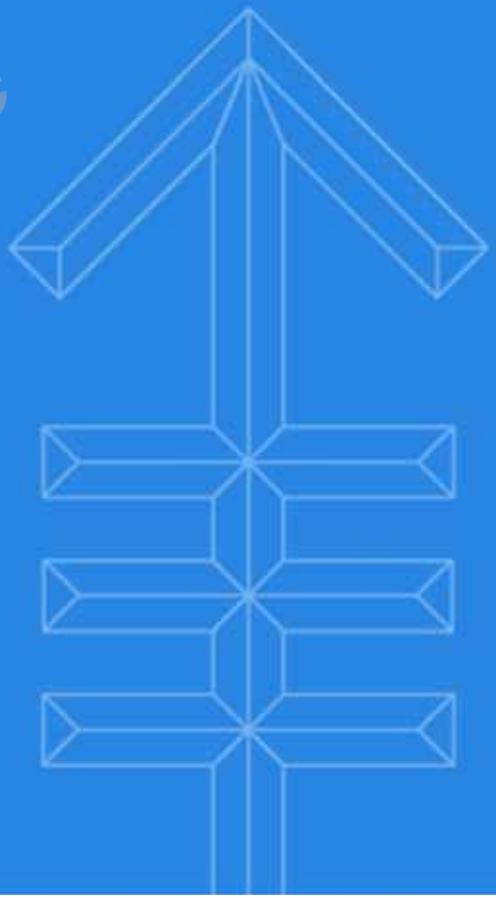
Memorial Sloan Kettering Cancer Center

The Importance of Pain in Cancer Patients

Mark H. Bilsky, MD
Attending Neurosurgery
MSKCC
Professor, Neurosurgery
Weill Cornell Medical Center



Tumor Overview

- Anatomic Classification
  - Extradural
  - Intradural Extramedullary
  - Intradural Intramedullary
- Primary vs Metastatic
- Histology
- Grade

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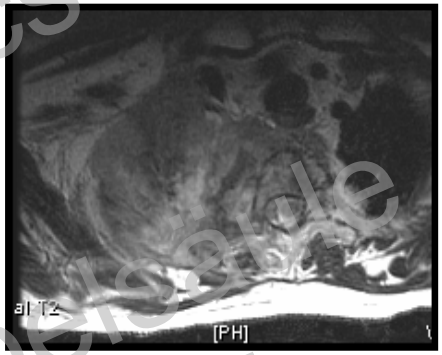

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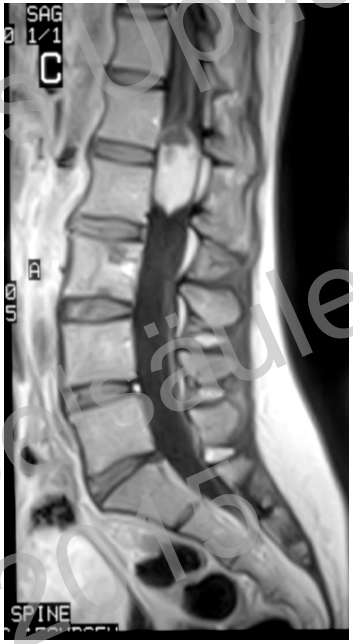

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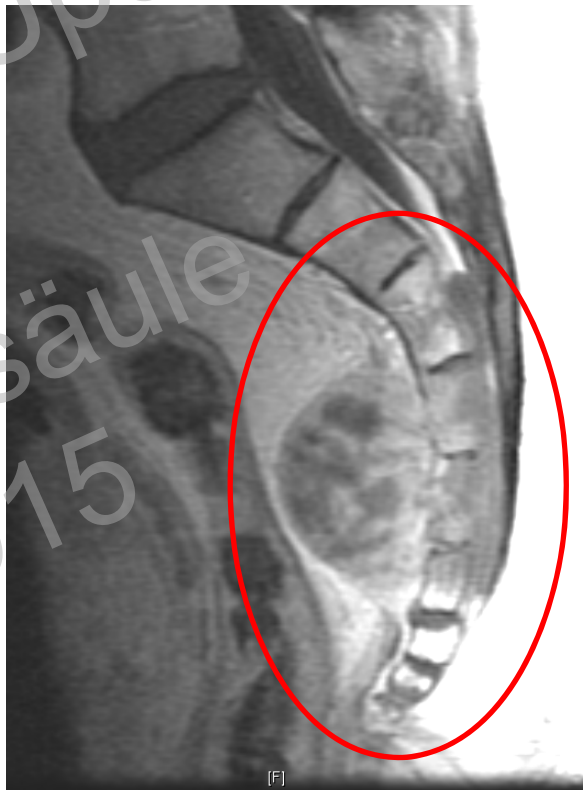

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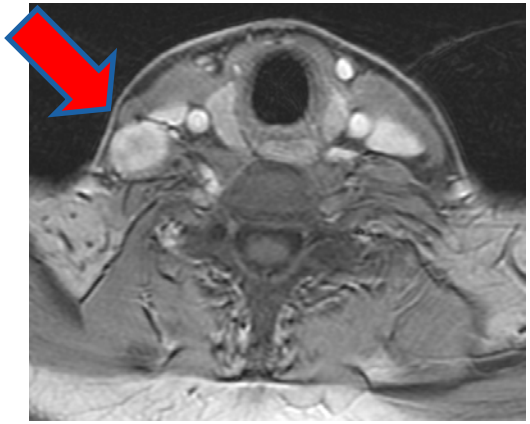


Clinical Presentation

- **Three Predominant Pain Syndromes:**
  - **Biologic**
  - **Mechanical**
  - **Radiculopathy**
- **Myelopathy**
- **Significant treatment implications**

Clinical Presentation

- **Biologic pain**
  - Tumor related-pain
  - Predominant pain syndrome (95%)
  - Night or morning pain that resolves over the course of the day
  - Inflammatory mediators
  - Mechanism: Diurnal variation in endogenous steroid secretion
  - Treatment:
    - Metastatic: Steroids/RT
    - Intradural: Steroids/Surgery
    - Primary: Neoadjuvant Chemo/RT/Surgery

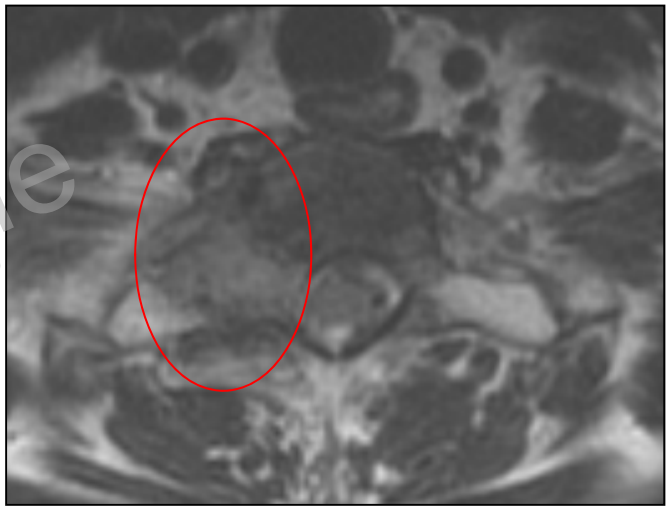
Clinical Presentation

- **Mechanical Pain**
- **Indicative of bone pathology**
- **Movement-related pain**
- **Level dependent**
  - **AA: Flexion/extension/rotation**
  - **SAC: Flexion/extension**
  - **Thoracic: Extension**
  - **Lumbar: Mechanical Radiculopathy[1]**
- **Radiographic correlates integrated into SINS**
- **Treatment: Open surgery/PMMA augmentation**
  Percutaneous pedicle screws
  Radiation/chemotherapy ineffective

[1]Moliterno J, etal. Improvement in pain after lumbar surgery in cancer patients with mechanical radiculopathy. Spine J. 2014, ebub ahead of print

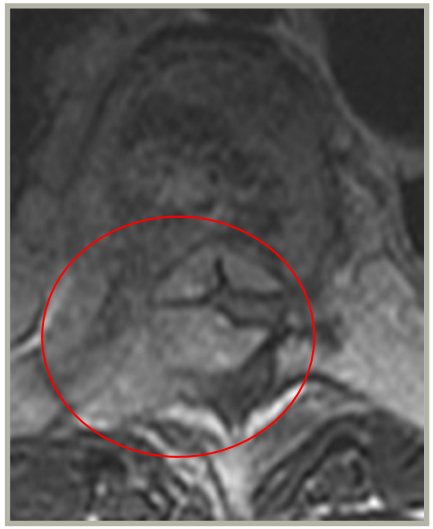
Presentation

- **Radiculopathy**
- **Indicative of neuroforaminal disease**
- **Differentiate from the following:**
  - **Bone lesion (eg. L3 vs. femur fracture)**
  - **Neuropathy**
  - **Brachial/Lumbosacral Plexus Tumor**
  - **Leptomeningeal Tumor**
- **Treatment: Dependent on tumor histology and degree of ESCC, often RT in absence of instability**



Presentation

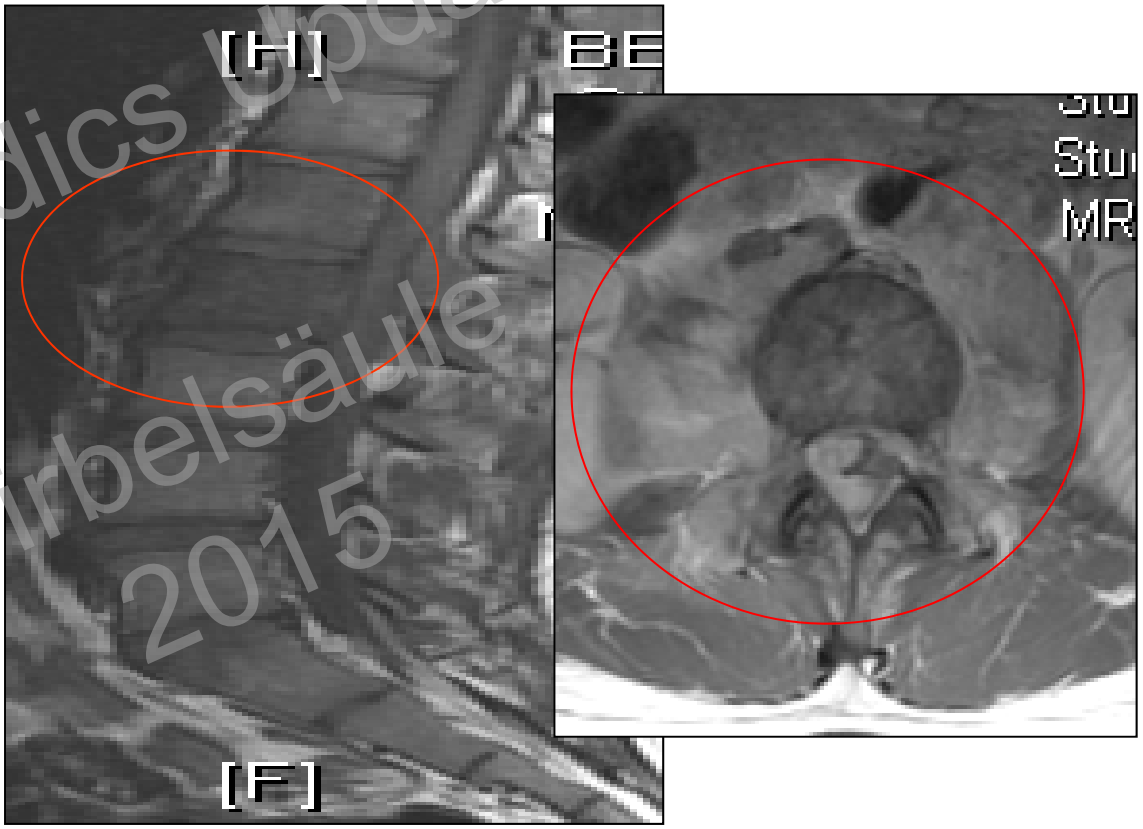
- **Myelopathy:**
- Indicative of high-grade ESCC
  - Spinothalamic tracts (Pinprick)
  - Corticospinal tracts (Motor)
  - Posterior Columns (Proprioception)
  - Autonomic (Bowel and Bladder)
    - ✓Neurogenic vs. other (eg. narcotics)
    - ✓Perineal numbness
    - ✓Conus medullaris or sacrum
    - ✓Other spinal levels: Significant degree of paralysis



➢ Treatment: Dependent on the radiosensitivity of the tumor

Diagnostic Radiology

- MRI
- Plain x-rays
- CT CPA
- Bone scan
- PET scan
- CT/myelogram



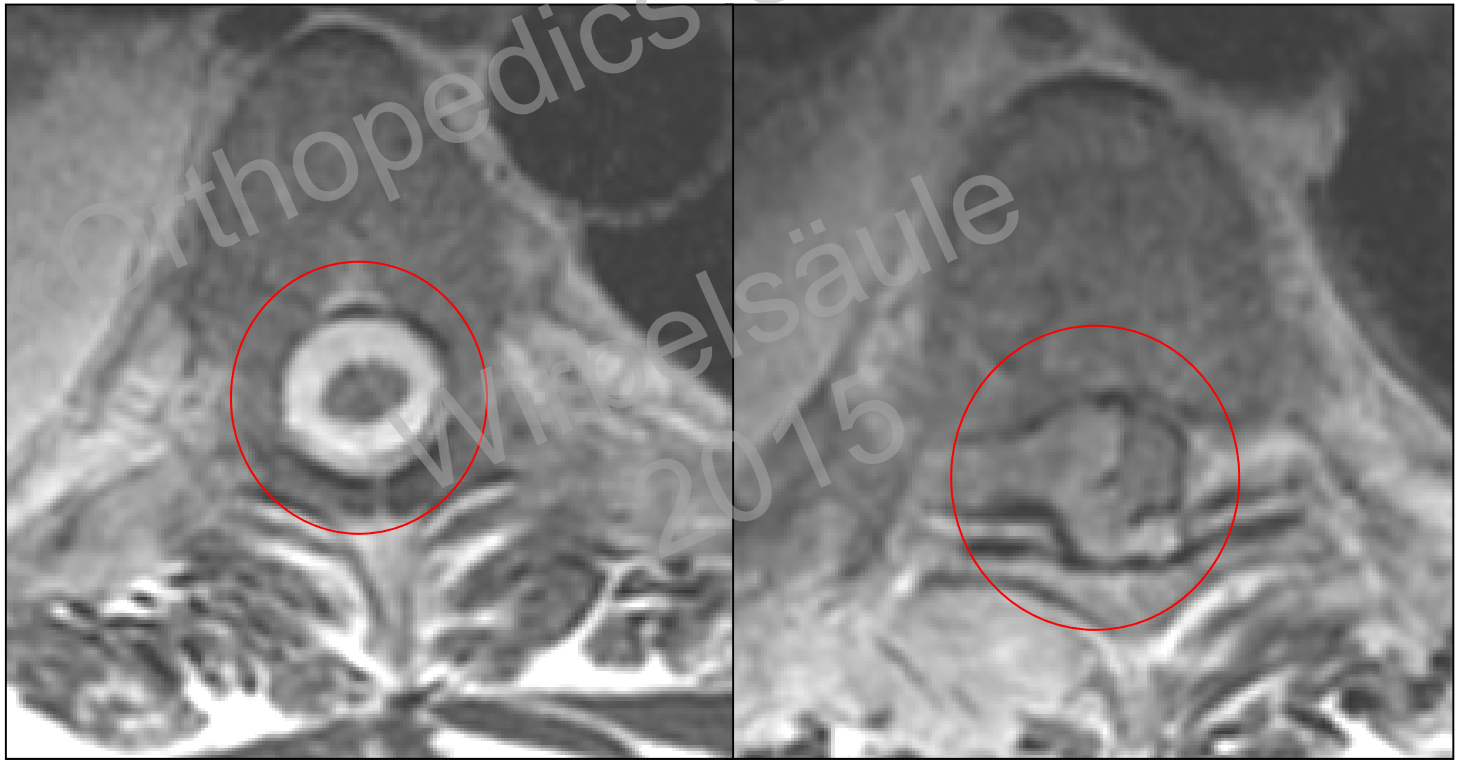
MRI - Sagittal

T1-Weighted Image

STIR Image

MRI: Axial

T2-weighted/T1-post contrast



MRI: Contrast

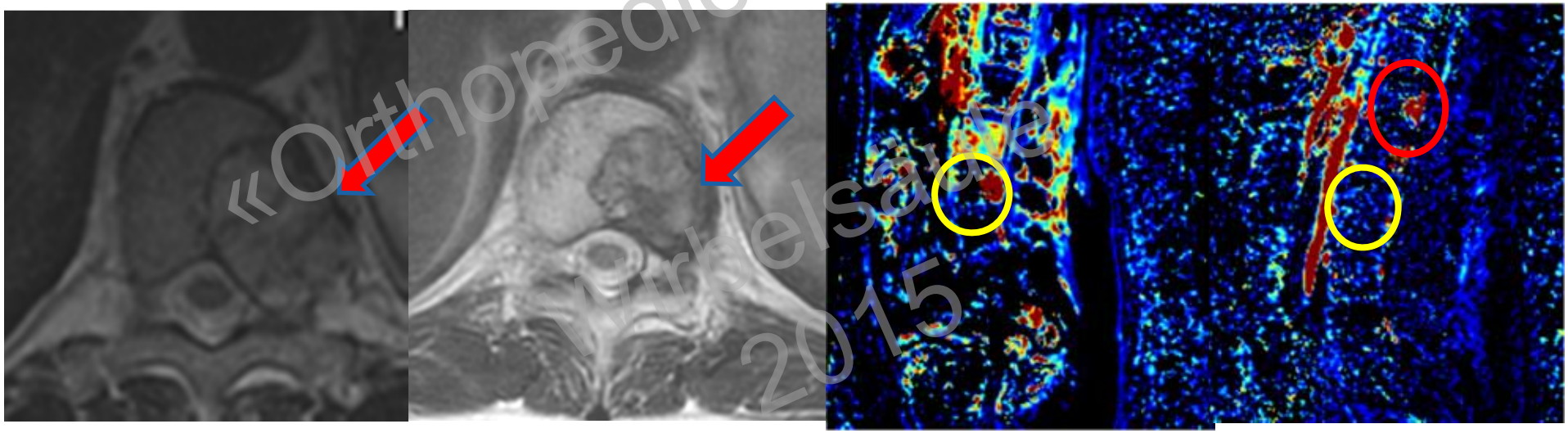
Leptomeningeal

Intramedullary

MR Spine Perfusion

- **Lesion size is not an reliable indicator of treatment response or progression.**
- **Different MR sequences that may provide sensitive and specific indicator of response**

