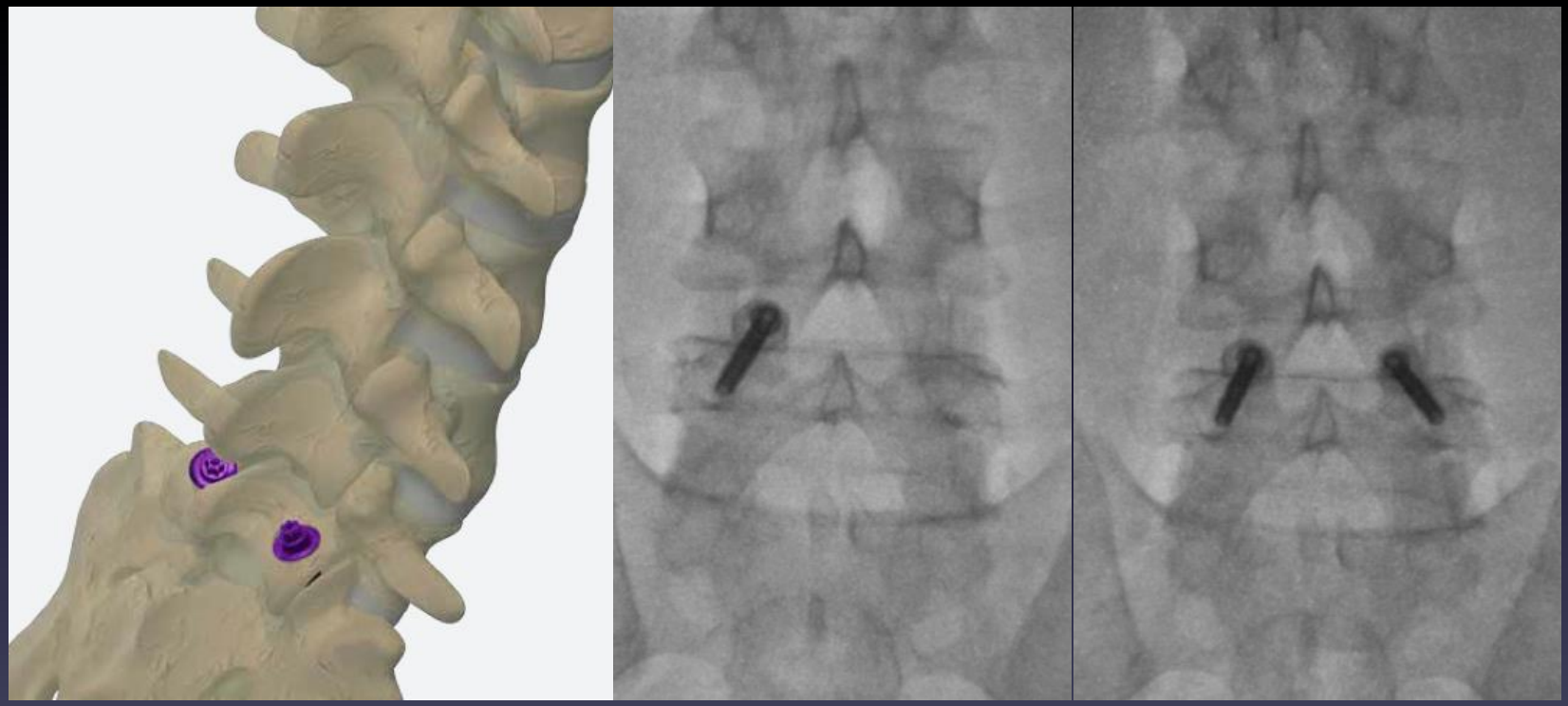


Percutaneous facet stabilization

Introduction of the screw through the screw driver

Procedure

Final result



Procedure

CT check after procedure

NO BIOMECHANICAL CHANGES

SPINE Volume 28, Number 12, pp 1226–1234

A Biomechanical Comparison of Facet Screw Fixation and Pedicle Screw Fixation

Effects of Short-Term and Long-Term Repetitive Cycling

Lisa A. Ferrara, MS, Jessica L. Secor, BS, Byung-ho Jin, MD, Andrew Wakefield, MD, Serkan Inceoglu, MS, and Edward C. Benzel, MD

Conclusions. The stability provided by both transfacet pedicle screw fixation and traditional pedicle screw fixation was not compromised after repetitive cycling. In this model, transfacet pedicle screw fixation appears equivalent biomechanically to traditional pedicle screw fixation.

NO BIOMECHANICAL CHANGES

Biomechanical Comparison of a Novel Percutaneous Transfacet Device and a Traditional Posterior System for Single Level Fusion

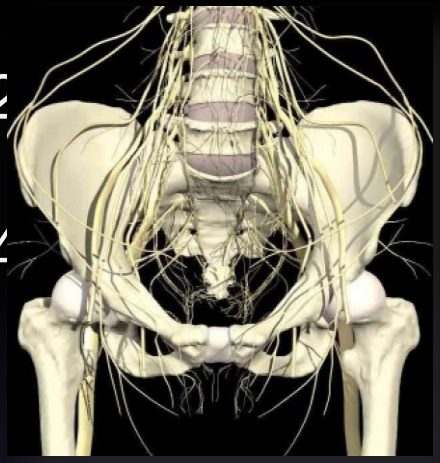
Andrew Mahar, MS,† Choll Kim, MD, PhD,* Richard Oka, BA,† Tim Odell, BS,† Andrew Perry, MD,* Srdjan Mirkovic, MD,‡ and Steve Garfin, MD**

attractive surgical option for single-level spinal fusions. A biomechanical evaluation of a novel device for this application demonstrated similar stability to a pedicle screw system. The length adjustability of the device may alleviate concerns for precise device placement and the biomechanical stability may produce similar rates and quality of posterior spinal fusions.

Courtesy L. Manfrè

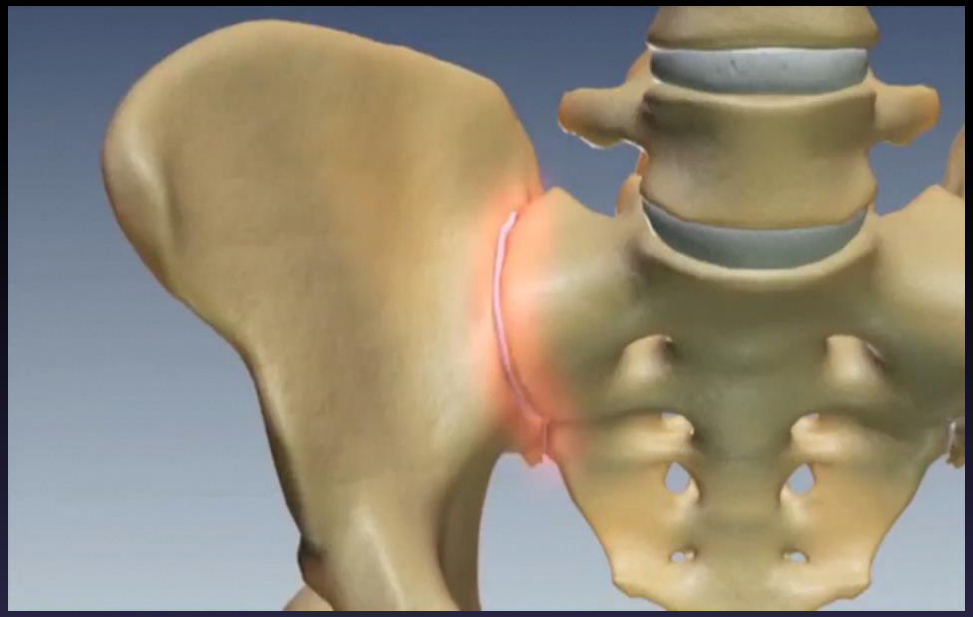
INNERVATION

Anterior
from L2 to S2
Posterior
from L4 to S4



SACROILIAC INSTABILITY

Frequently unknown…



SIJ INSTABILITY

5-25% of ALL Low Back Pain!!!