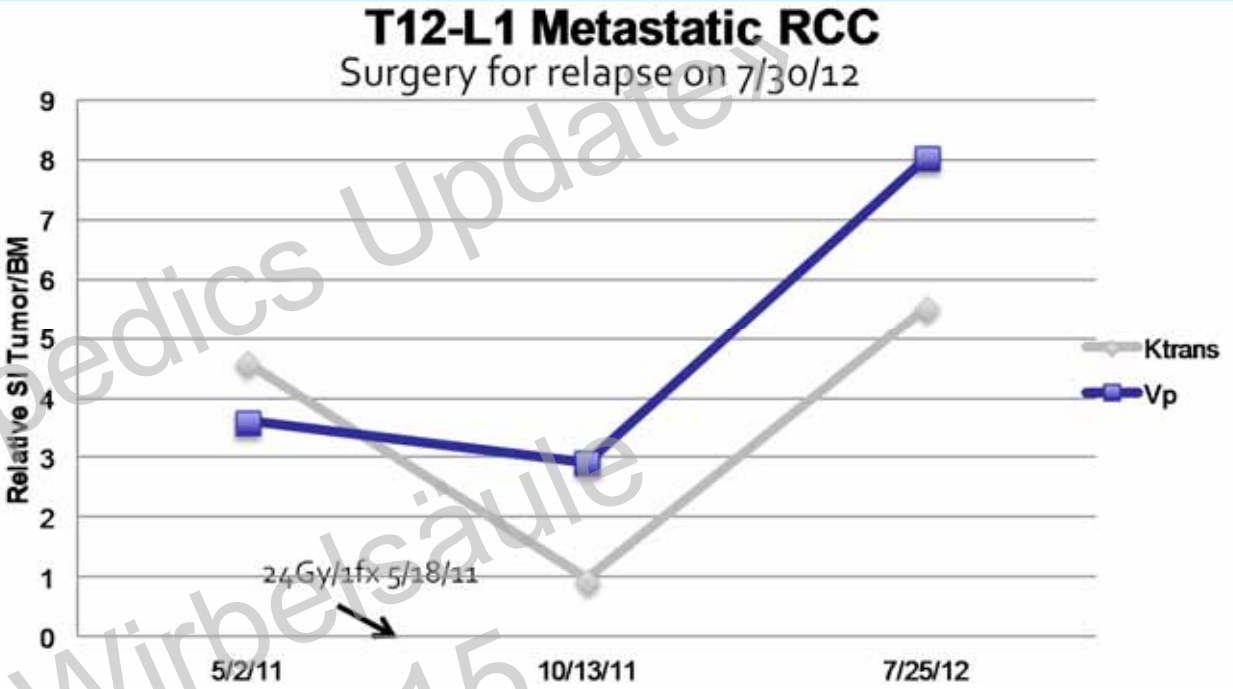
Tumoral Response in Bone



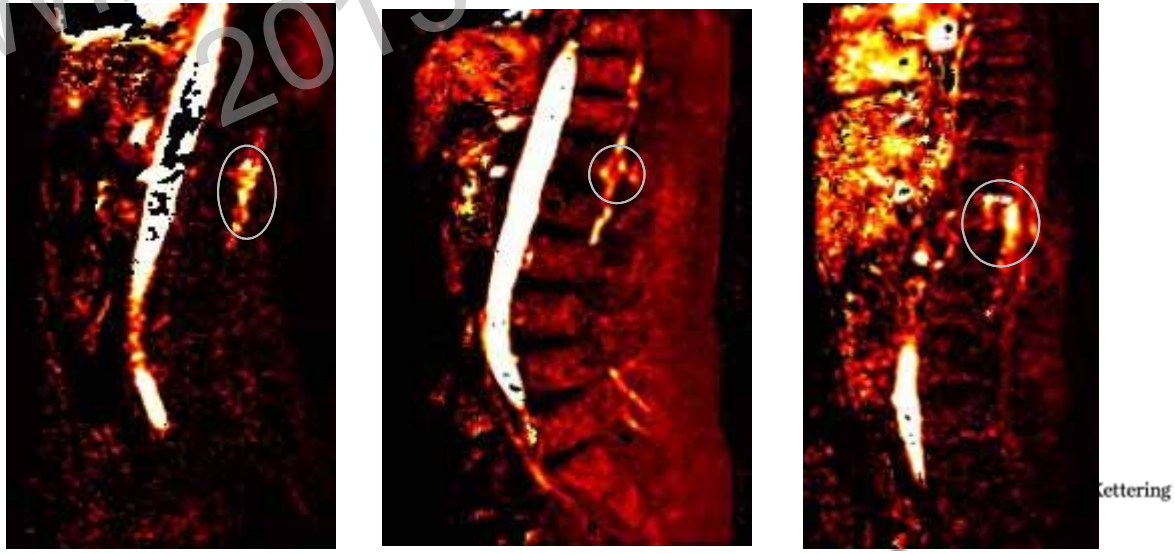
Dynamic Contrast Enhancement (DCE): Plasma Volume are predictive of active tumor or recurrence before standard MR findings

Chu S, et. Measurement of blood perfusion in spinal metastases with dynamic contrast-enhanced MRI: Evaluation of tumor response to radiation therapy. Spine 38 (22):E1418-24. 2013.

Local Recurrence

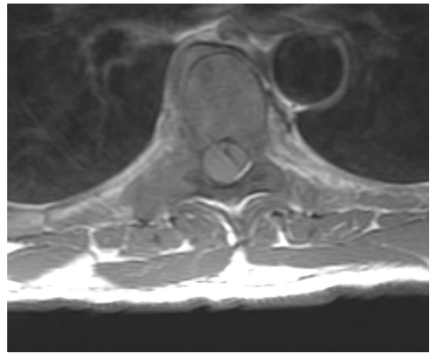


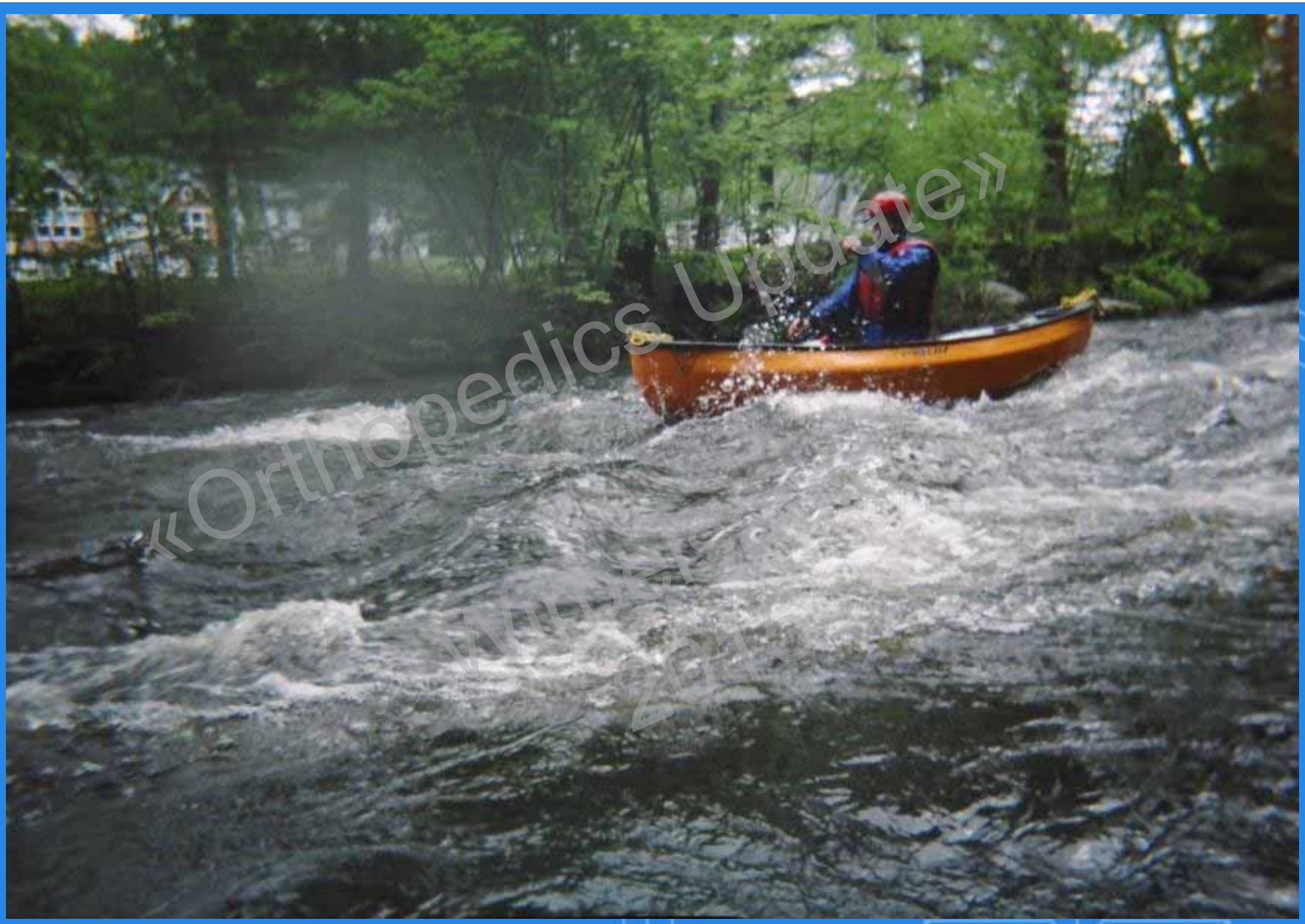
LR	% Change from BL	
#40	V_p	K_{trans}
5 mos	-18%	-79%
14 mos	+49%	+20%



Goals of Treatment

- Metastasis
- Palliation
  - ➢ Pain Control
  - ➢ Neurology
  - ➢ Oncology
  - ➢ Mechanical Stability





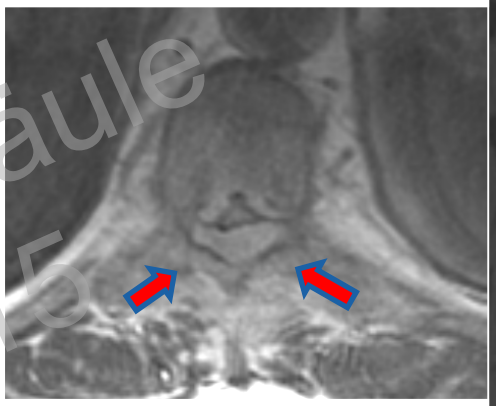
RCC: 100 mile paddle on the Alagash

Case Presentation

- 66 y.o., Hx of RCC
- 3 week Hx of biologic back pain
- VAS 8/10
- Acute onset of weakness: ASIA C
- PMH: Chronic Renal Insufficiency
- Systemic w/u:

  RCC extending into renal vein

  Pulmonary nodules, Acetabular fx.



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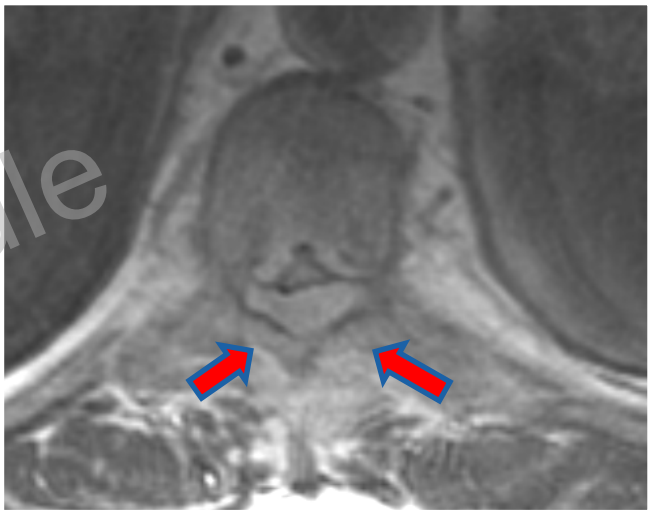
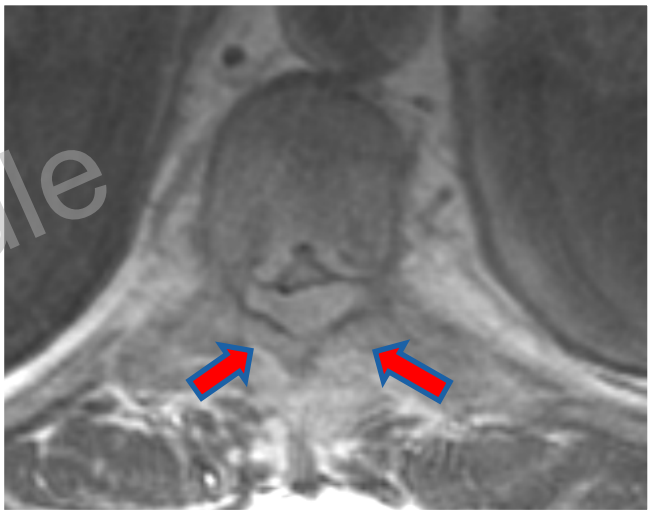
Options for Therapy
Multi-disciplinary Approach

- Systemic Therapy
  - Chemo/Immuno/Hormonal therapy
- Radiation Therapy
  - Conventional EBRT (30 Gy in 10 fractions)
- Surgery
  - Open: Anterior, Posterolateral, Combined



Options for Therapy
Multi-disciplinary Approach

- Systemic Therapy
  - Chemo/Immuno/Hormonal therapy
  - Targeted Therapy
- Radiation Therapy
  - Conventional EBRT (30 Gy in 10 fractions)
  - Image-guided intensity modulated RT
    - Hypofractionated RT (8 to 10 Gy x 3)
    - Single Fraction RT (24 Gy)
  - Brachytherapy: p32 plaque/Ir catheters
- Surgery
  - Percutaneous Cement Augmentation/Pedicle Screws
  - Open: Anterior, Posterolateral, Separation Surgery, Combined
  - En bloc resection for margins

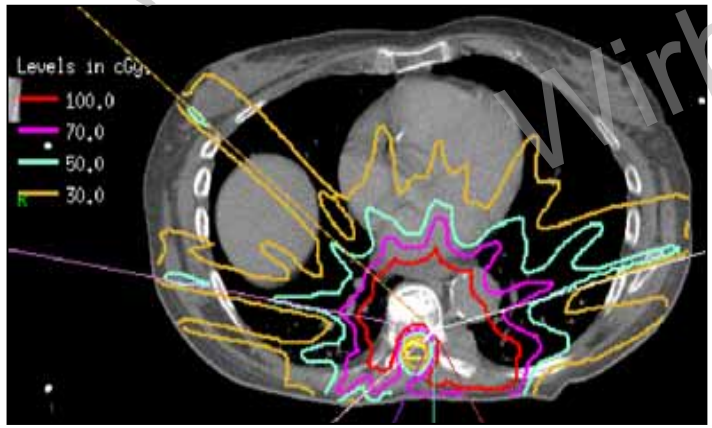


Treatment Considerations

NOMS[1,2]

- **N**eurologic
- **O**ncologic
- **M**echanical Stability
- **S**ystemic disease

- Systemic Therapy
- Radiation Therapy
- Surgery



vs.

[1]Bilsky MH, Smith M. Surgical approach to epidural spinal cord compression. Hematology/Oncology Clinics of North America.;20(6):1307-1317, 2006

[2]Bilsky MH, Azeem S. The NOMS framework for decision making in metastatic cervical spine tumors. Current Opinions in Orthopedics 2007;18(3):263-269.

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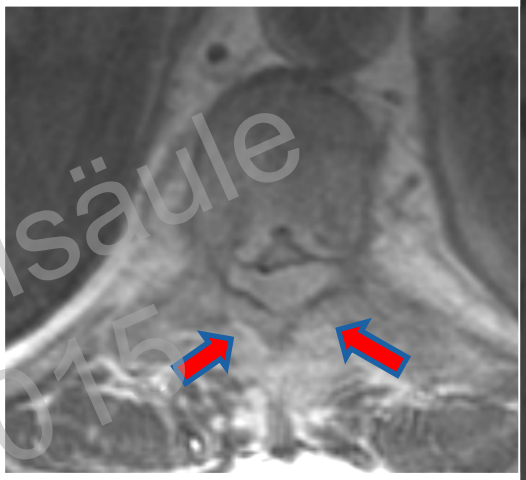
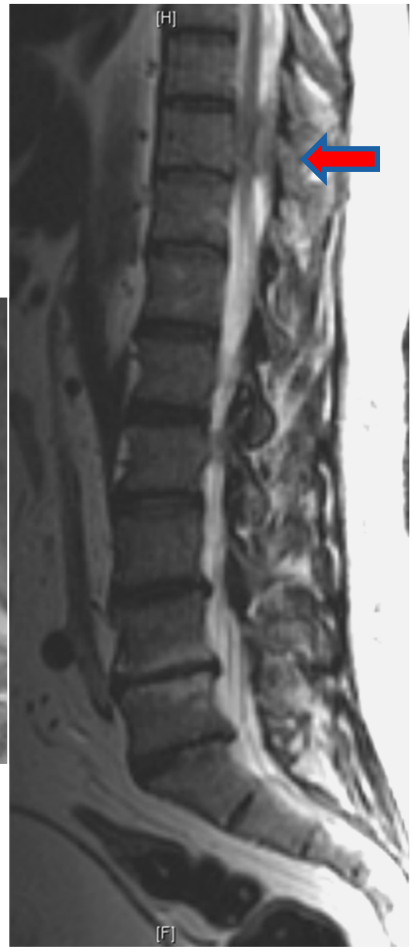
Treatment Considerations
NOMS

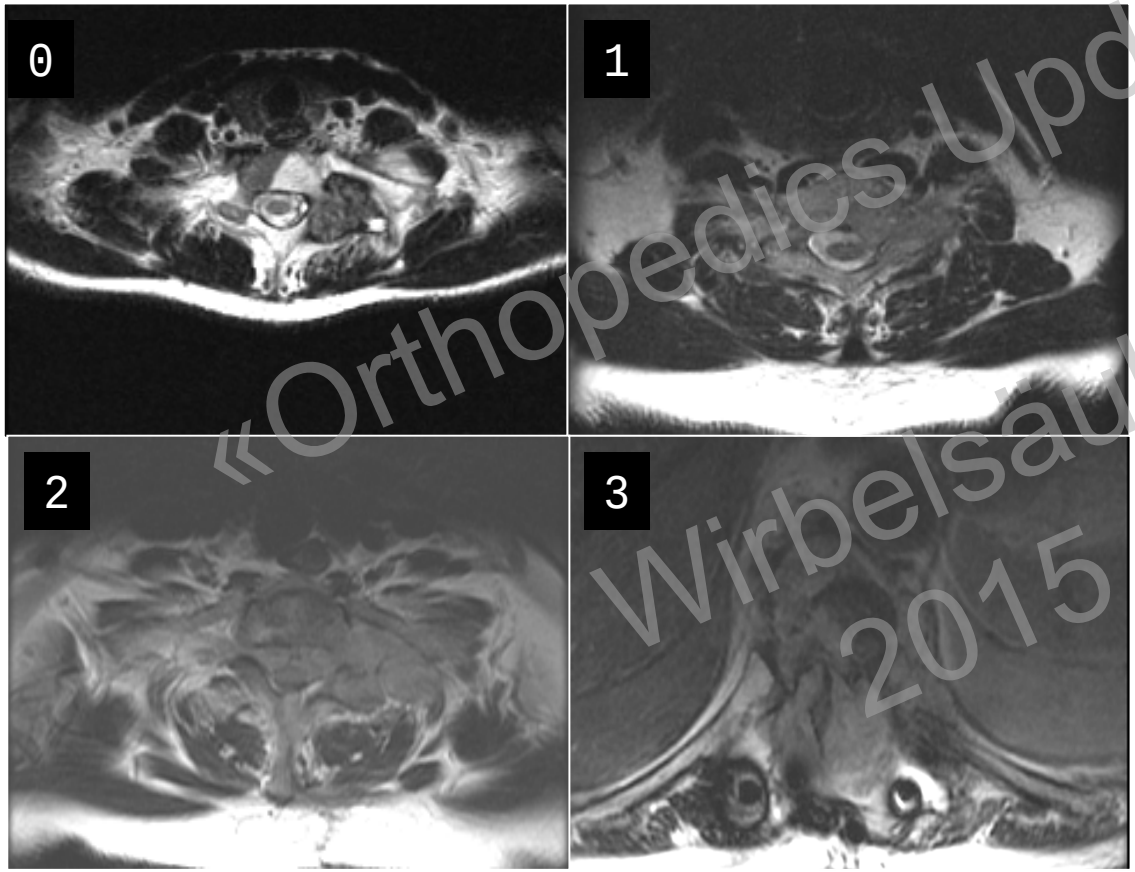
- Neurologic
  - Myelopathy
  - Functional Radiculopathy
  - Degree of epidural spinal cord compression
- Oncologic
  - Tumor Histology
  - Radiation or Chemosensitivity
- Mechanical Instability
- Systemic Disease and Medical Co-morbidity





NOMS

N: ESCC



O: Radiation Sensitivity

Radiation Sensitivity	Tumor Histology
Sensitive	Myeloma Lymphoma
Moderately Sensitive	Prostate Breast
Moderately Resistant	Colon NSCLC
Highly Resistant	Thyroid Renal Sarcoma Melanoma

Bilsky MH, et.al. Reliability analysis of epidural spinal cord compression scaleJ Neurosurg Spine. 2010 Sep;13(3):324-8.

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NOMS

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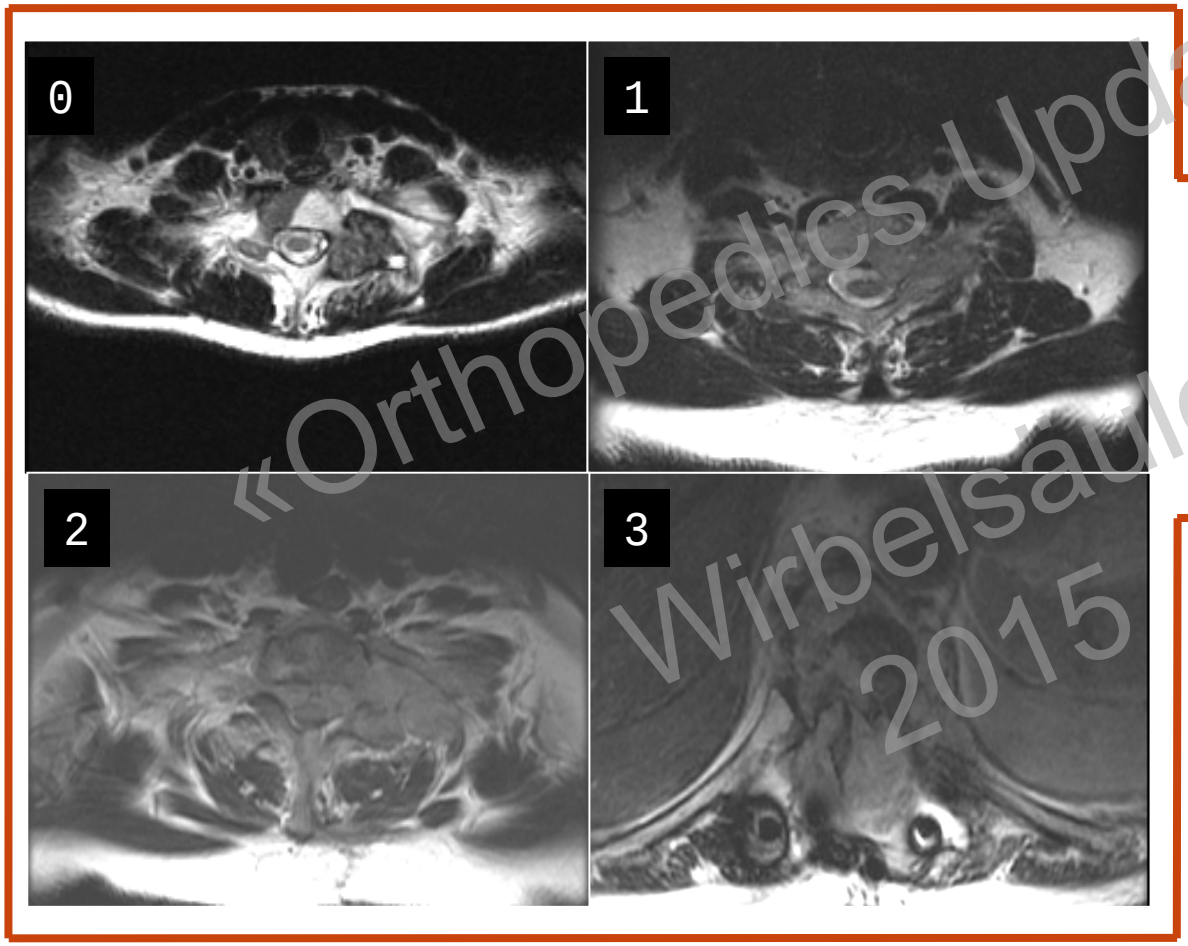

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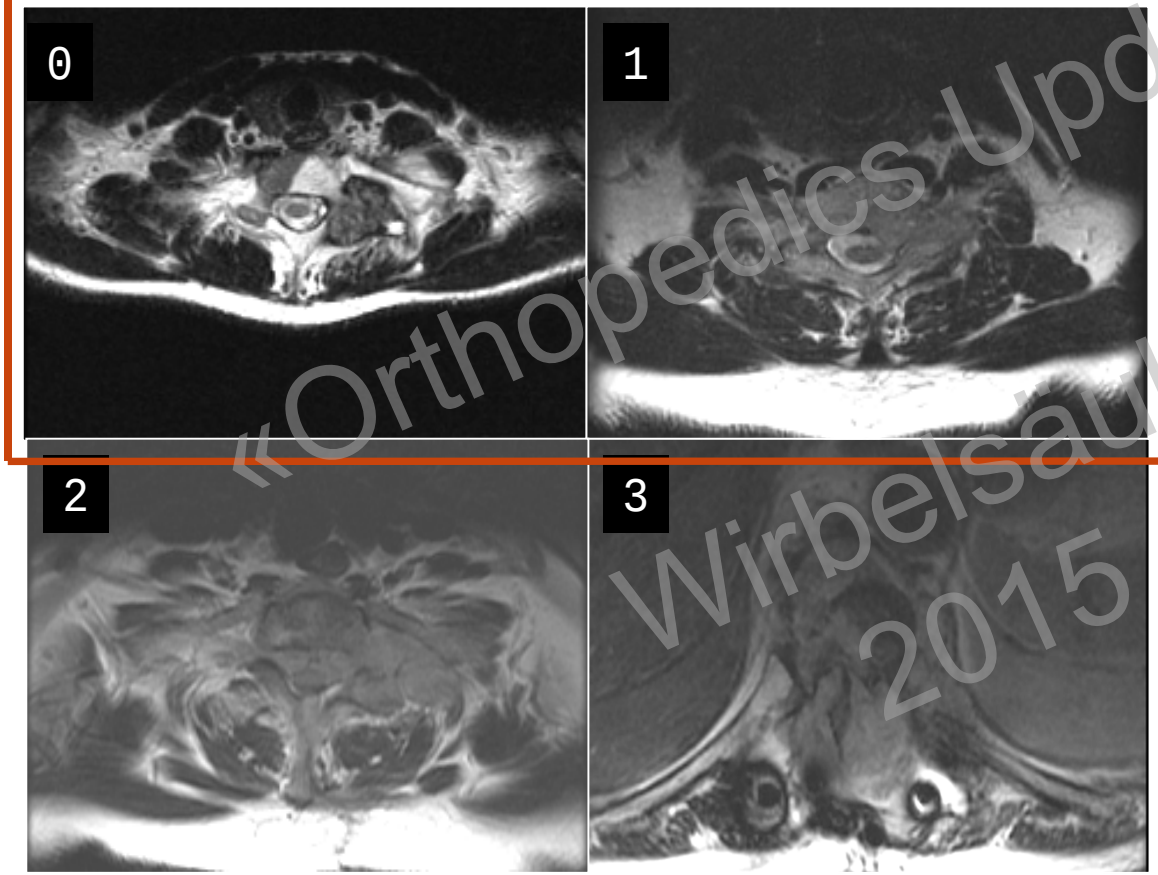
cEBRT (30Gy in 10)

NOMS

N: ESCC



SRS

24Gy or 9Gy x 3

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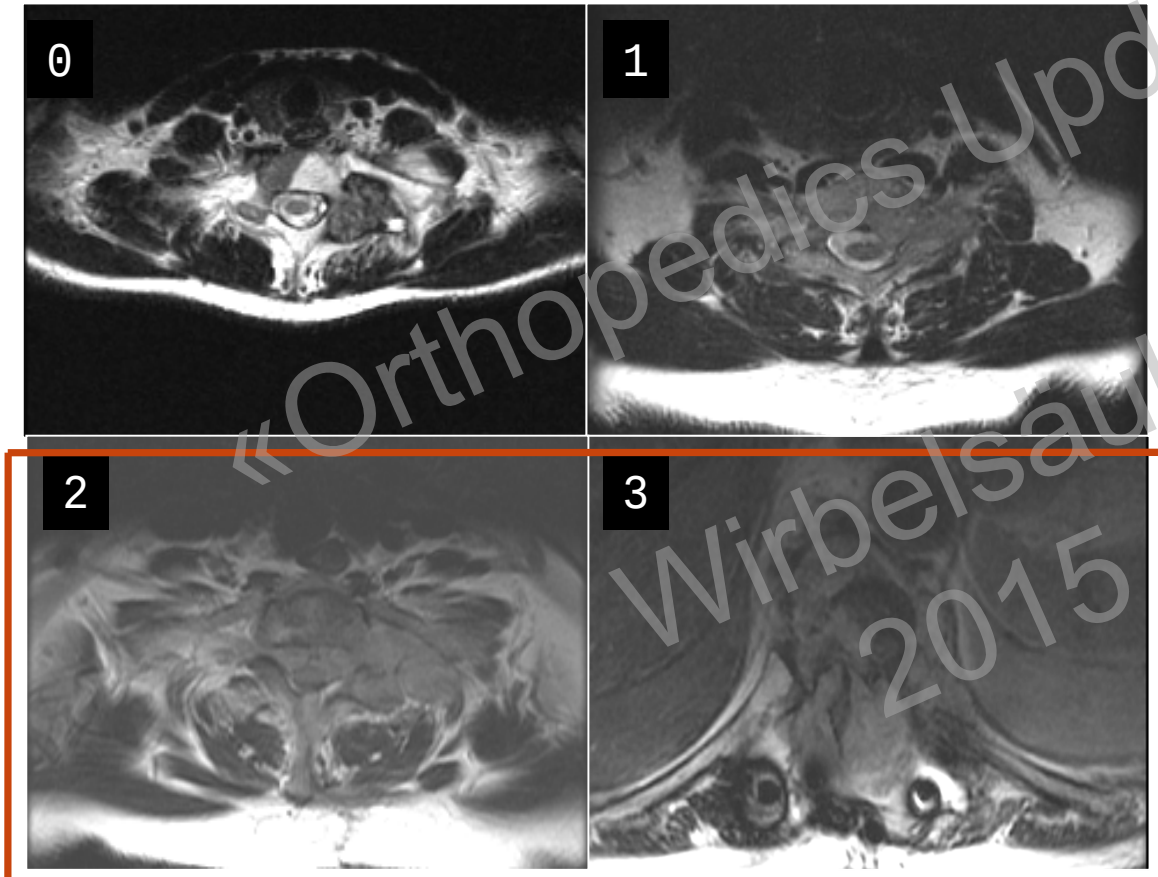
NOMS

N: ESCC



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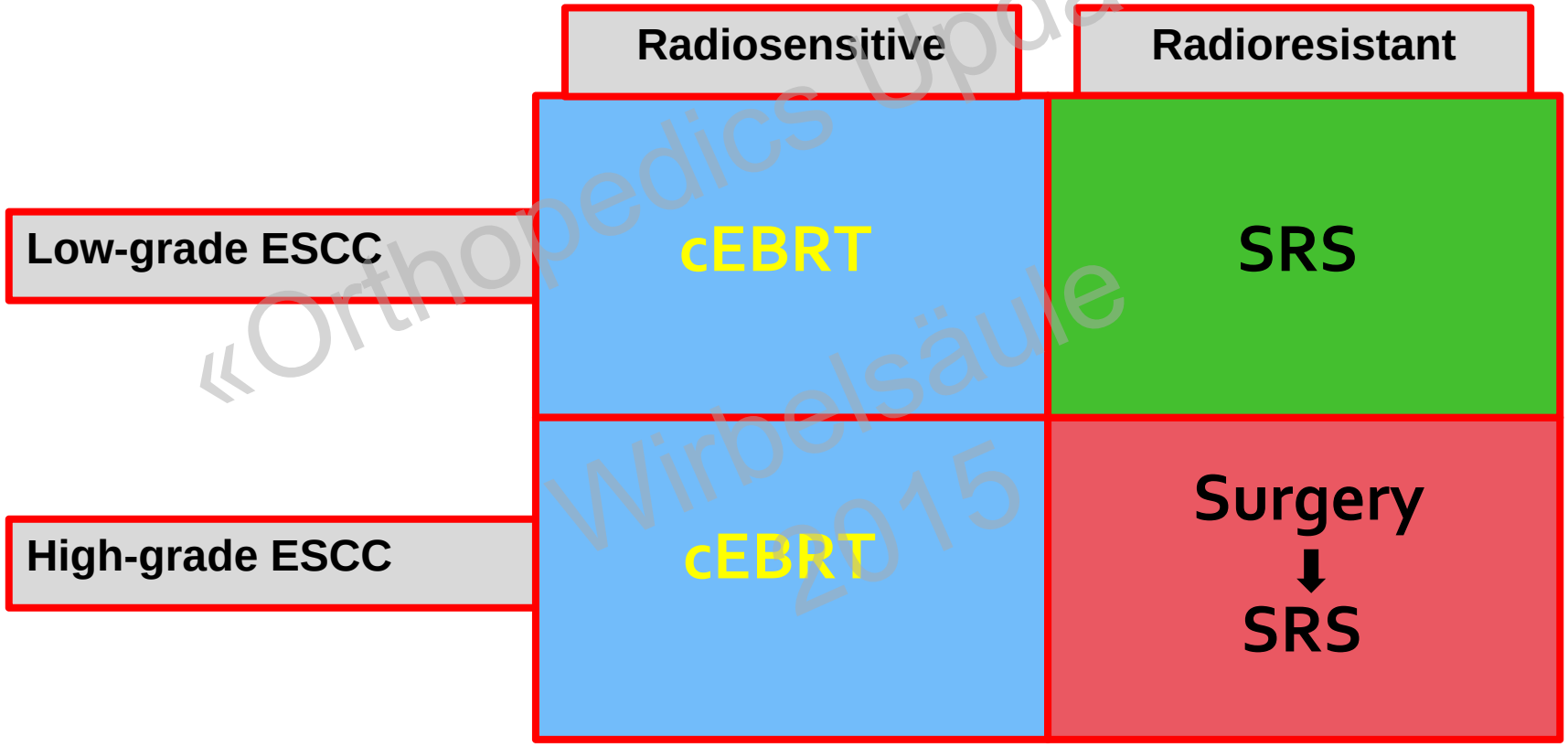
Surgery + SRS

Neurologic and Oncologic Assessment



Histologic Classification
Radiosensitivity to cEBRT (30 Gy in 10)