Polly, Sembrano Spine 2008
Cohen, SA Anesthesia and analgesia 2005

PIF increase sacroiliac mechanical stress

75% of patients have SI after PIF in 5 years

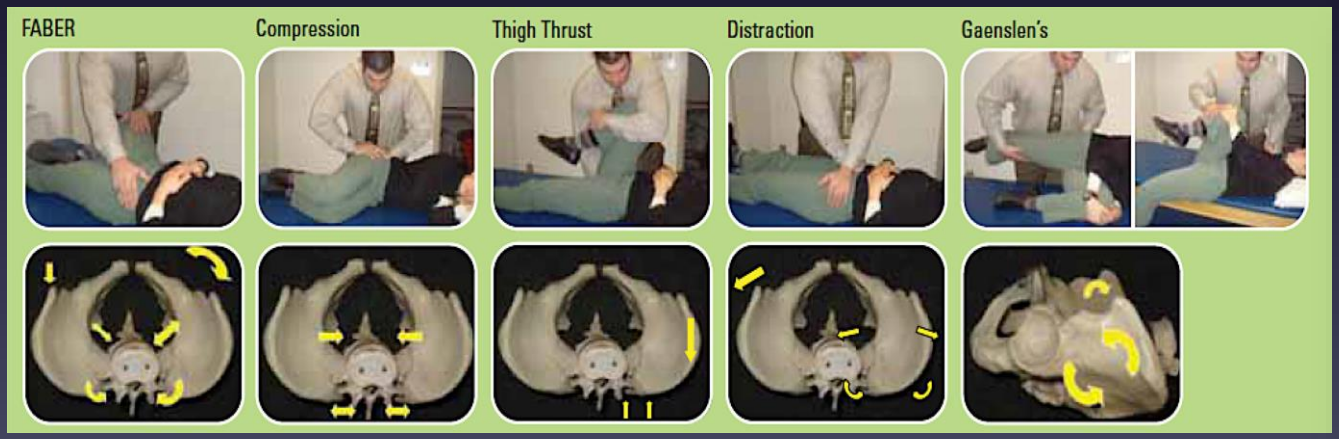
HA Young , Spine 2008, Ivanov Spine 2009

After Delivery / Post-Partum syndrome

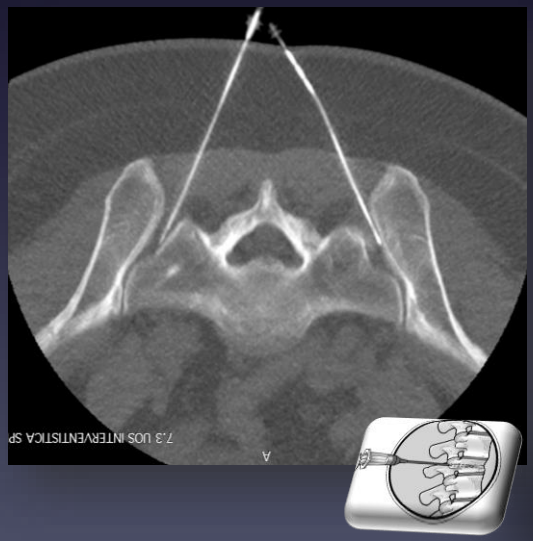
Symptoms

- ✓ Low Back Pain (generally L5 to S2 level)
- ✓ Pelvic, Buttom Pain +++ when seated
- ✓ Coxofemoral Pain
- ✓ Leg Numbness / Dizzness
- ✓ Insomnia
- ✓ Ipsilateral limb instability

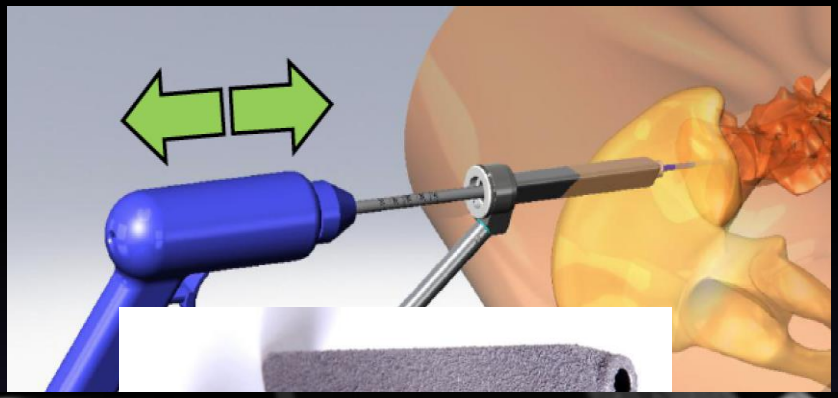
Diagnosis



CT GUIDET LIDOCAINE INFILTRATION: *THE BEST*



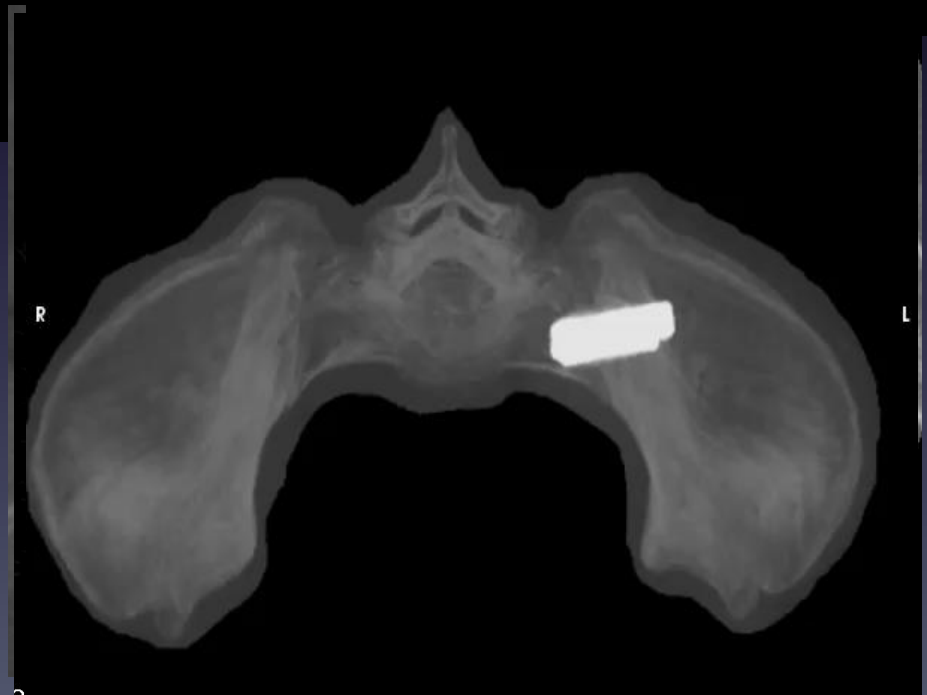
SI-BONE I-FUSE EU / USA first CT-guided treatments



STABILIZATION

- *Phase 1* 3-6 wks: extra-articular (intraprothesis bone regrowth) 90%
- *Phase 2* 10-12 wks: intra-articular

(intraarticular bone regrowth) 10%



PRIMARY OR SECONDARY SPINE PATHOLOGY

Multiple myeloma

Spine mets

MULTIPLE MYELOMA

Nature of Spine Metastases

Type and Extent of Lesion	Number of Cases	Percent of Cases
Osteoblastic	45	8,0%
Osteolytic	**399**	**70,9%**
Mixed	**119**	**21,1%**
Involving 1 Vertebra	77	13,4%
Involving > 1 Vertebra	**486**	**86,3%**
Lesion of entire Vertebra	81	14,4%
Lesion of Vertebral Body	252	44,8%
Lesion of Posterior Arch	228	40,5%

Metastatic Spinal Metastases are commonly osteolytic and affect multiple vertebrae.

- 600 cases of spinal metastases were reviewed of which 563 had characteristics of bone lesions
- Examined according to clinical characteristics, type of primary tumor, site of lesion, and survival
- Active treatment occured in all but 7 of the cases

Constans, JP. et al. Spinal metastases with neurological manifestations. J. Neurosurg 1983

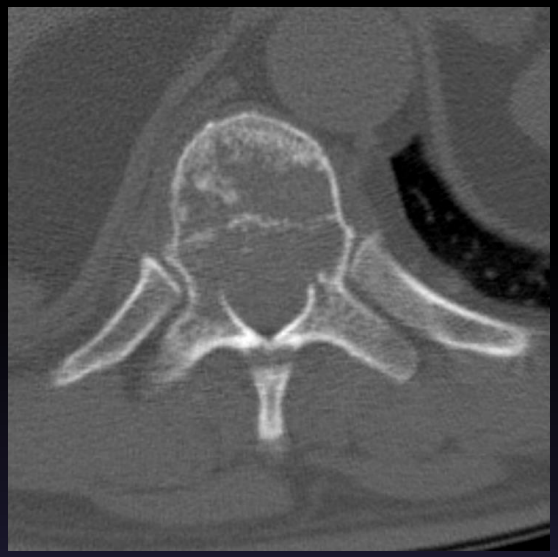
What offer these therapies?[2]

Therapy aims in the treatment of bone metastases

	Paintherapy	Recovery/ Regain of stability	Skeletal related events (SRE)	Tumor control (local)
RF-Ablation	✓	✓	✓	✓
Radiotherapy	8 - 30 Gy (16 w)	30 Gy		> 50 Gy
Nuklidtherapy	✓			
Chemotherapy				✓
Bis//D-mab	✓		✓	
Surgical Intervention		✓	✓	✓
Cement	✓	✓	✓	

2 Coleman et. al.: Handbook of Cancer-Related Bone Disease, BioScientifica (2012)

SPINE METS



Spine Instability Neoplastic Score (SINS)

Location :
- Junctional (C0-C2, T11-L1, L5-S1): 3
- Mobile segment (C3-C6; L2-L4): 2
- semirigid (D3-D10): 1
- rigid (S2-S5): 0

Allignement with x-ray:
- subluxation/translation: 4
- new deformity: 2
- normal: 0

Type of lesions:
- lytic: 2
- miste: 1
- blastic: 0

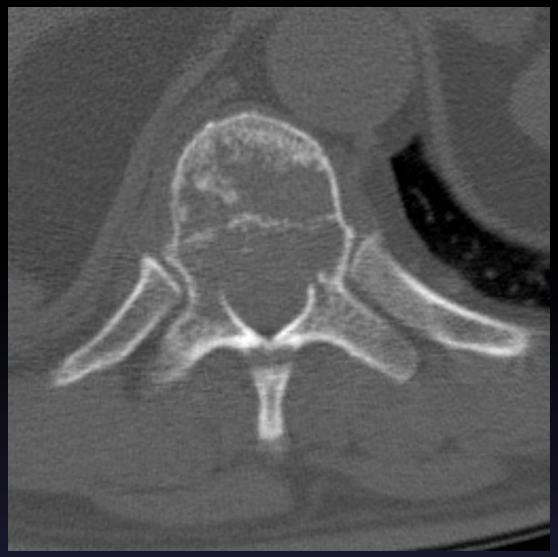
Pain :
- meccanic: 3
- not meccanic: 1
- absent: 0

Post. Arch inv:
- bilateral: 3
- unilateral: 1
- absent: 0

0-6= stable
7-12= possible instability
13-18=instability

Body involv:
- >50% collapse: 3
- <50% collapse: 2
- no collapse with >50% of the soma: 1
- none of the previous: 0

Fisher CG, Ryken TC, Berven SH et Al. A Novel Classification System for Spinal Instability in Neoplastic Disease. Spine 35(22): 1221-1229,2010.