NOMS

	Radiosensitive			Radioresistant				
	Lymphoma Seminoma Myeloma	Breast	Prostate	Sarcoma	Melanoma	GI	NSCLC	Renal
Gilbert	F	F	U	U	U	U	U	U
Maranzano	F	F	F	U	U	U	U	U
Rades	F	I	I	I	U	I	U	I
Rades	F	F	F	U	U	U	U	U
Katagiri	F	F	F	U	U	U	U	U
Maranzano	F	F	F	U	U	U	U	U
Rades	F	I	I	I	U	I	U	I

Responses: F-Favorable, I-Intermediate, U-Unfavorable

Gerszten PC, Mendel E, Yamada Y. Radiotherapy and radiosurgery for metastatic spine disease: What are the options, indications, and outcomes. Spine 34(22S):S78-92, 2009

Histologic Classification Radiosensitivity to cEBRT (30 Gy in 10)

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	Lymphoma Seminoma Myeloma	Breast	Prostate	Sarcoma	Melanoma	GI	NSCLC	Renal
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Maranzano				U				U
Rades				I				I
Rades				U				U
Katagiri	F	F	F	U			U	U
Maranzano	F		F	U			U	U
Rades	F		I	I			U	I

Median Response Duration **11 months**[1]

2y LCR **86%**[2]

Median Response Duration **3 months**[1]

2y LCR **30%**[2]

Responses: F-Favorable, I-Intermediate, U-Unfavorable

Gerszten PC, Mendel E, Yamada Y. Radiotherapy and radiosurgery for metastatic spine disease: What are the options, indications, and outcomes. Spine 34(22S):S78-92, 2009

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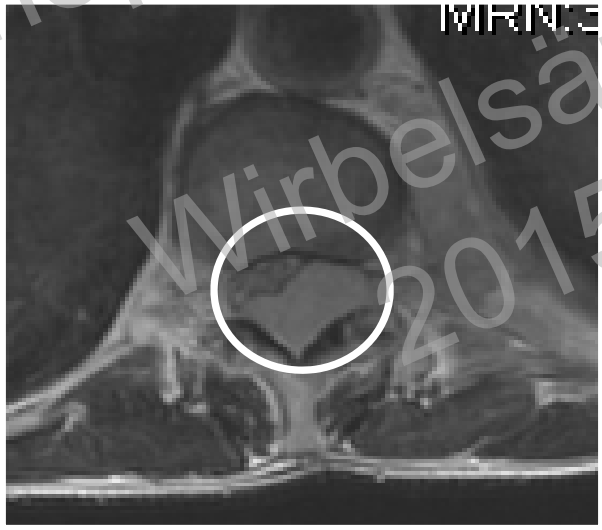
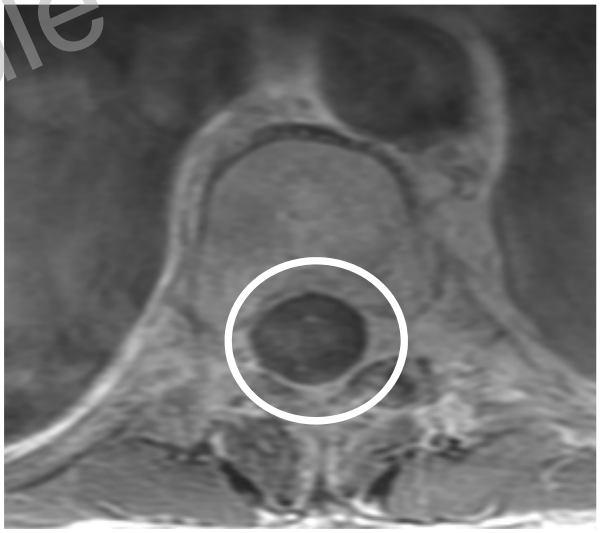
Multiple Myeloma

300 cGy x 8

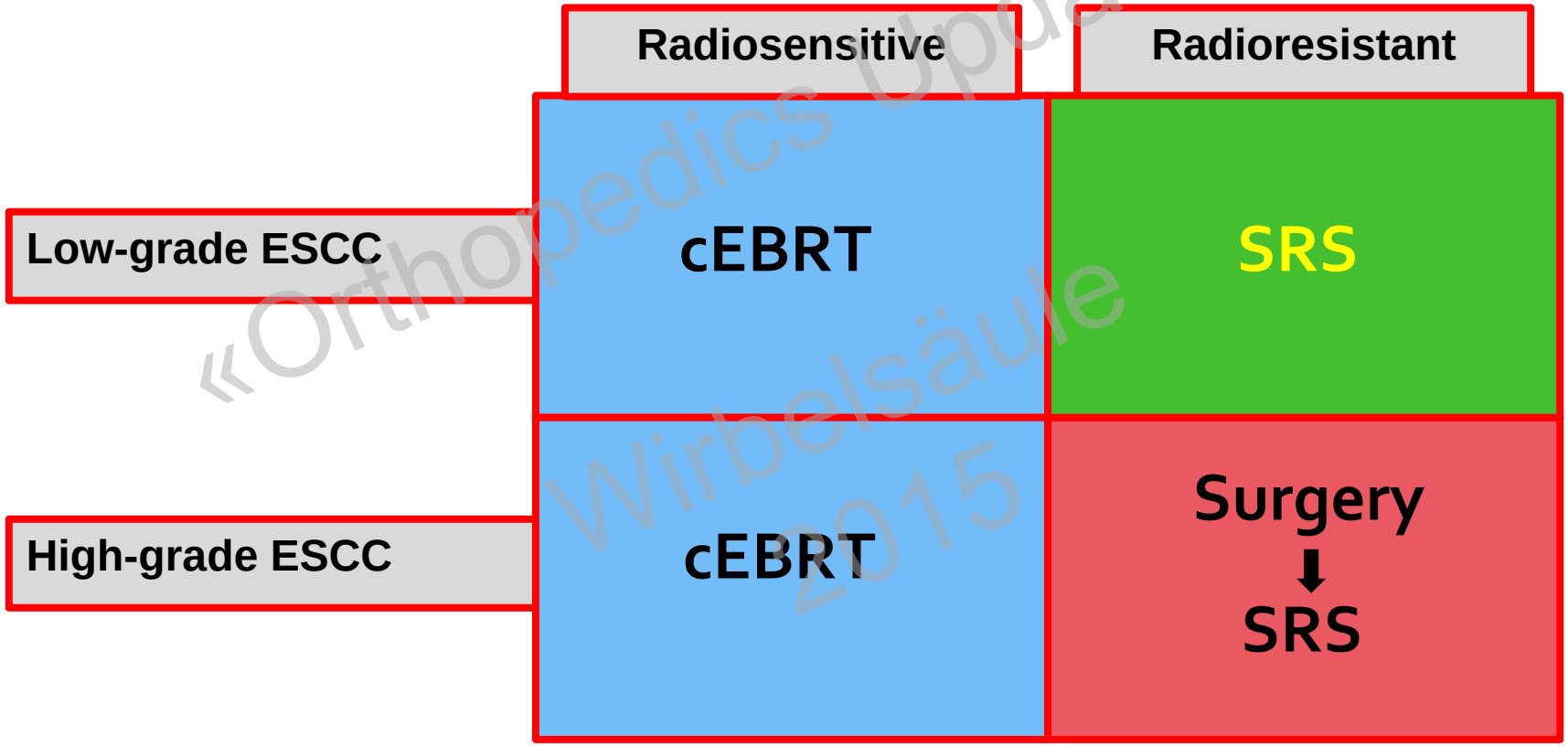
7/22/08



7/31/08



Neurologic and Oncologic Assessment

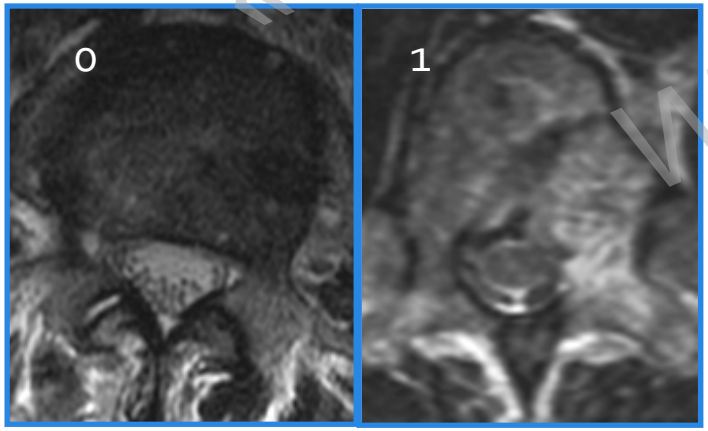


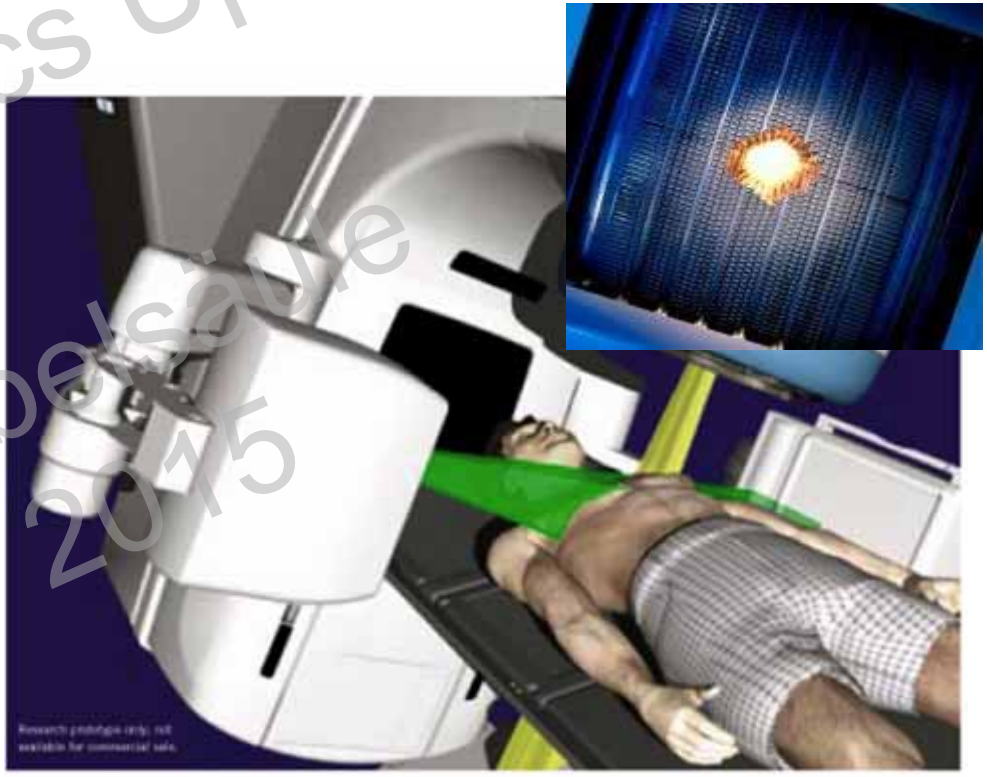
Stereotactic Radiosurgery

Single-Fraction or Hypofractionated High-dose Conformal Photons

Image-guided Intensity Modulated RT: IGRT

- ✓Novalis
- ✓Trilogy
- ✓Truebeam
- ✓Tomotherapy
- ❖Cyberknife





MSKCC Single Fraction

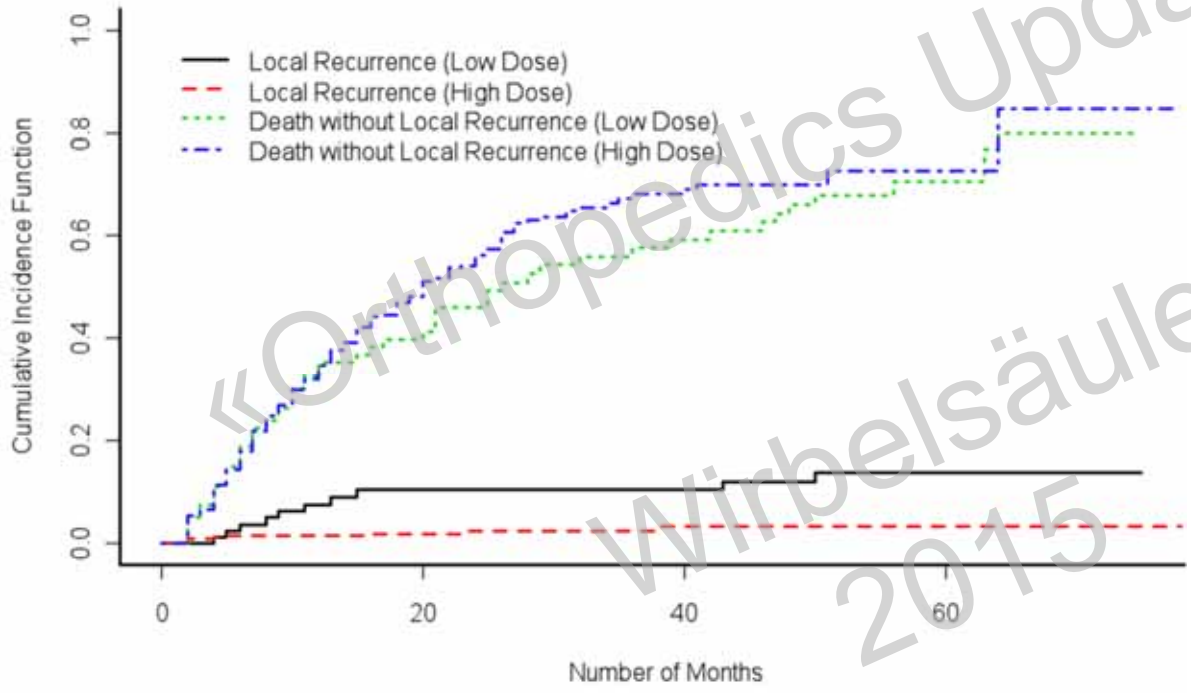


Figure 1: Local recurrence analysis – cumulative incidence functions for the two competing risks stratified by dose level.

413 patients
3-yr Recurrence Rates
All patients: 4%
18 to 23 Gy: 10.4%
24 Gy: 2.4%

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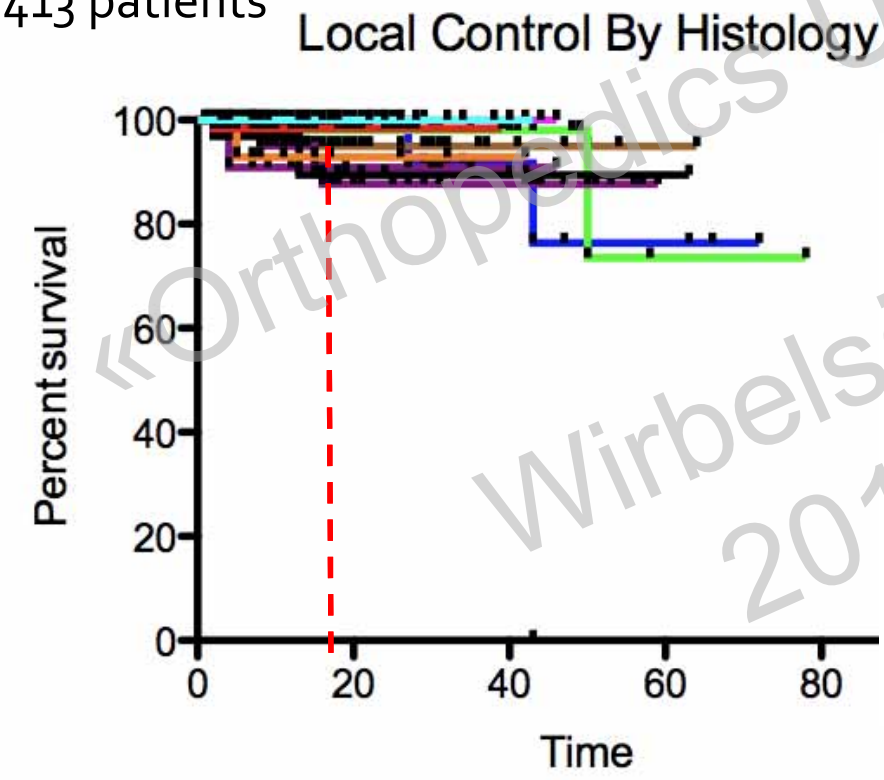
MSKCC Single Fraction Local Control: Histology

413 patients



Histology	3 Yr Local Control
Breast	98%
GI	98%
H&N	93%
Lung	98%
Melanoma	90%
Unknown	91%
Prostate	98%
Renal	89%
Sarcoma	96%
Thyroid	92%

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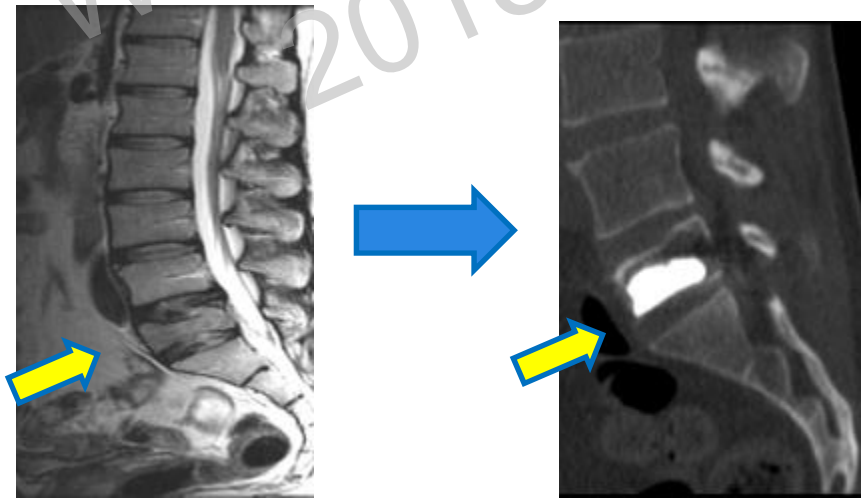
Single Fraction Toxicity

- **Acute ~ Grade 1-2: Skin/Esophageal**
- **Late ~ Grade 3-4: Esophageal (Adriamycin recall, repeated dilations)**
- **Acute or Late ~ No myelopathy/ Radiculoplexopathy (5%)**
- **Late ~ Vertebral Body Fractures?**

SRS: 71 solid tumors/62 patients*

- **27 (39%) Progressive or new fractures**
- **7% Symptomatic**



*Rose P, Laufer I, Lis E, et al. *J Clin Oncol* 2009

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Radiosurgery
Recommendations

A strong recommendation can be made with low-quality evidence that radiosurgery should be considered over conventional fractionated radiotherapy for the treatment of solid tumor spine metastases in the setting of oligometastatic disease and/or radioresistant histology in which no relative contraindications exist.

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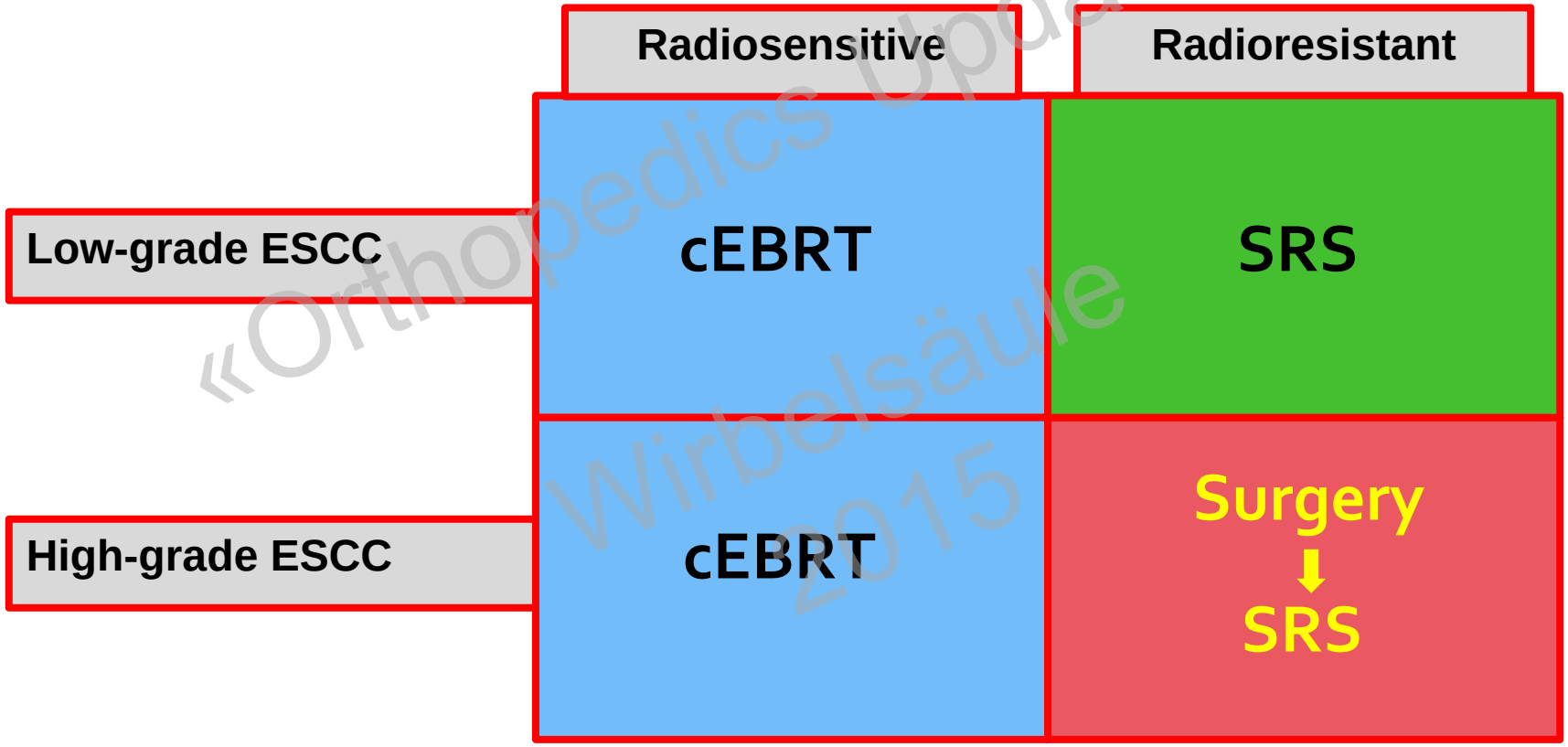
Neurologic and Oncologic Assessment



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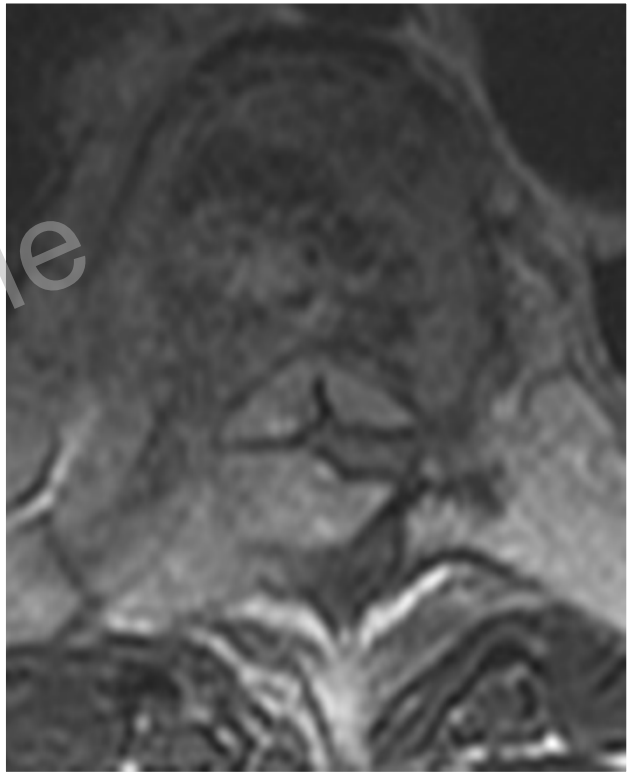
Neurologic Oncologic Assessment

- Prospective randomized trial
- Solid tumors
- HG-ESCC with myelopathy
- Surgery + cEBRT vs. cEBRT alone
- Exclusion criteria
  - RT-sensitive tumors ie. Hematologic malignancies and GCT
  - Multi-level disease
  - Systemic contraindications to surgery



RA Patchell, et al., Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: a randomized trial. Lancet 366: 643, 2005

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Results

	Surgery	Radiation	Significance
Overall Ambulation	84% (42/50)	57% (29/51)	**p=.001**
Duration	122 days	13 days	**p=.003**
Recover Ambulation	62% (10/16)	19% (3/16)	**p= .012**
Continence	155 days	17 days	**p=.016**
Narcotics (MSO4)	.4mgs	4-8 mgs	**p=.002**
Survival Time	**126 days**	**100 days**	**p=.033**

RA Patchell, et al., Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: a randomized trial. Lancet 366: 643, 2005

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Evidence-based Recommendations (GRADE methodology) :
A strong recommendation is made for patients with high-grade spinal cord compression due to solid tumor malignancy undergo surgical decompression and stabilization followed by RT.[1]

Bilsky M,, et.al. Shifting Paradigms in the Treatment of Metastatic Spine Disease. Spine 34(22S): S101-S107, 2009

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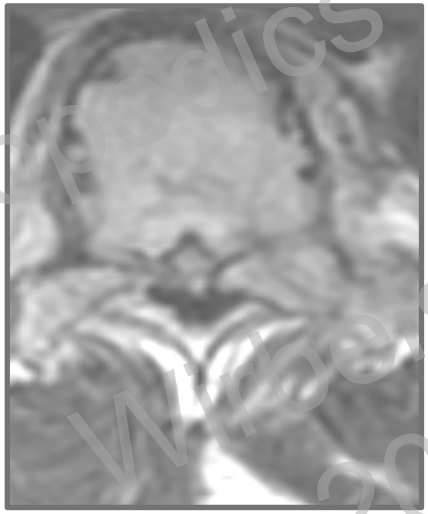
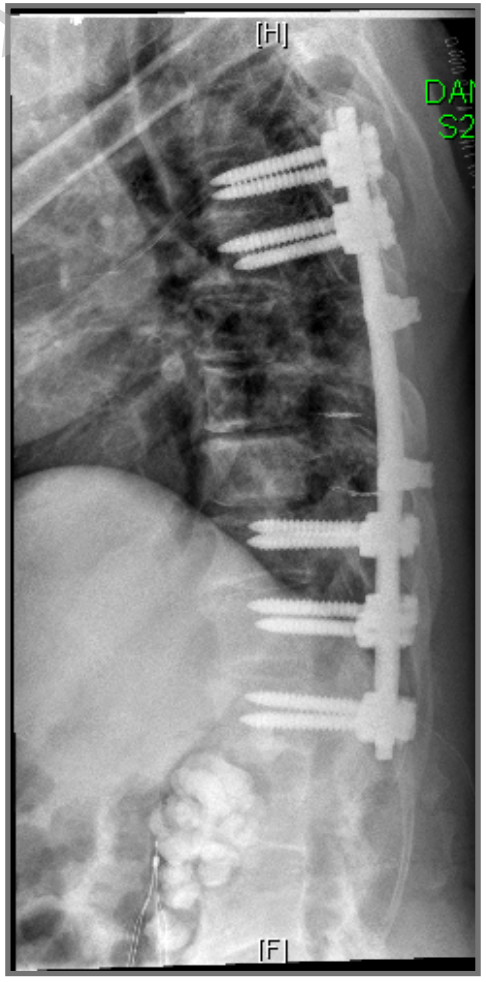
“Separation Surgery” + SRS

86 year old
Papillary thyroid
ASIA C
Absent proprioception

N: HG ESCC
O: RT-resistant
M: Stable
S: Tolerable





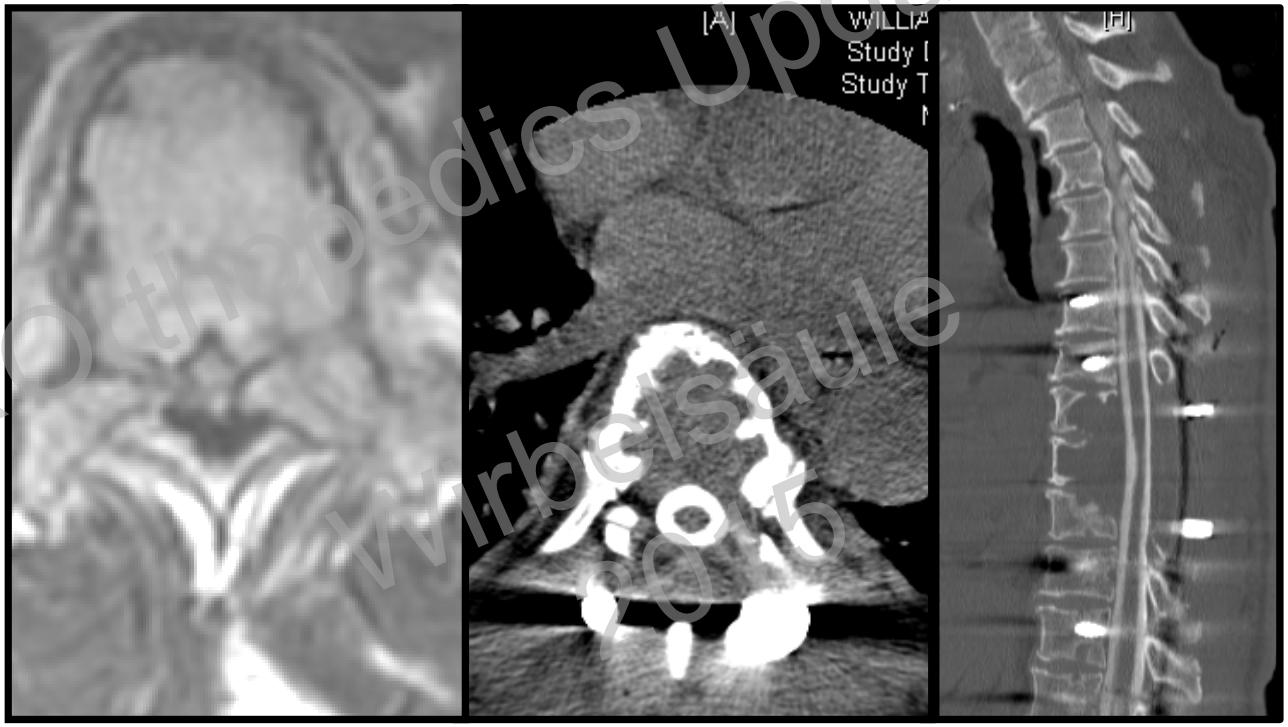
HEMATOLOGY/ONCOLOGY CLINICS OF NORTH AMERICA

Surgical Approach to Epidural Spinal Cord Compression

Mark Bilsky, MD[a,b,*], Michelle Smith, MD[b]

Memorial Sloan Kettering Cancer Center

“Separation Surgery” + SRS



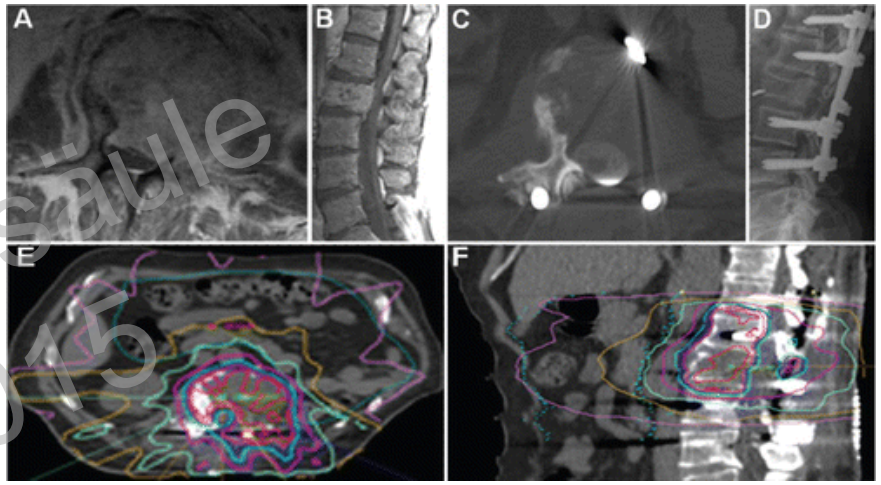
Postoperative Adjuvant Radiation

- 101 patients/106 metastases operated between 1977 to 1996
- Surgery:
  - Posterolateral: 79%
  - Anterior: 12%
  - Combined Anterior/Posterior: 9%
  - Partial (48%) or Complete Resection (43%): 91%
- Adjuvant Treatment (cEBRT): 100%
- Local Control: 40% @ 6 months
  30% @ 1 year
  4% @ 4 years
- Significant Predictors of Recurrence:
  - Ambulation, Tumor Histology, Completeness of Resection

Klekamp J, Samii. Surgical results for spinal metastases. Acta Neurochir (Wien) 140 (9):957-967, 1998

Postoperative Adjuvant SRS

- Retrospective review of 186 patients with spinal metastatic tumors treated with Separation surgery followed by SRS
- 2002 and 2011
- 7.6 months median follow-up
- 136 (73%) high-grade ESCC
- 144 (77%) radioresistant histologies
- 91 (49%) failed previous XRT
- SRS strategies:
  - Single Fraction SRS: 24Gy
  - High-Dose Hypofractionated: 8-10Gy x 3
  - Low-Dose Hypofractionated: 6Gy x 5



Images obtained in a 66-year-old man with metastatic L-2 renal cell carcinoma. **A and B:** Initial axial (A) and sagittal (B) T1-weighted postcontrast MR images demonstrating Grade 3 ESCC. The patient was neurologically intact. **C and D:** Axial postoperative CT myelogram (C) and postoperative radiograph (D) obtained after "separation surgery" to decompress the spinal cord and CSF space and instrumentation placement. **E and F:** Axial (E) and sagittal (F) postoperative CT myelograms that were used for planning of the adjuvant high-dose hypofractionated SRS.