Location T11	3
Lytic	2
Pain	3
Allignment	0
Posterior arch	1
Body involv	3

Total 12 possible instability

HOW CAN YOU MANAGE THIS LESION ?

Surgery ?
RT ?
CHT?
VP?
RF?

Combined therapy ?

RF Kyphoplasty Technology

1. MultiPlex Controller

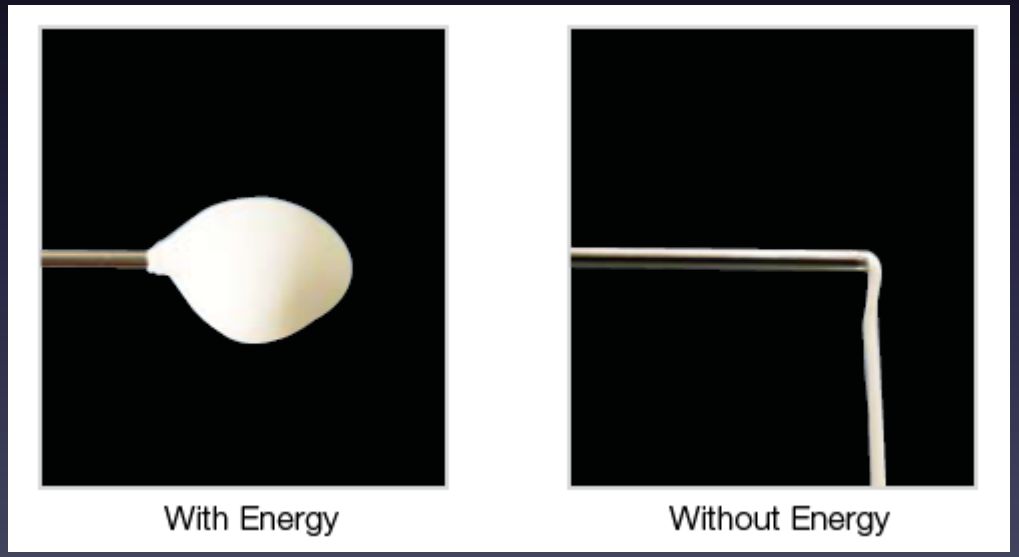
2. StabiliT® ER² Bone Cement & Saturate Mixing System

3. Disposables

Hydraulic Assembly
Activation Element
AE Cable
Hand Switch Cable (10 ft.)
Locking Delivery Cannula
VertecoR® MidLine Cement
Staging Osteotome
VertecoR® StraightLine Cement
Staging Osteotome

- Minimizes potential for extravasation
- Injection rate 1.3 ml /min, high viscosity

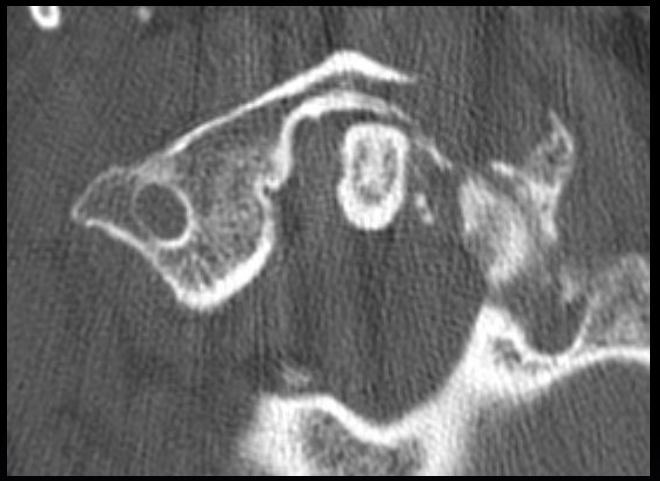
®

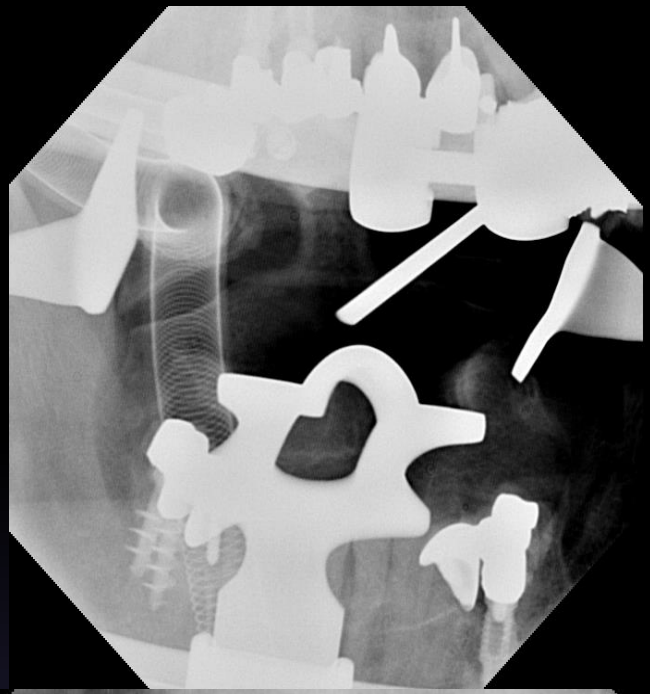


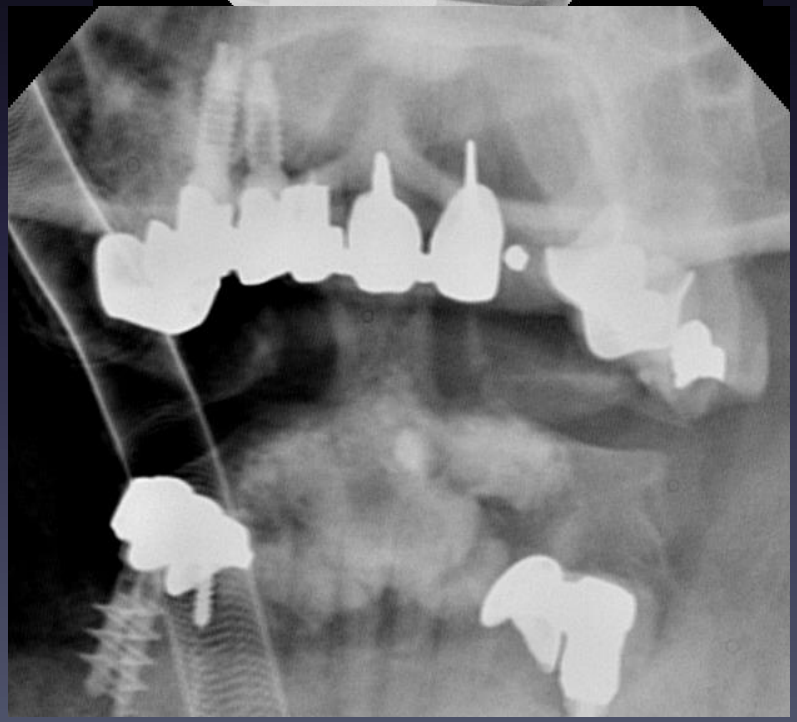
HIGH DENSITY CEMENT

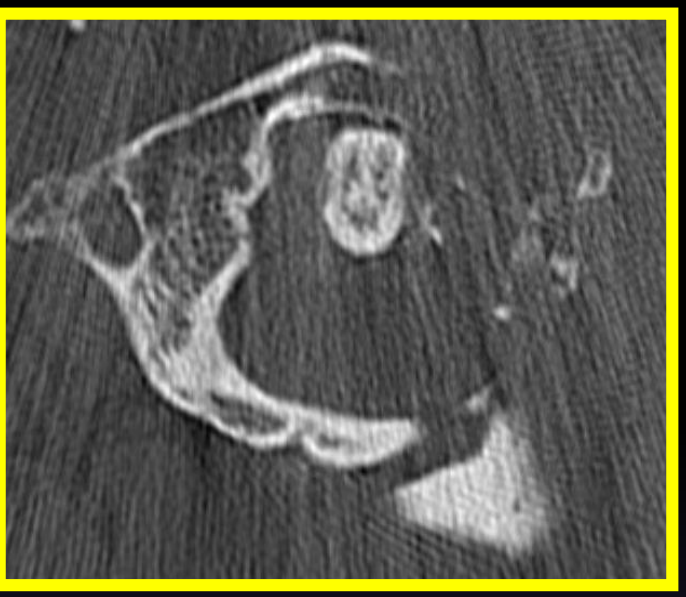
- 52 yo, female, acute cervical pain.
- CT total body show renal Ca and osteolysis of C1 and C2
- Primary renal cell CA
- No other bony or parenchymal lesions