Laufer I, et.al. Local disease control for spinal metastases following "separation surgery" and adjuvant hypofractionated radiation or high-dose single-fraction stereotactic radiosurgery: outcome analysis in 186 patients. J Neurosurg Spine: January 22, 2013

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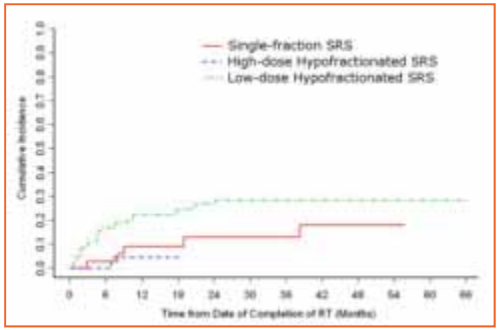
Postoperative Adjuvant SRS

- **1-year estimated cumulative incidence of recurrence**
  - **Total – 16.4%**
  - **Single-fraction SRS: 9.0%**
  - **High-dose hypofractionated:4.1%***
  - **Low-dose hypofractionated: 22.6%**
- **No neurologic complications**
- **No association:**
  - **Radioresistant tumor histologies**
  - **Previous radiation**
  - **Epidural extension**



Factor	Univariate HR	Univariate p Value	Est Cumulative 1-Yr Incidence (%) Value	Est Cumulative 1-Yr Incidence (%) 95% CI
postop adjuvant SRS				
low-dose hypo	reference		22.6	14.3–30.8
high-dose hypo	0.12	0.04	4.1	0–12.2
single-fraction	0.45	0.09	9.0	0–19.0
preop RT failure				
no preop RT	reference		11.2	4.6–17.9
cEBRT	1.96	0.07	22.2	10.9–33.6
hypo SRS	1.84	0.29	23.8	2.4–45.2
single-fraction SRS	0.98	0.99	17.1	0–51.2
radiation sensitivity	1.23	0.60	—	—
male sex	0.72	0.34	—	—
total incidence	NA	NA	16.4	10.7–22.2

* Est = Estimated; NA = not applicable

Laufer I, et.al. Local disease control for spinal metastases following "separation surgery" and adjuvant hypofractionated radiation or high-dose single-fraction stereotactic radiosurgery: outcome analysis in 186 patients. J Neurosurg Spine: January 22, 2013

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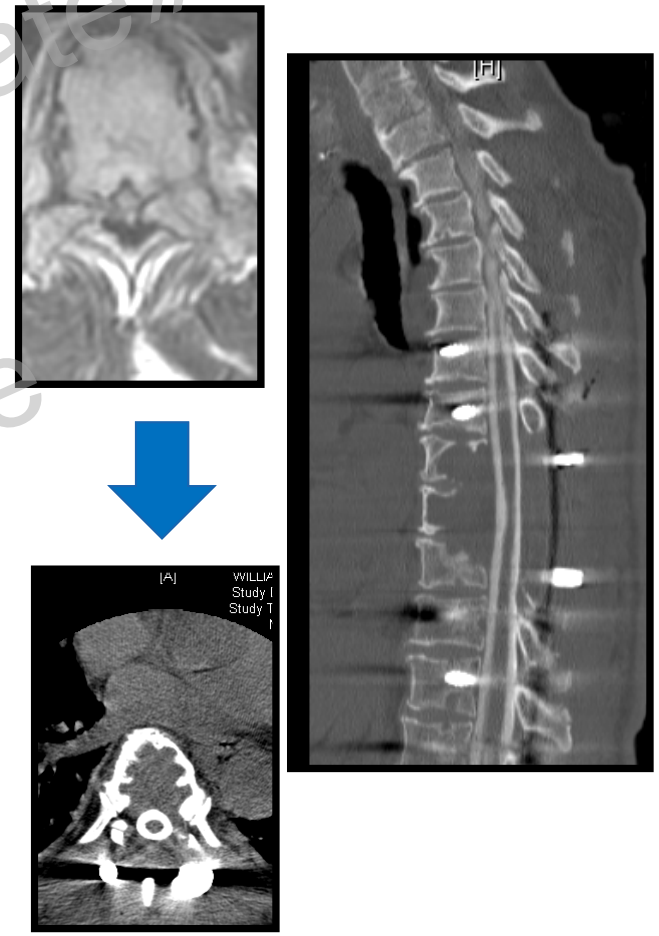
Separation Surgery
Durability of Construct

- 319 patients
- Procedure:
  - Posterolateral Laminectomy
  - Epidural decompression of thecal sac
  - Pedicle screw fixation: 5-6 levels (range 3 to 16)
  - Limited VB resection, no anterior reconstruction
- Major histologies
  - NSCLCa, RCC, Prostate Sarcoma



Amankulor NM, Xu R, Iorguescu JB, et.al.The incidence and patterns of hardware failure after separation surgery in patients with spinal metastatic tumors. Spine 38(22): 2013.

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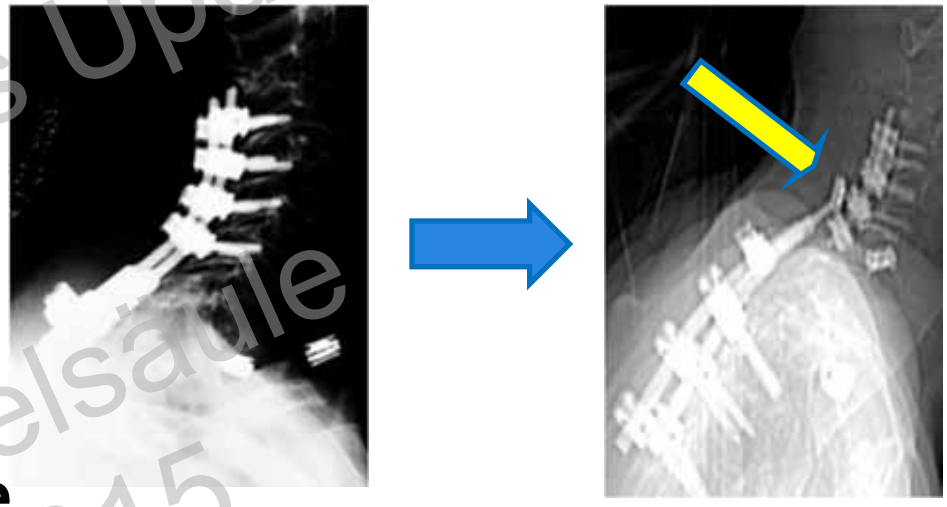
Separation Surgery

- *Failures 9/316 (2.8%)
- Instrumentation failure
  - Rod or Screw Break
  - Screw Pull out
- Symptomatic VB fracture
- Risk factor:
  - Junctional Spine (CT or TL)
  - Early failure: Post menopausal women

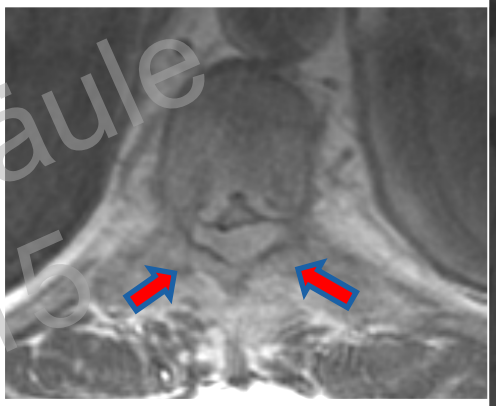


Case Presentation

- 66 y.o., Hx of RCC
- 3 week Hx of biologic back pain
- VAS 8/10
- Acute onset of weakness: ASIA C
- PMH: Chronic Renal Insufficiency
- Systemic w/u:

  RCC extending into renal vein

  Pulmonary nodules, Acetabular fx.



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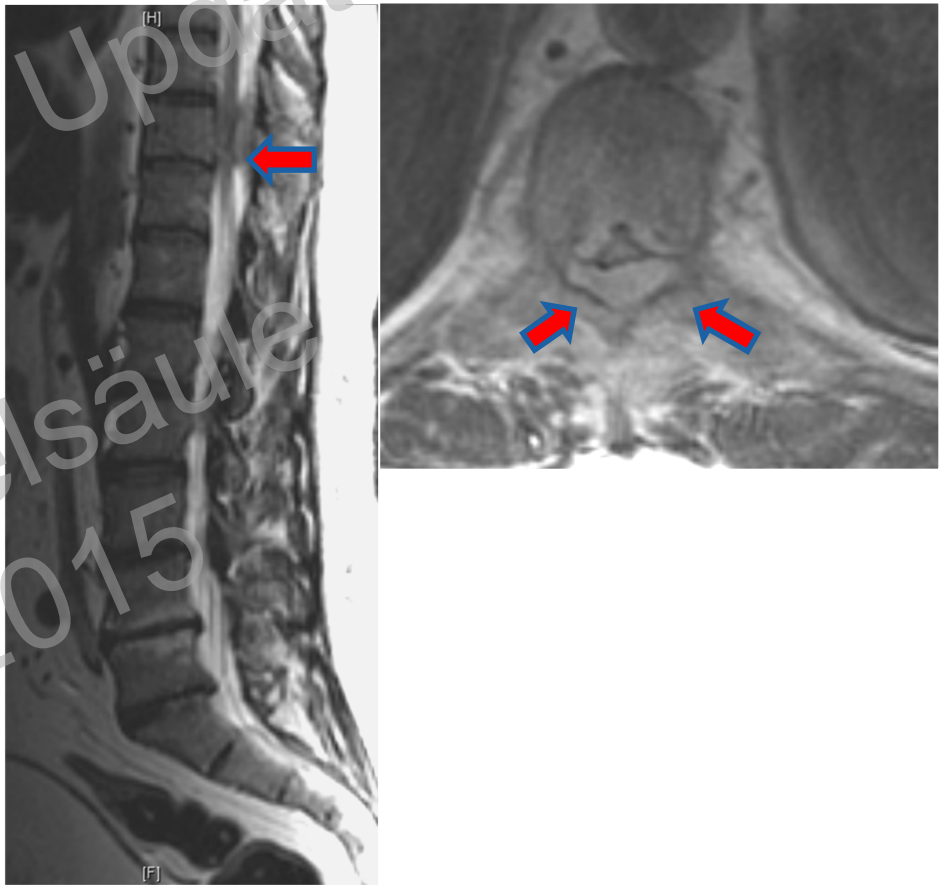
NOMS

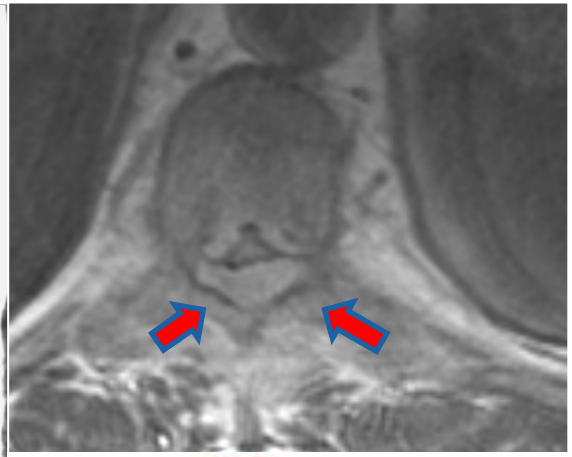
- Neurologic
  - Myelopathy
  - Functional Radiculopathy
  - Degree of epidural spinal cord compression:
- Oncologic
  - Tumor Histology: RCC
  - Radiation or Chemosensitivity
- Mechanical Stability
- Systemic Disease and Medical Co-morbidity

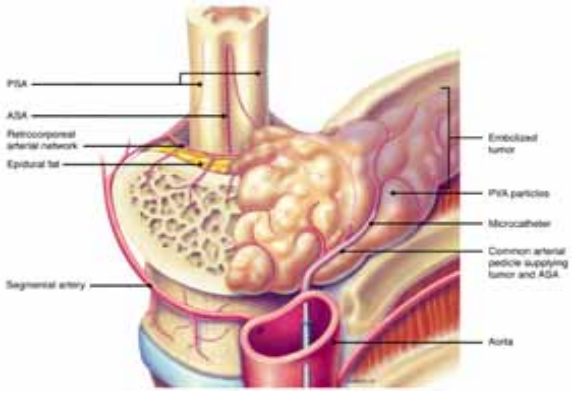


NOMS

- **Neurologic**
  - **Myelopathy**
  - **Functional Radiculopathy**
  - **Degree of epidural spinal cord compression: ESCC 3**
- **Oncologic**
  - **Tumor Histology: RCC**
  - **Radiation or Chemosensitivity: RT-resistant**
- **Mechanical Stability: Stable**
- **Systemic Disease and Medical Co-morbidity**

High-dose steroids
Embolization





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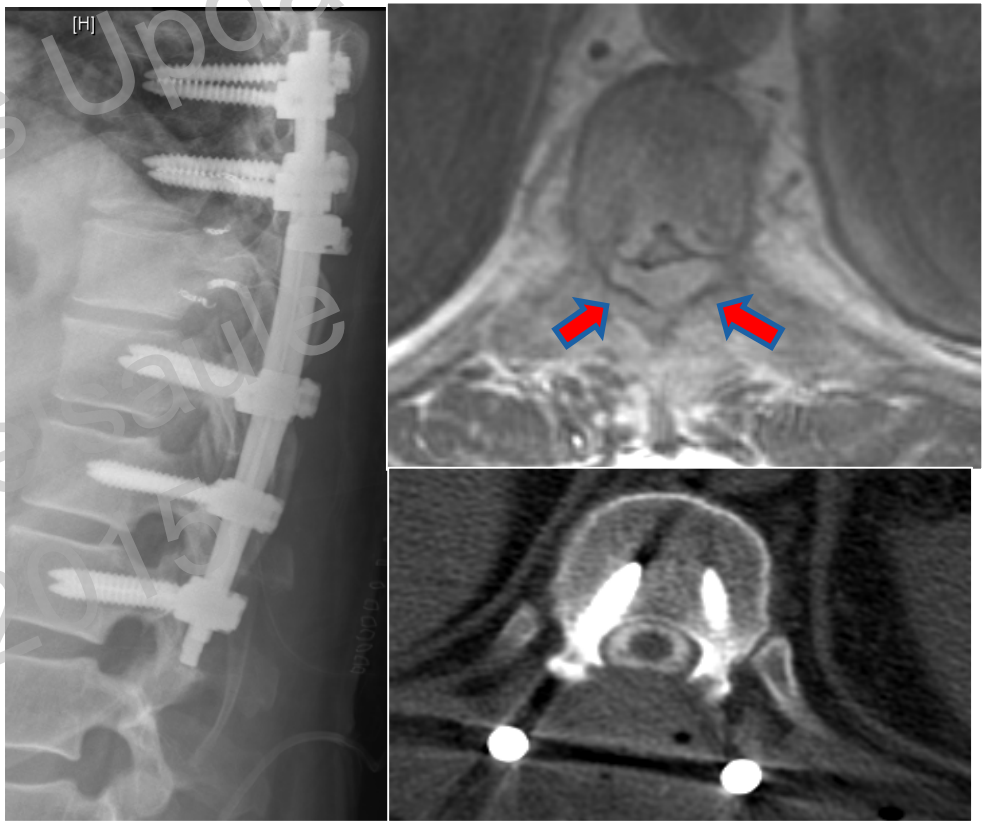
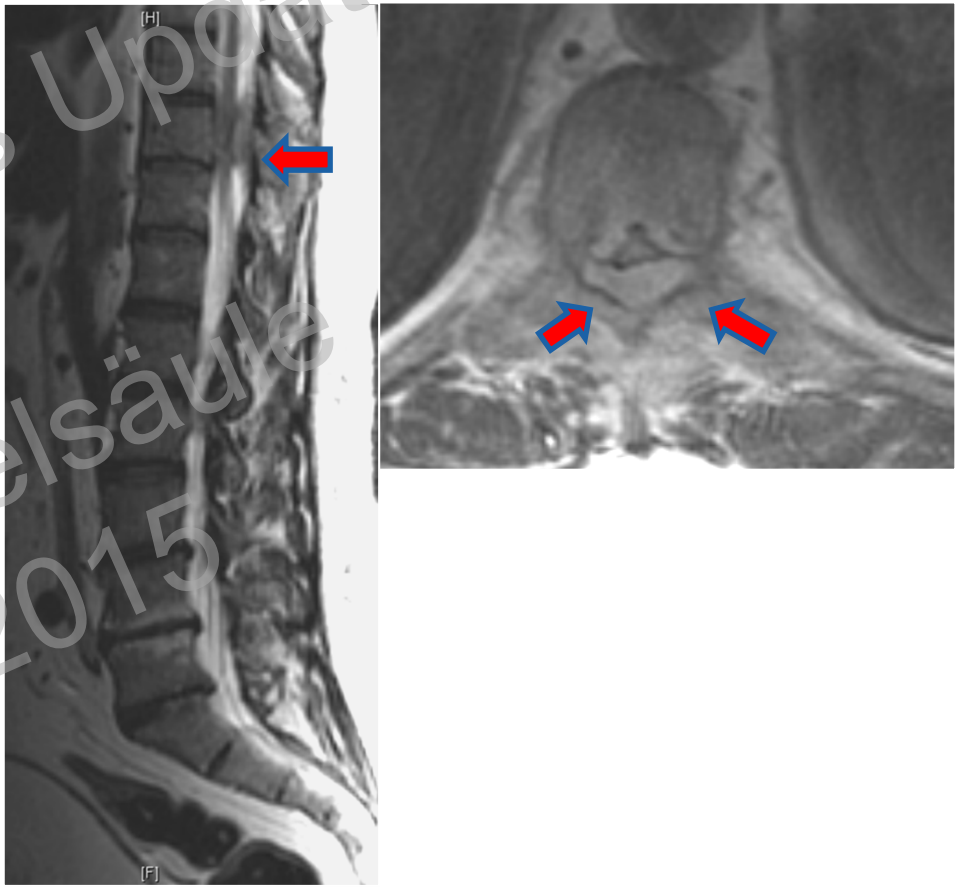


Separation Surgery
Instrumentation /p32 plaque/SRS

NOMS

- **Neurologic**
  - **Myelopathy**
  - **Functional Radiculopathy**
  - **Degree of epidural spinal cord compression: ESCC 3**
- **Oncologic**
  - **Tumor Histology: Lymphoma**
  - **Radiation or Chemosensitivity**

    RT-sensitive cEBRT
- **Mechanical Stability: Stable**
- **Systemic Disease and Medical Co-morbidity**



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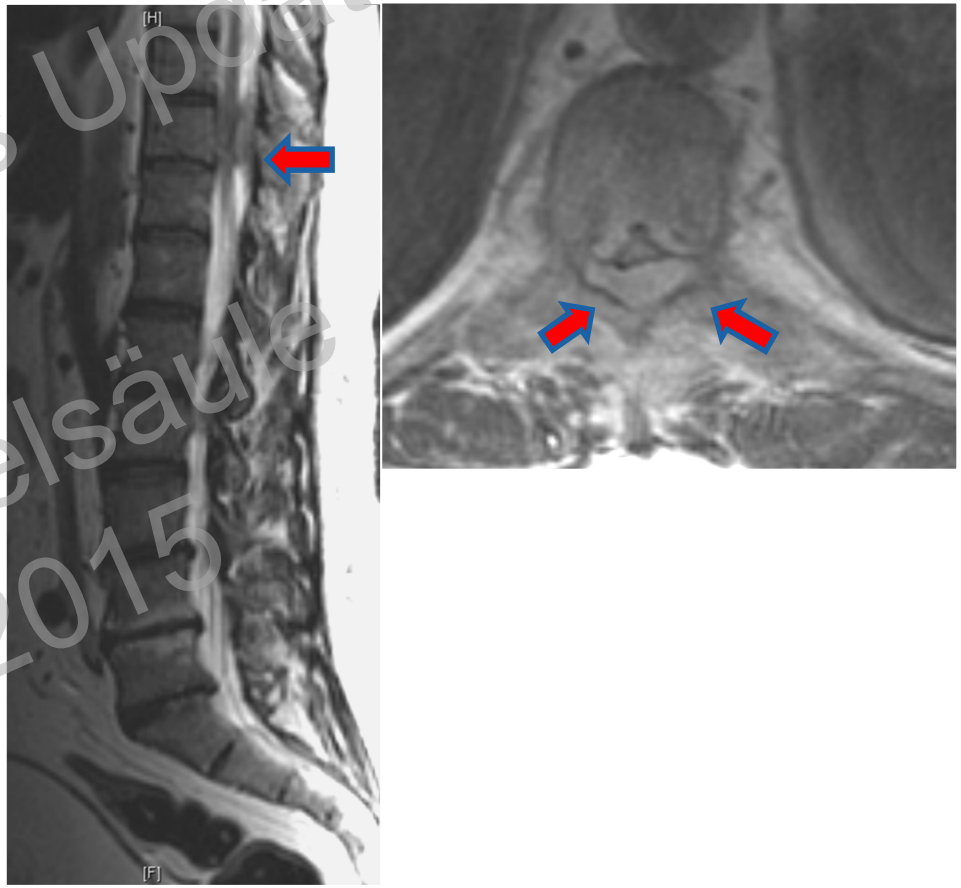

High-dose steroids
cEBRT (30 Gy in 10 fractions)

NOMS

- **Neurologic**
  - **Myelopathy**
  - **Functional Radiculopathy**
  - **Degree of epidural spinal cord compression: ESCC 3**
- **Oncologic**
  - **Tumor Histology: Unknown**
  - **Radiation or Chemosensitivity Unknown**
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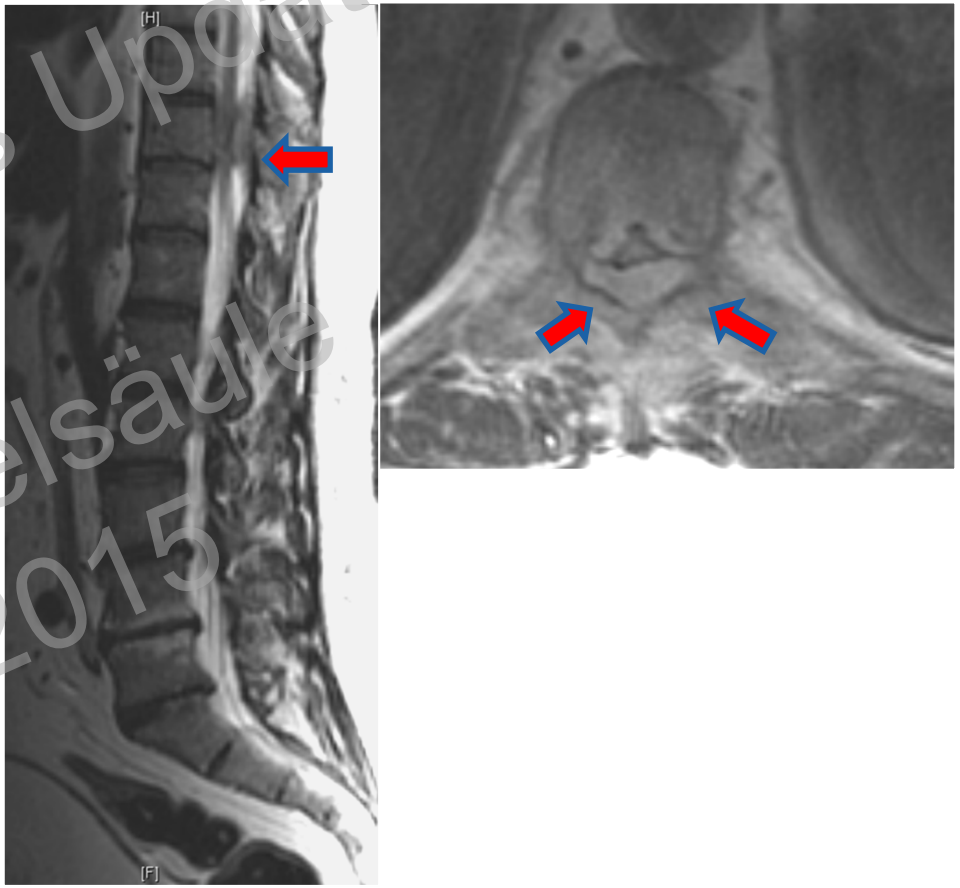

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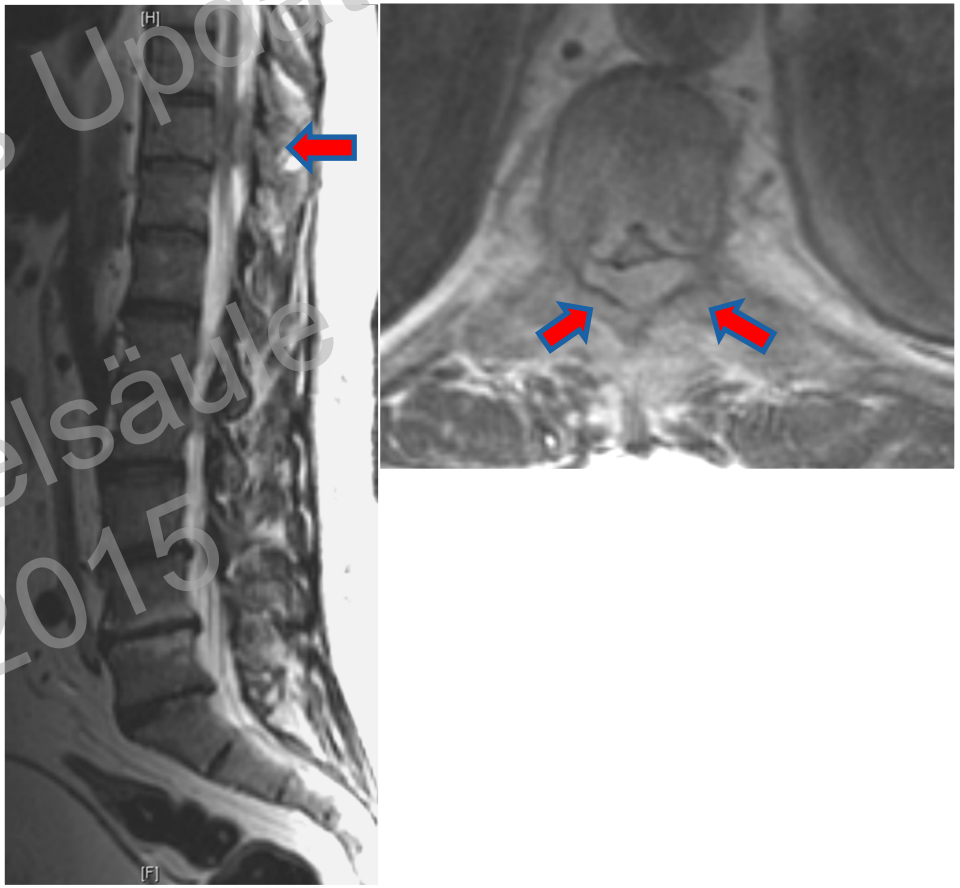

High-dose steroids
Establish RT-sensitive: cEBRT
No Dx: Surgery

NOMechanical InstabilityS

- **Recognition of instability as an indication for surgery or percutaneous cement augmentation prior to RT**
- **Spine Oncology Study Group (SOSG) created a scoring system Spine Instability Neoplastic Score or SINS[1]**

  -Integrates systematic literature review with expert opinion

  -Reliable: High inter and intra-rater reliability[2]

  -Valid: Substantial agreement between SINS score and expert opinion[2]

1Fisher CG, et al. A novel classification system for spinal instability in neoplastic disease: an evidence-based approach and expert consensus from the Spine Oncology Study Group. Spine. 2010;35(22):E1221-9.
2Fourney DR, et al. Spinal instability neoplastic score: an analysis of reliability and validity from the spine oncology study group. J Clin Oncol 2011;29(22):3072-71

Spine Instability Neoplastic Score (SINS)

SINS Component	Description	Score
Location	Junctional (Occ-C2, C7-T2, T11-L1, L5-S) Mobile (C3-6, L2-4) Semirigid (T3-10) Rigid (S2-5)	3 2 1 0
Pain	Yes* Occasional non-mechanical pain No	3 1 0
Bone Lesion	Lytic Mixed Blastic	2 1 0
Alignment	Subluxation / translation De novo deformity Normal	4 2 0
Vertebral Body	>50% collapse <50% collapse No collapse with >50% VB involved None of above	3 2 1 0
Posterolateral Involvement	Bilateral Unilateral None	3 1 0

Tallied Score from 6 components

Stable	Potentially Unstable	Unstable
0-6	7-12	13-18

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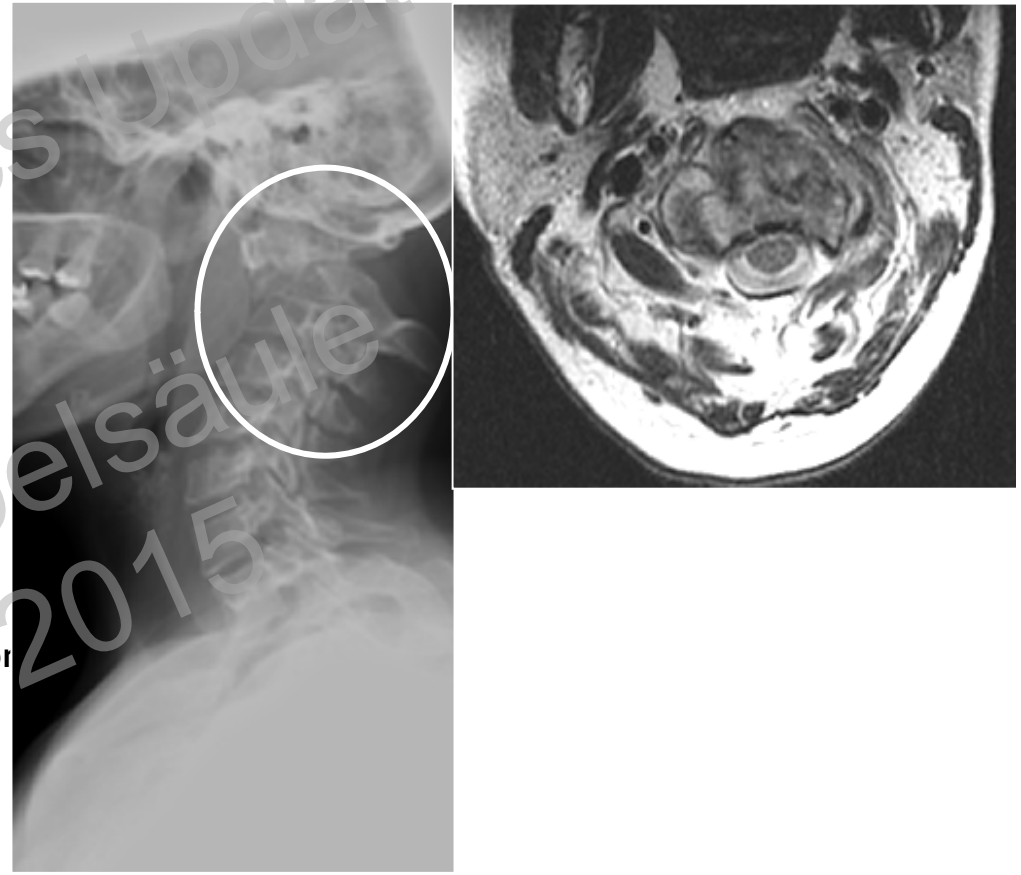
Case Example

- 45 y.o. female with hormone-refractory breast carcinoma
- Presents with progressive neck pain on flexion, extension and lateral rotation
- Neurologically intact except severe right occipital neuralgia
- Imaging:
  - Plain X-rays: C1-C2 fracture subluxation
    5 mm anterior translation/45 degree angulation
  - MR: Lytic bone destruction



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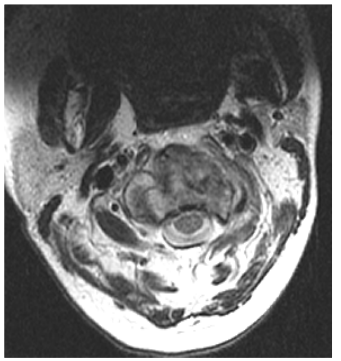
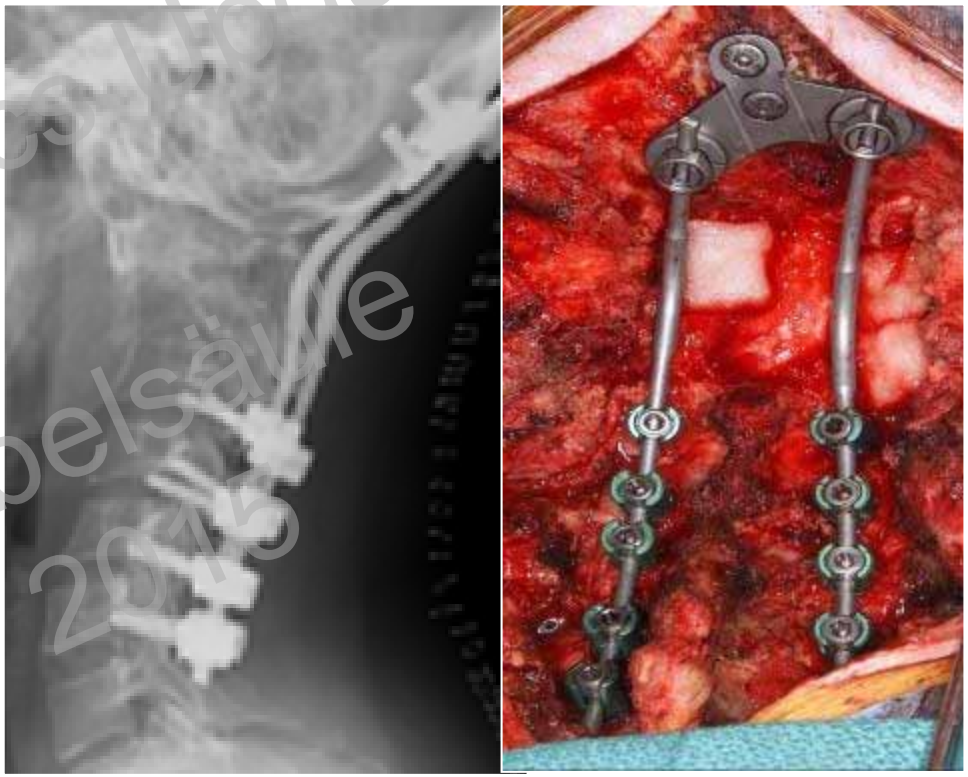
SINS=17
Unstable



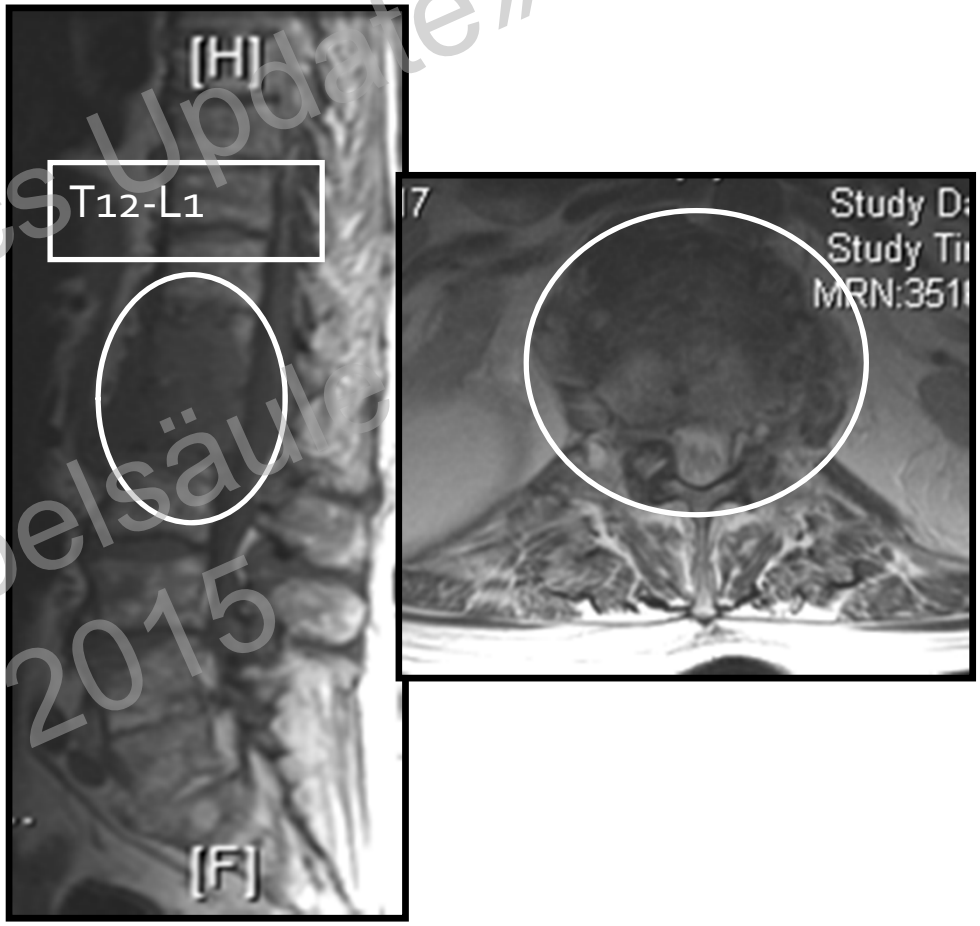
Metastatic Tumor of the Atlanto-axial Spine
Irreducible Fracture

- **Management:**
  - **C1-2 Laminectomy**
  - **O-C6 Instrumentation**
  - **No anterior resection / reconstruction**
  - **Postoperative adjuvant cEBRT (30 Gy in 10)**



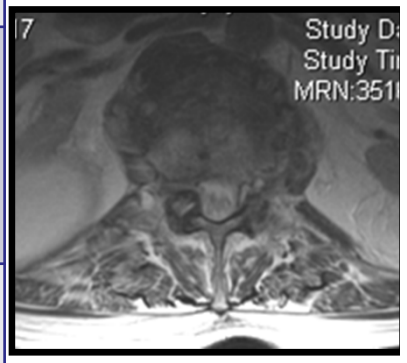
Case example

- 85 year old, hx of CASHD,
- 8 weeks of progressive worsening mechanical back pain (10/10)
- MRI scan
- Metastatic w/u negative
- Emergency admission for biopsy
- Multiple myeloma
- Revlimid