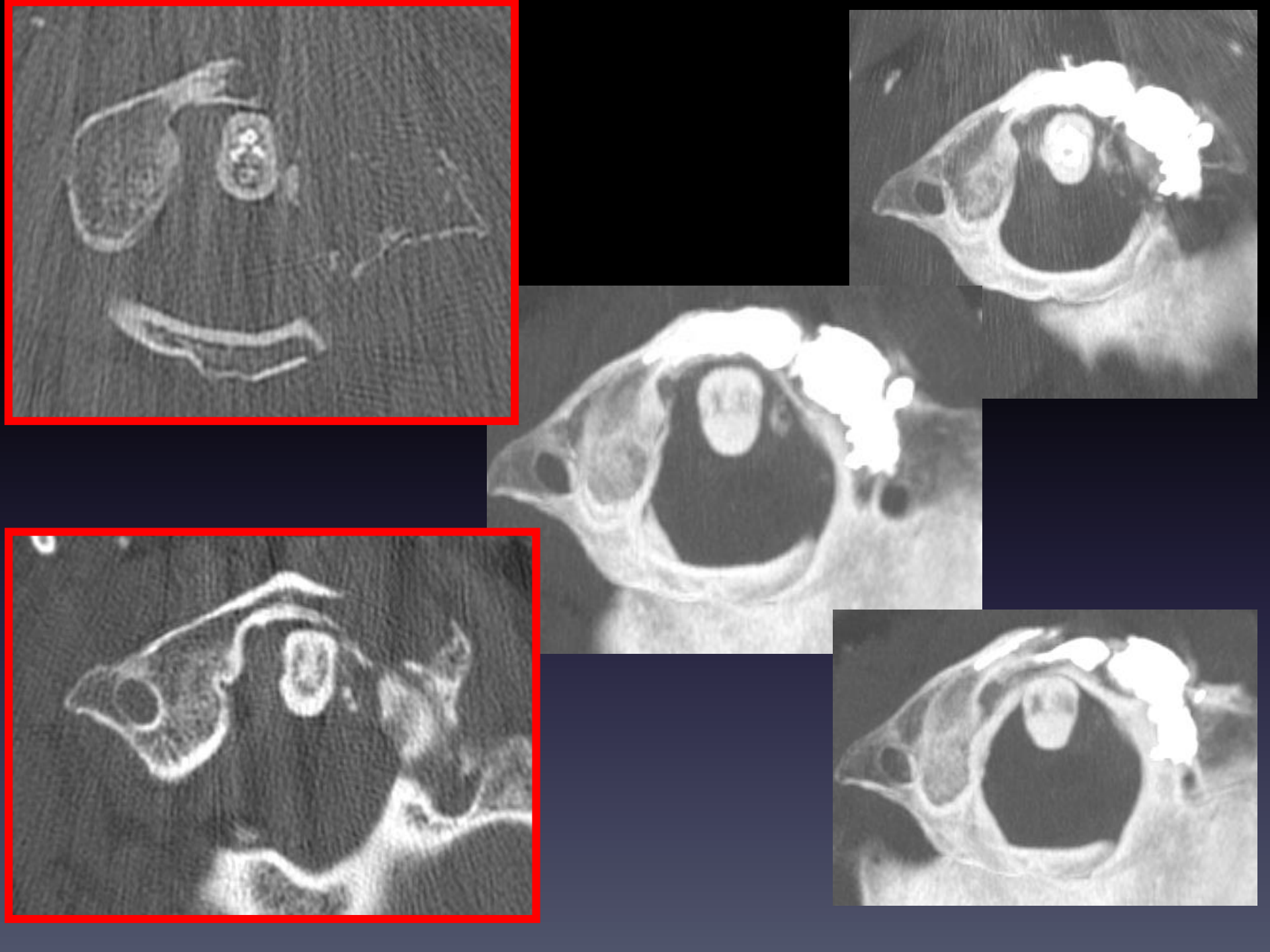










Three major concept dealing with spine metastasis

- Pain treatment
- Stability treatment
- Antineoplastic effect (RF and crioablation)

RADIOFREQUENCY

RF Ablation is well understood

Wide adoption to treat lesions throughout the body

Liver 1

Lung 2, 3

Complete necrosis in nearly 70% of tumors after one treatment

Prostate 4

Predictable tumor necrosis yielding effective

follow up in > 80% RFA- treated tumors

➢80% success in eliminating tumors in one treatment

Kidney 5 • No residual tumors at 7 month

Osteoid Osteomas 6

Bone Metastases 7

Targeted RF Ablation (t-RFA)

- Controlled access
- Controlled energy delivery
- Controlled lesion creation

RF Generator

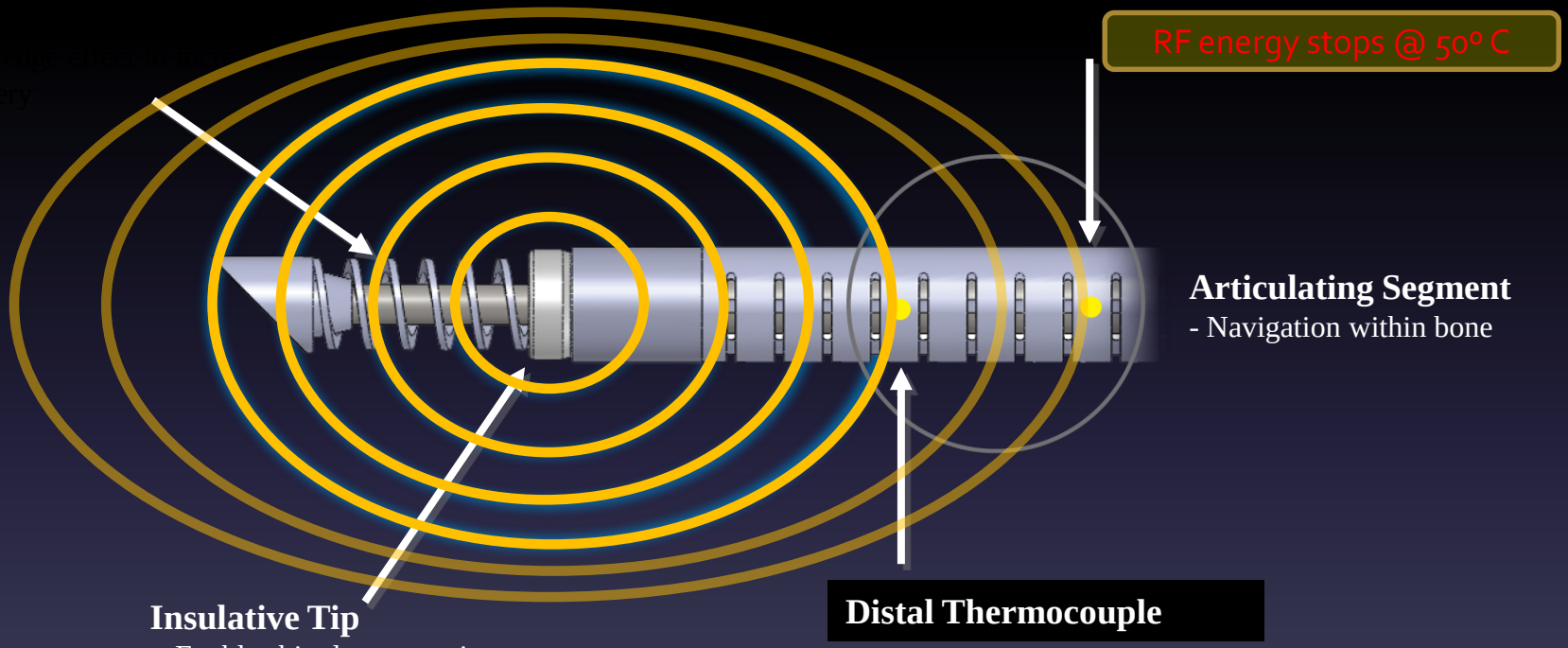
- Active temperature measurements
- Controlled energy delivery
- Displays critical real-time information

Ablation Instrument

- Articulating electrode designed to permit unipediculate access & multiple ablation passes
- Bipolar design requires no grounding pads

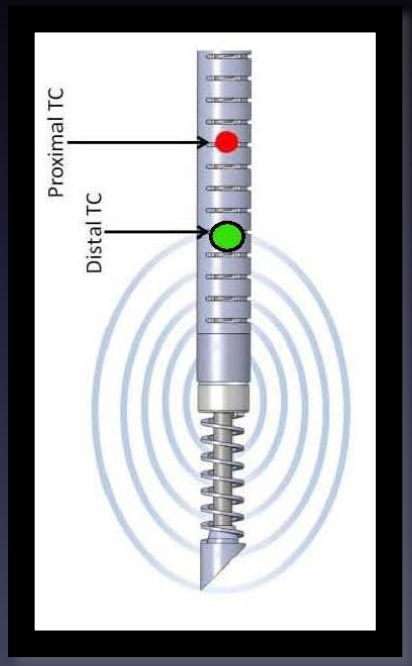
Active navigation enables site-specific ablation zones throughout vertebral body via unipediculate access

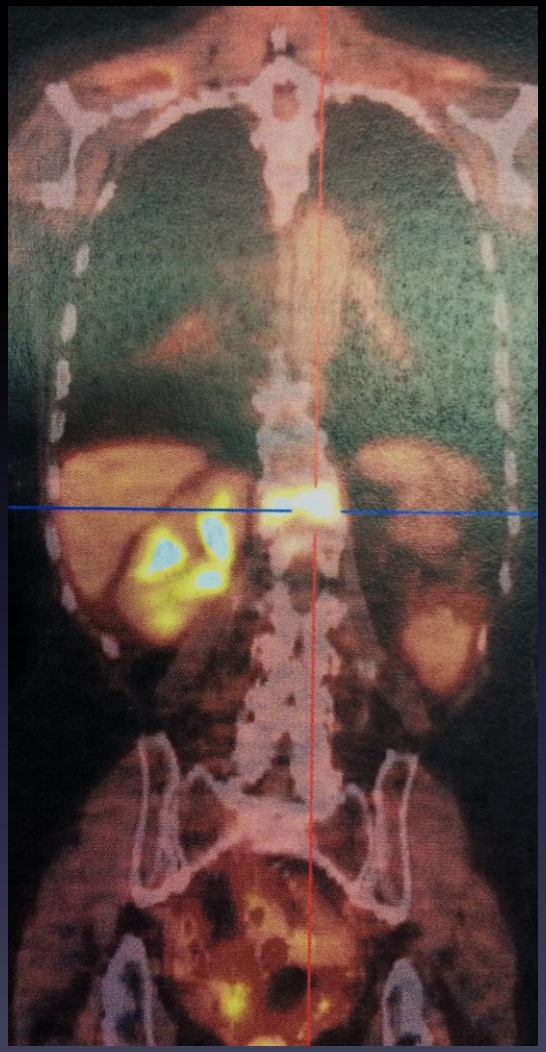
Real-time temperature monitoring: gauge thermal spread and intra-operative decisions



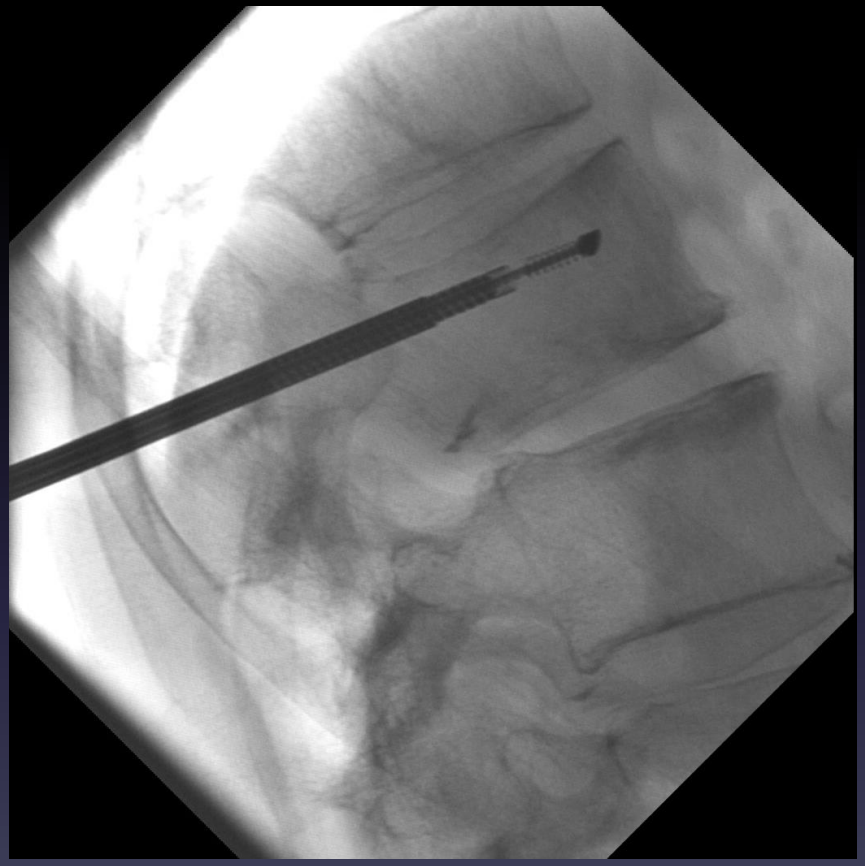
Real-time temperature monitoring with CT permits:

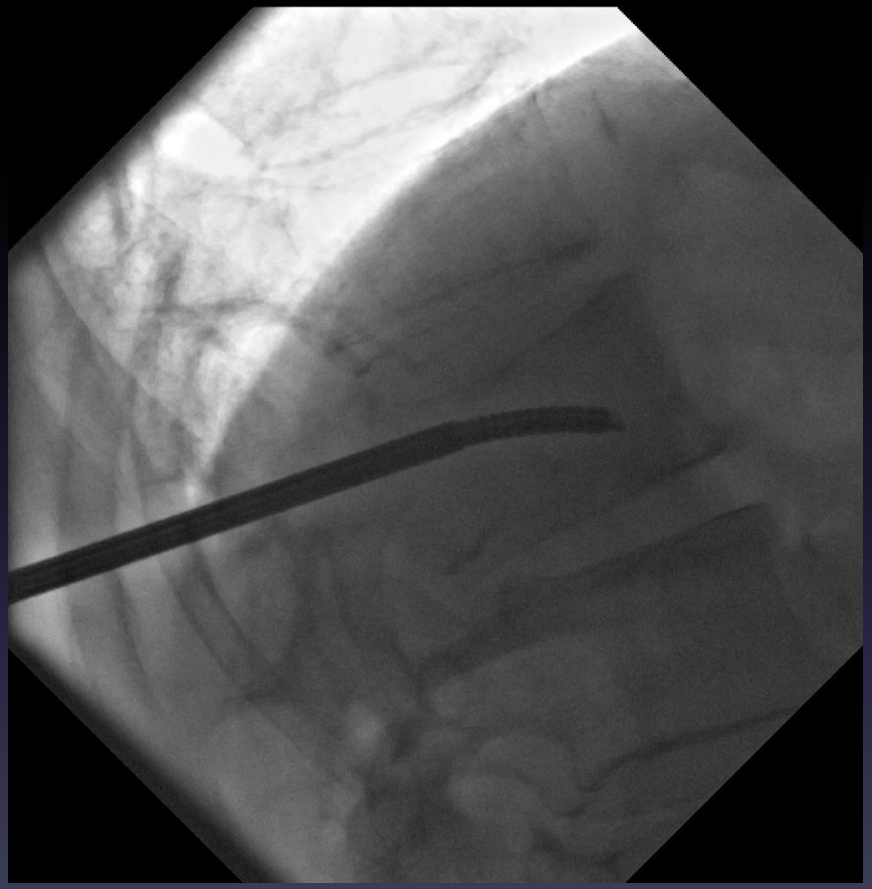
- assess thermal spread
- confirm physiologic temp prior to cement delivery

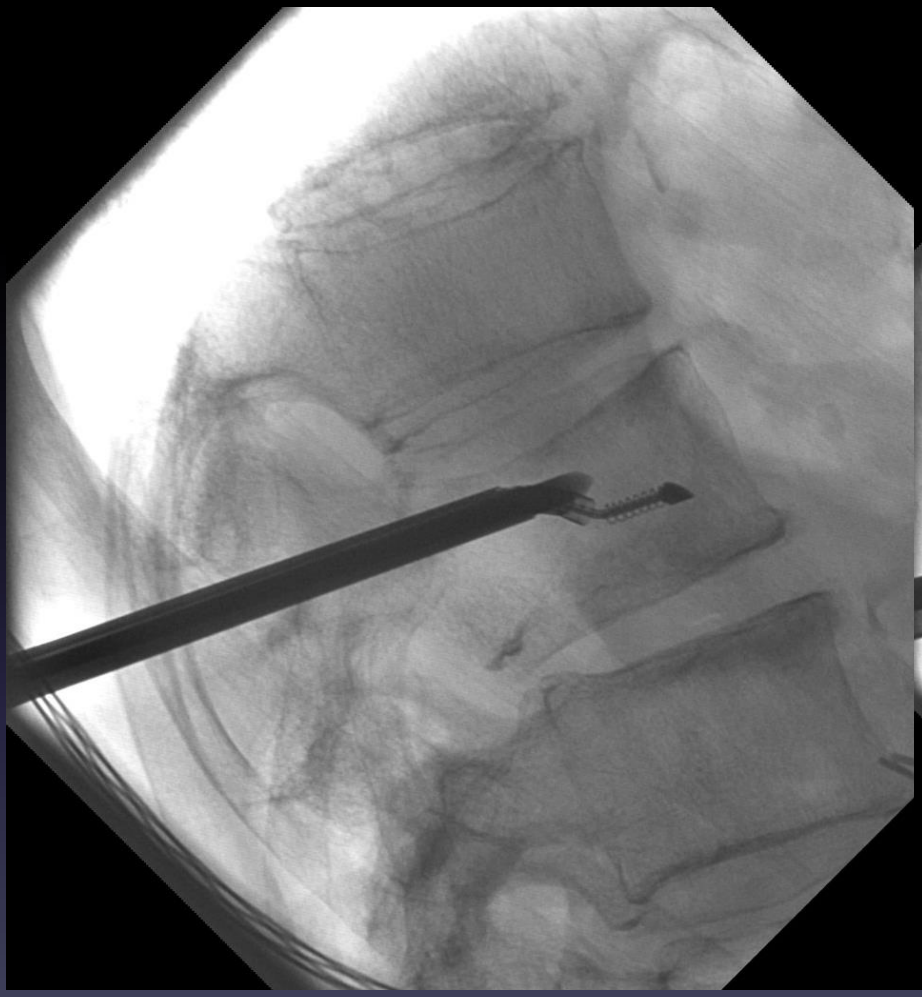


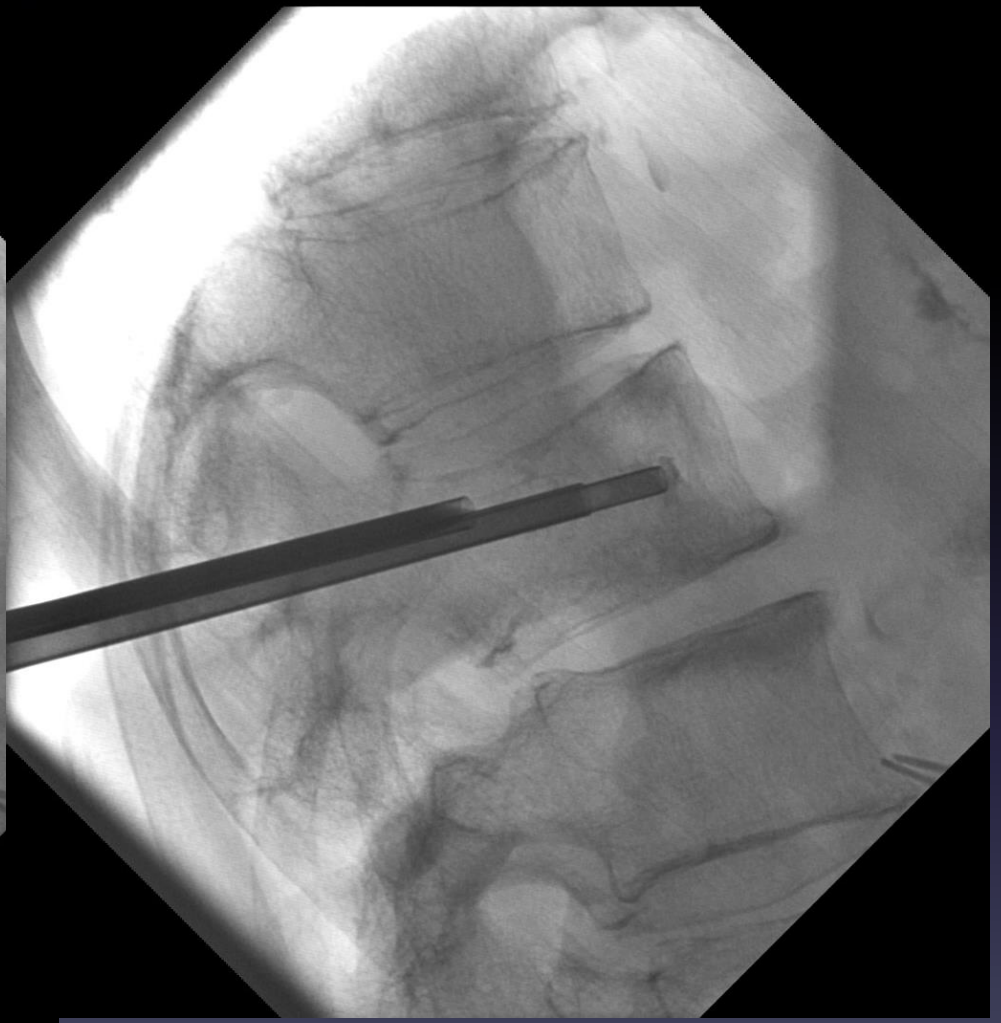


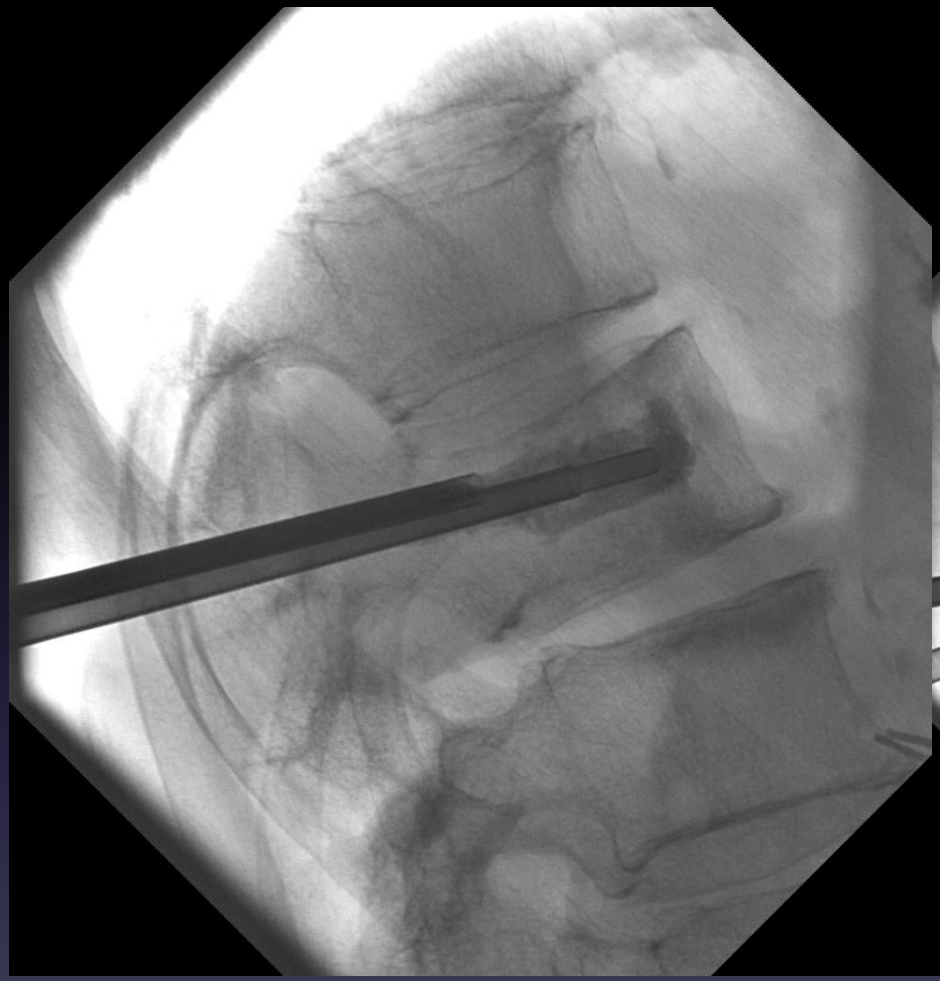
Women 75 y.o.

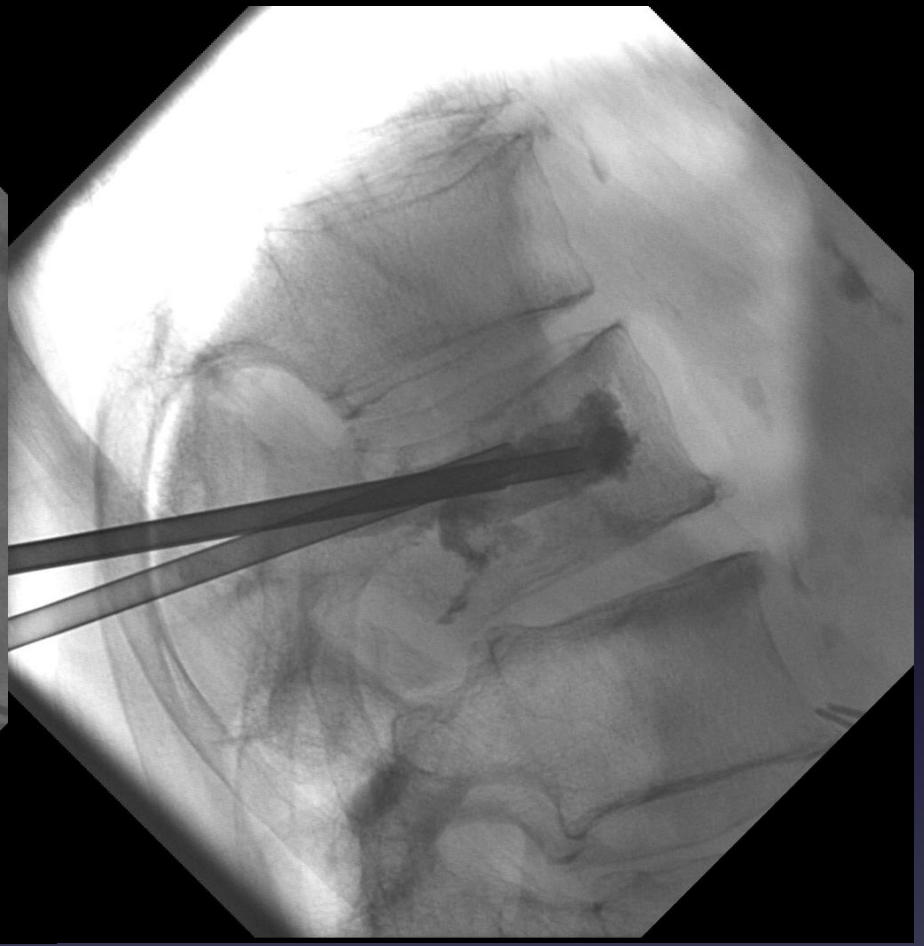


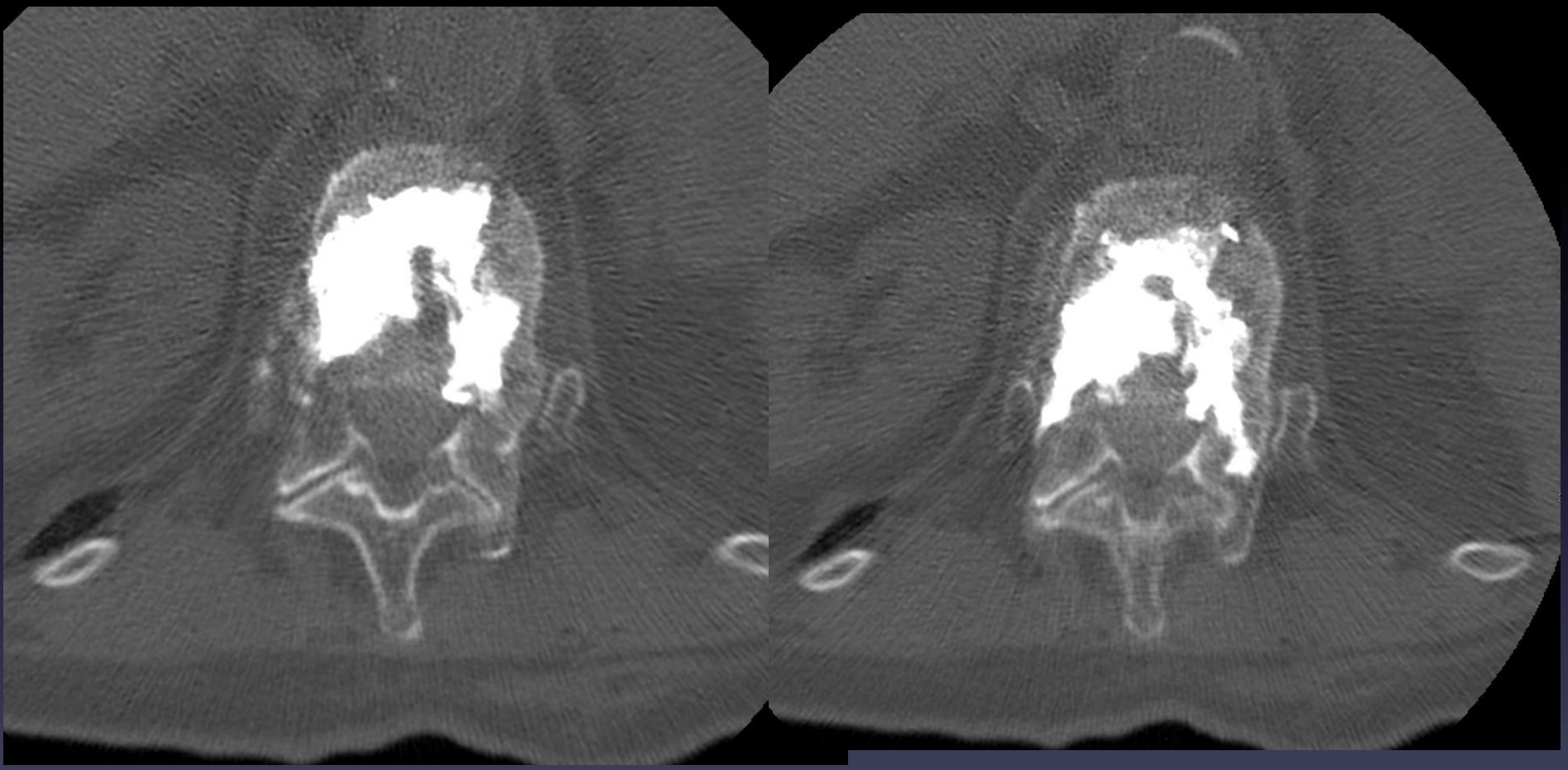


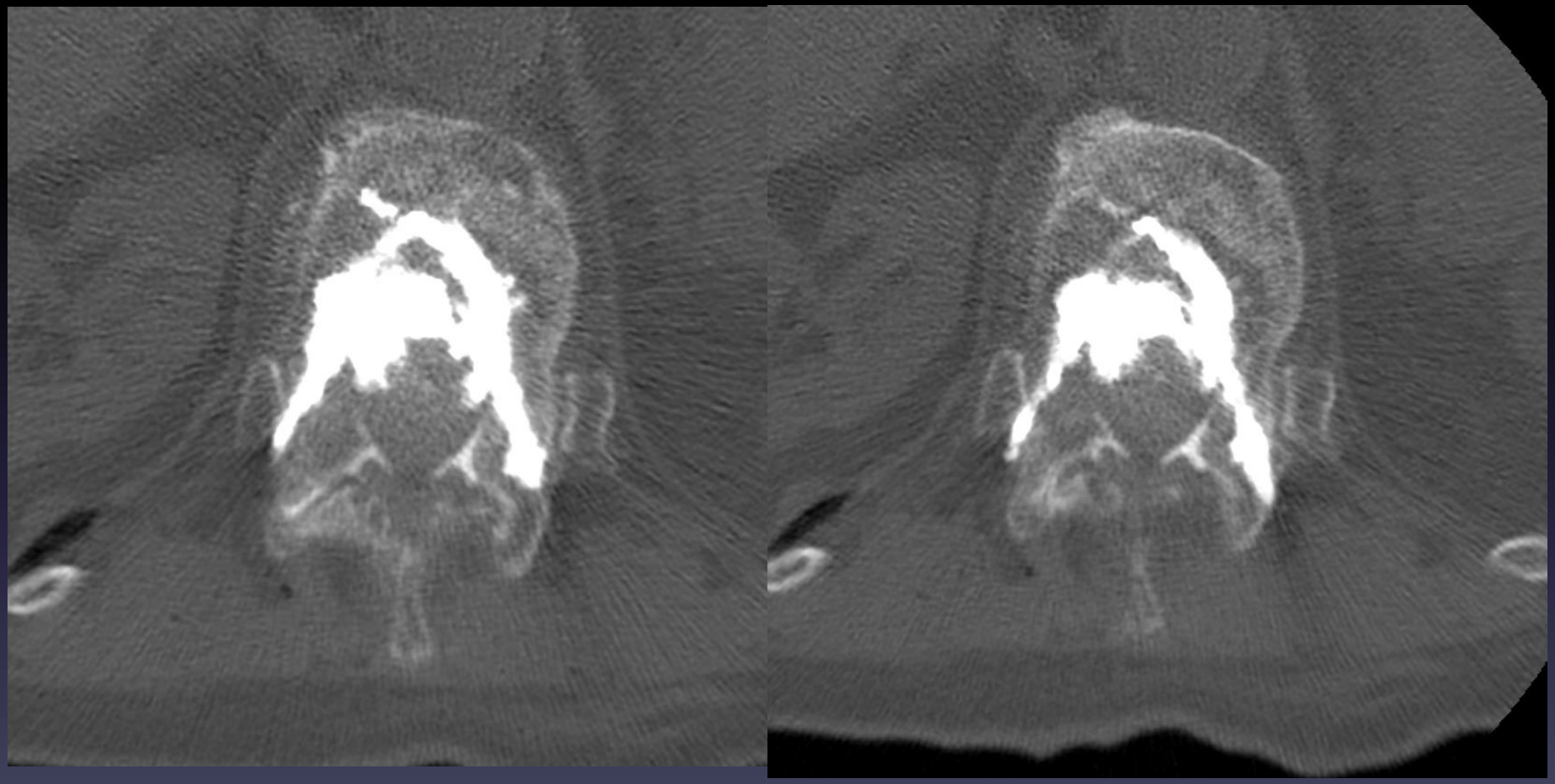




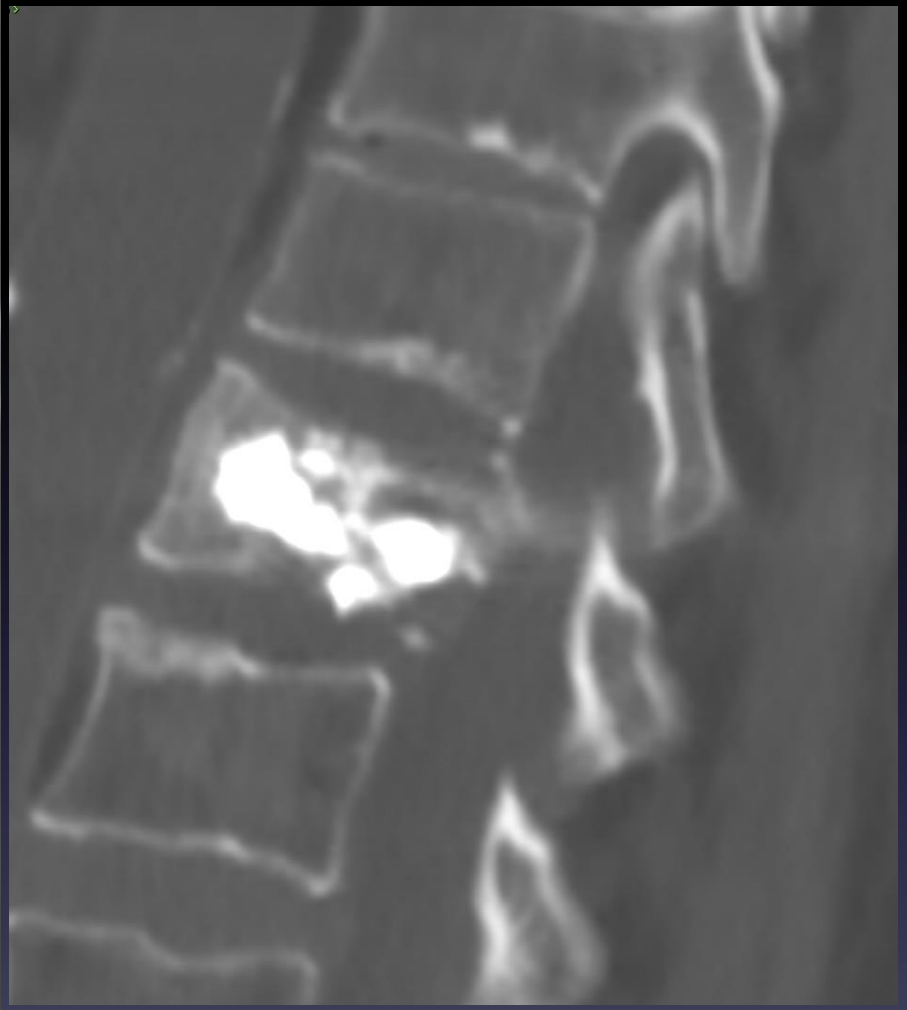


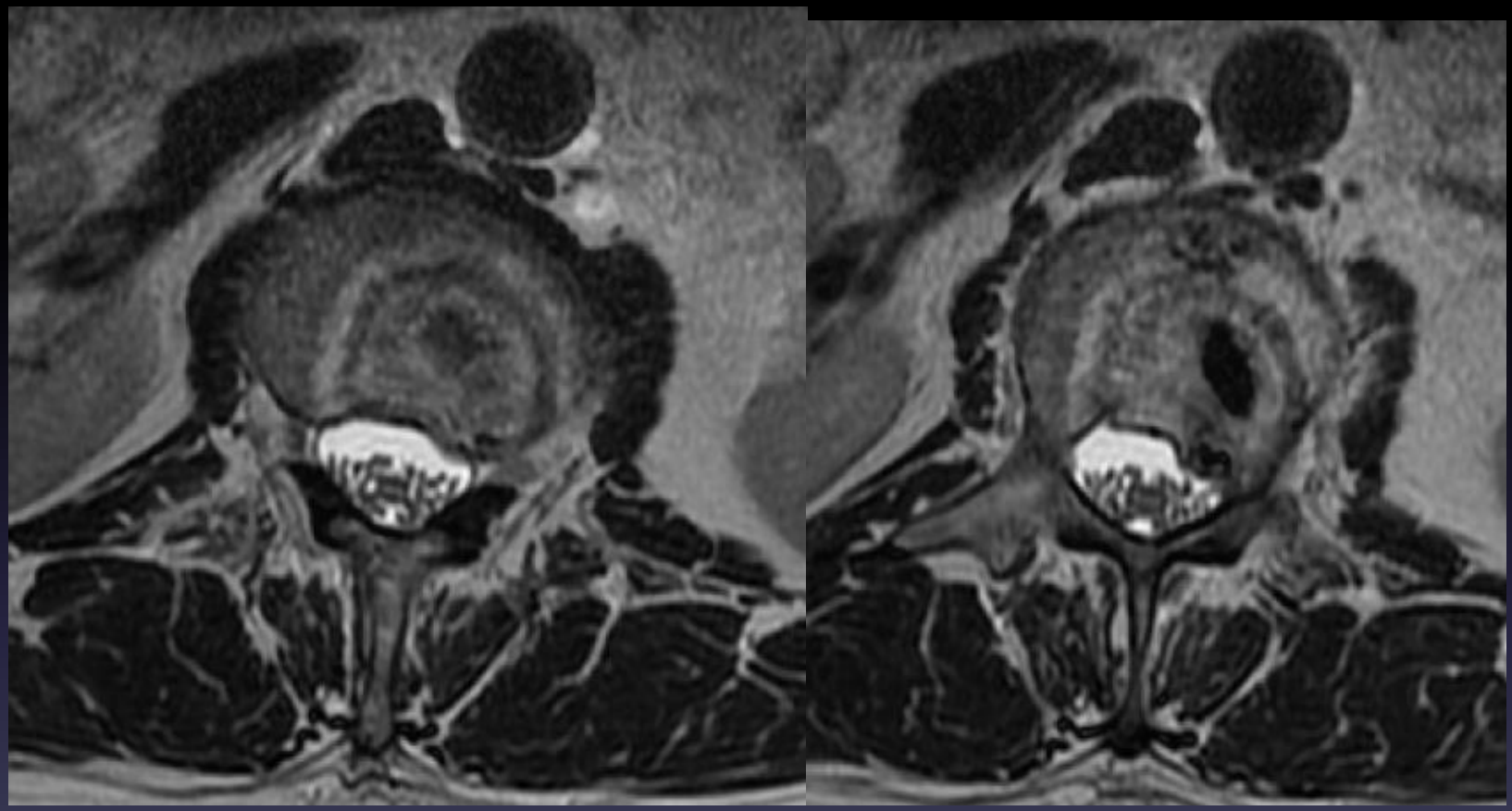







sc serie: LS SAG
8-13>





Pain Physician. 2014 Jul-Aug;17(4):317-27.

Treatment of metastatic spinal lesions with a navigational bipolar radiofrequency ablation device: a multicenter retrospective study.

Anchala PR, Irving WD, Hillen TJ, Friedman MV, Georgy BA, Coldwell DM, Tran ND, Vrionis FD, Brook A, Jennings JW1.

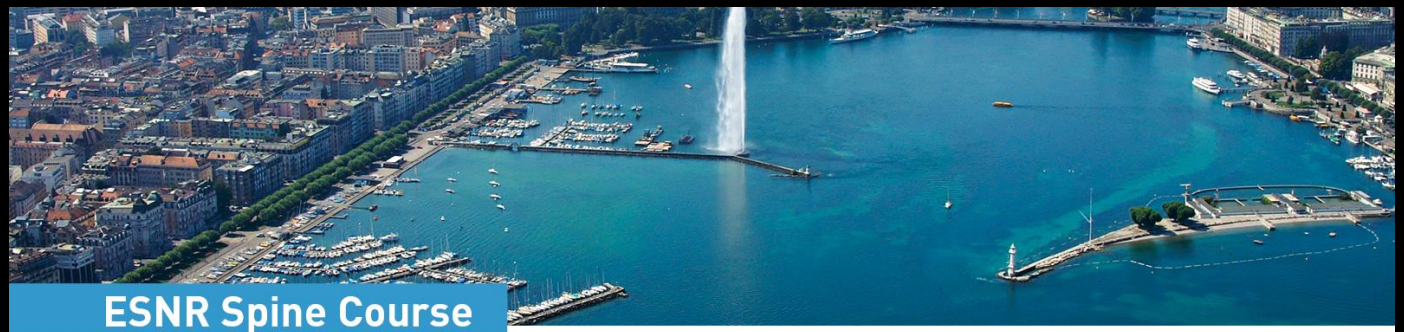
Conclusions:

- Correct Clinical approach and Diagnosis
- Choice of treatment – evaluate the cost
- Team with endocrinologist, oncologist, radiotherapist, neurosurgeons, orthopedics, and pain therapist.

- Oncologist. 2015 Oct;20(10):1205-15
- **The Metastatic Spine Disease Multidisciplinary Working Group Algorithms.**
- **Wallace AN and coll**

European Diploma in Spine Interventional Neuroradiology (EDiSINR)

- Diagnostic and Interventional ESNR P. Lasjaunias Diploma
- Attendance to the annual spine meeting
- Minimum amount of procedure as first operator
- Log book
- Final examination



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Diagnostic and Interventional

June 1-4, 2016

Geneva, Switzerland

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PROGRAM

SARDINIA SPINE 2016

...and stroke

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30th June
2nd July
2016

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