SINS Component	Description	Score
Location	Junctional (Occ-C2, C7-T2, T11-L1, L5-S1)	3
	Mobile (C3-6, L2-4)	2
	Semirigid (T3-10)	1
	Rigid (S2-5)	0
Pain	Yes*	3
	Occasional non-mechanical pain	1
	No	0
Bone Lesion	Lytic	2
	Mixed	1
	Blastic	0
Alignment	Subluxation / translation	4
	De novo deformity	2
	Normal	0
Vertebral Body	>50% collapse	3
	<50% collapse	2
	No collapse with >50% VB involved	1
	None of above	0
Posterolateral Involvement	Bilateral	3
	Unilateral	1
	None	0

SINS=10
Potentially Unstable



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Percutaneous Cement Augmentation

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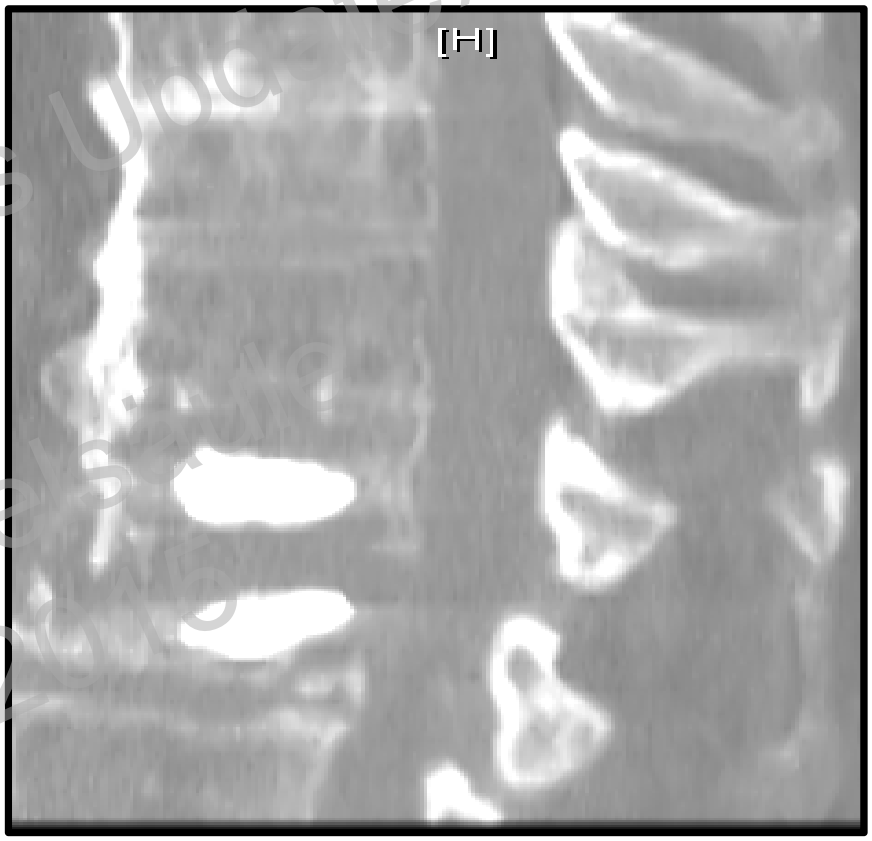
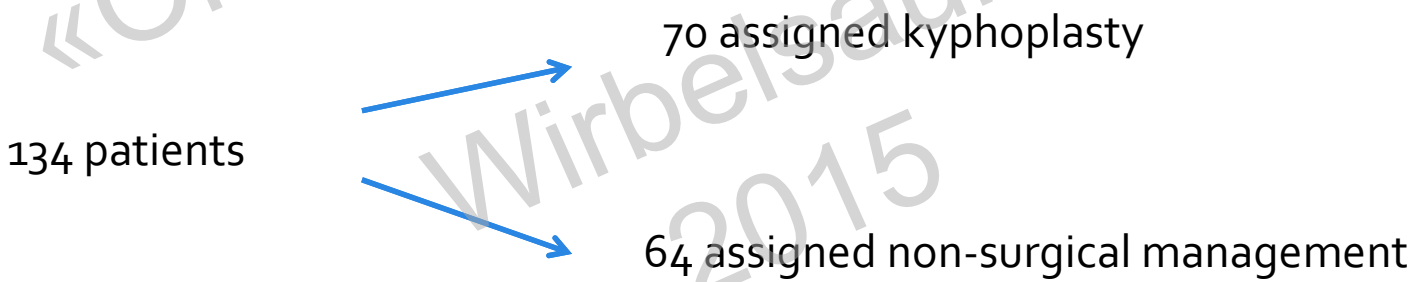
Percutaneous Cement Augmentation

- ✓16 months post treatment
- ✓Pain 3/10
- ✓Requesting gym pass



CAncer Patient Fracture Evaluation (CAFE) Study

Balloon Kyphoplasty versus Non-surgical Fracture Management for Treatment of Painful Vertebral Body Compression Fractures in Patients with Cancer: A Multicentre, Randomized Controlled Trial



Berenson *et al.* 2011;**12**:225-35.
Published Online February 17, 2011

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CAncer Patient Fracture Evaluation (CAFE) Study

Crossover

- 73% (38/52) NSM patients that completed the 1 month evaluation eventually crossed over to BKP
- 55% (21/38) of the patients crossed over within 1 week after their 1 month visit

Outcomes

Improvements seen at 1 month post-BKP (patients randomized to immediate BKP and crossover) were generally maintained through the final 12-month assessment for:

- Back pain 7.3 to 3.5 Control 7.3- to 7.0
- Back-specific function
- Quality of life

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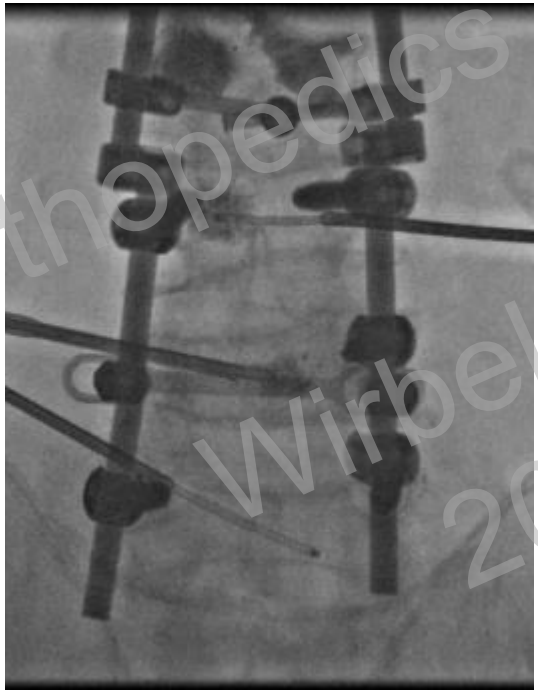
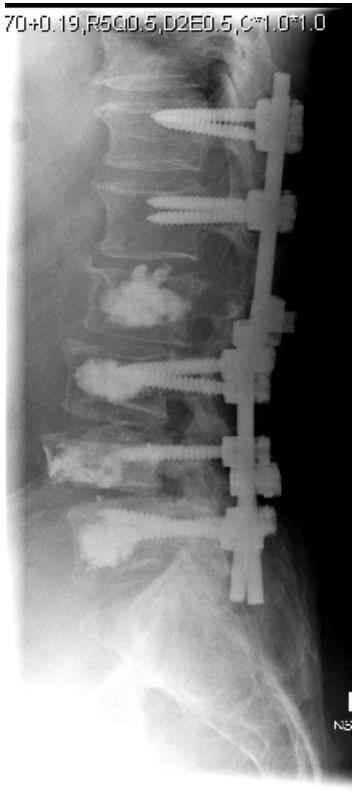
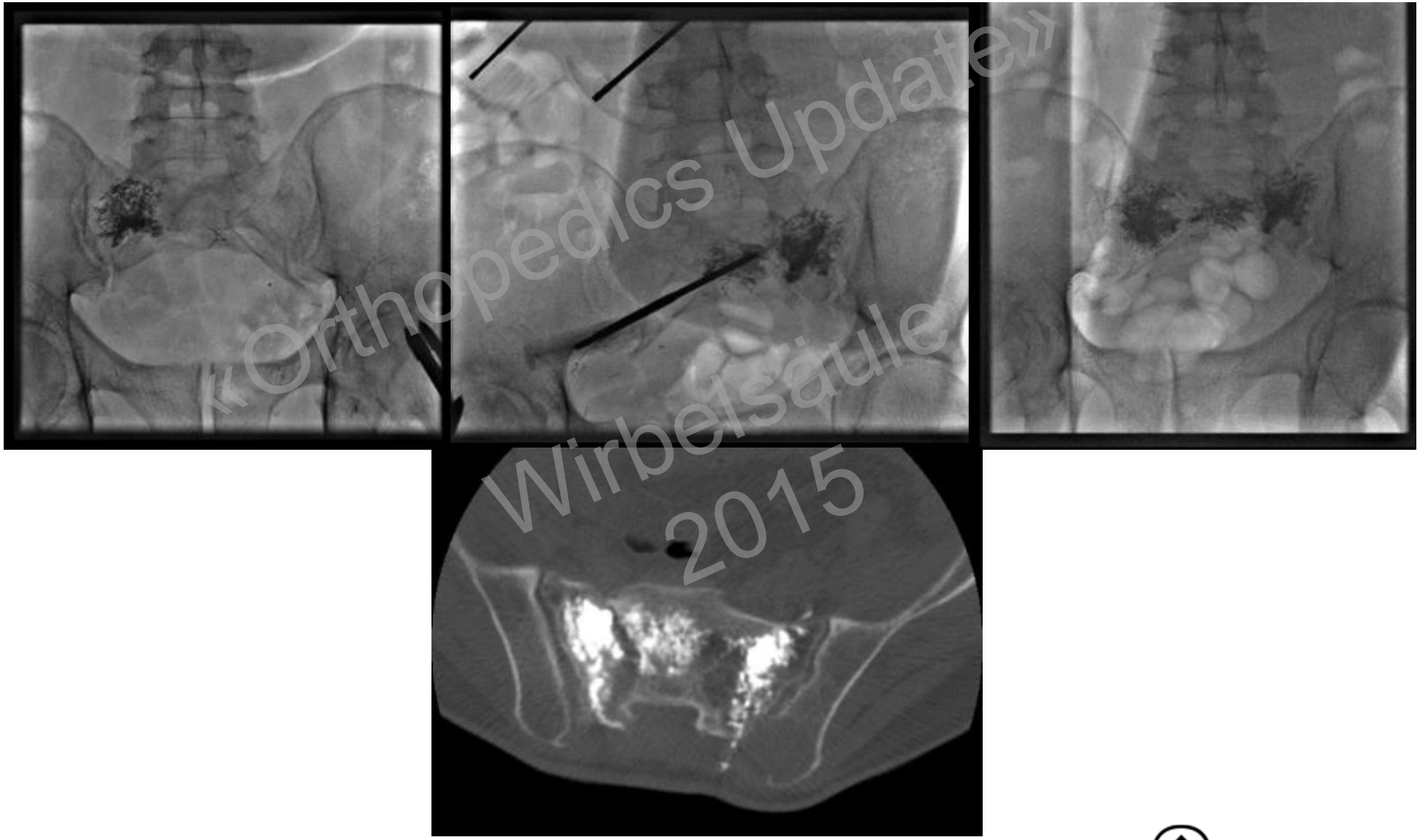
Salvage Kyphoplasty





SACROPLASTY



Moussazadeh N,et.al. Sacroplasty for cancer-associated insufficiency fractures.Neurosurgery 74(6):446,2015

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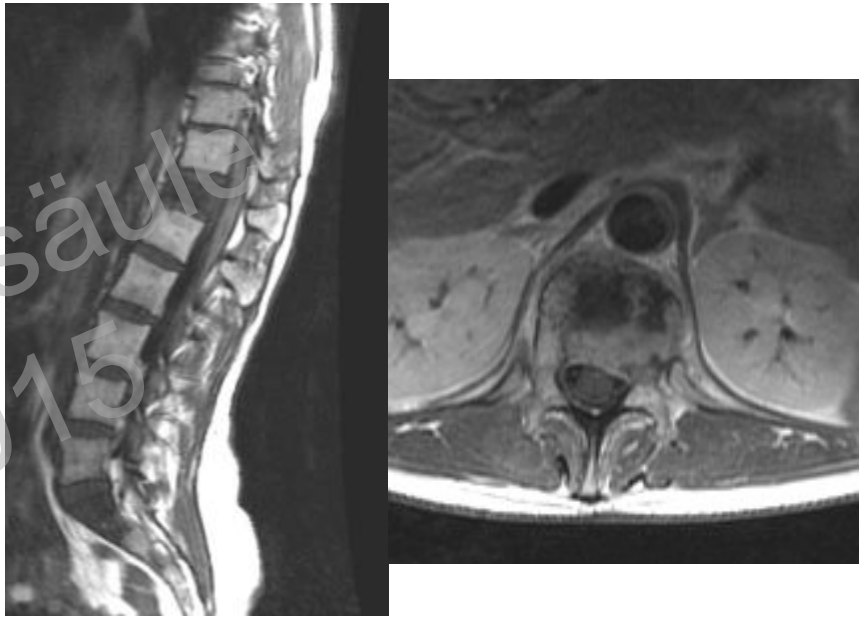
Case Example

- 33F recently breast cancer
- Metastatic to spine and brain
- Rx'ed: cEBRT to T12-L1
- Progressive movement-related back pain
- MRI: T12 burst fracture and cord impingement
- Neurologically intact



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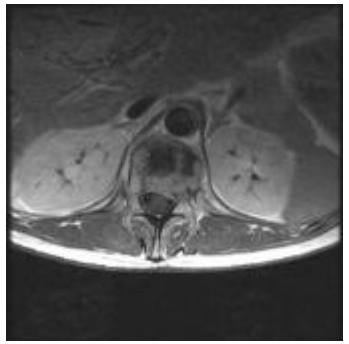
Pain	Yes* Occasional non-mechanical pain No	3 1 0
Bone Lesion	Lytic Mixed Blastic	2 1 0
Alignment	Subluxation / translation De novo deformity Normal	4 2 0
Vertebral Body	>50% collapse <50% collapse No collapse with >50% VB involved None of above	3 2 1 0
Posterolateral Involvement	Bilateral Unilateral None	3 1 0

SINS=14
Unstable



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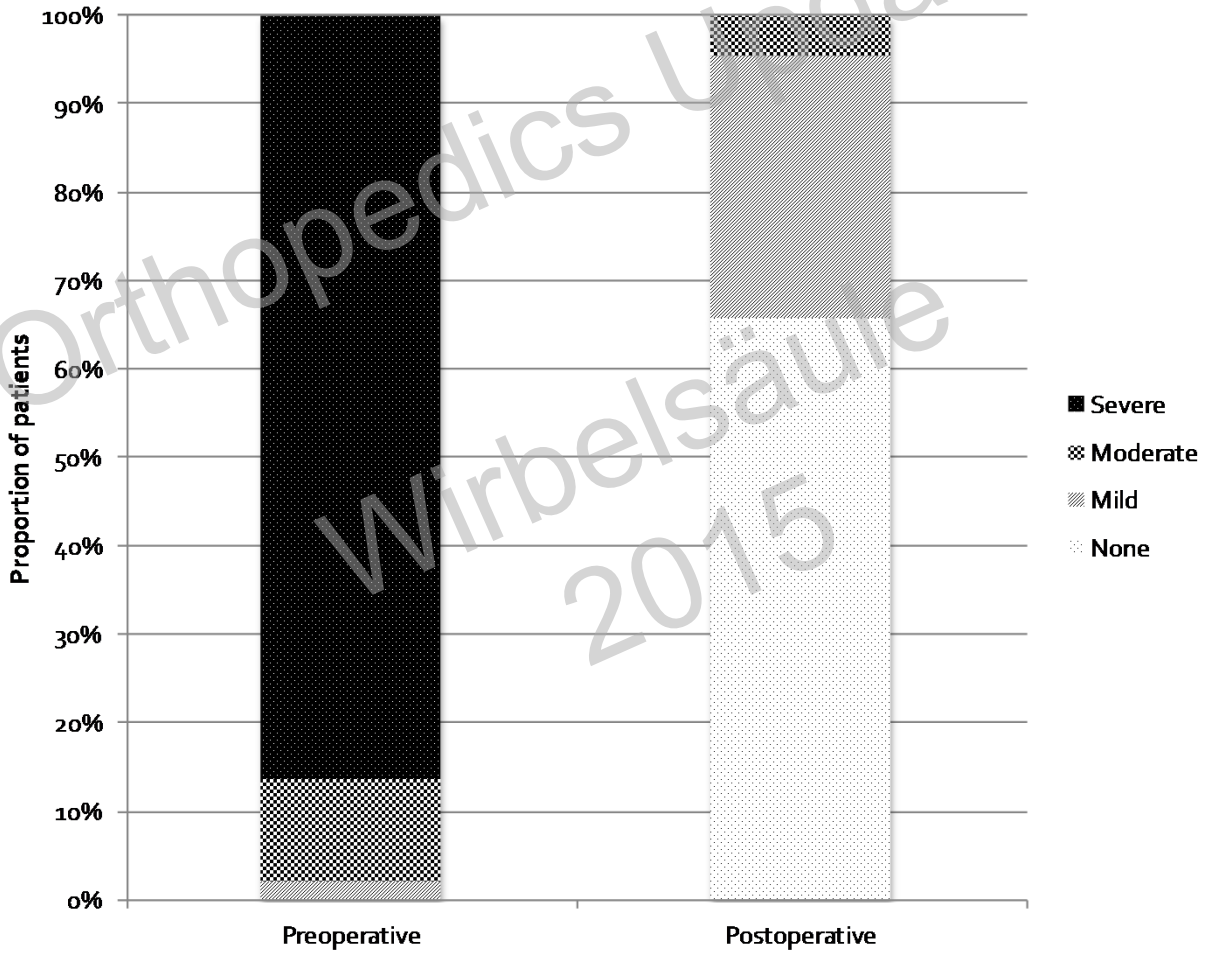
Percutaneous Pedicle Screws
PMMA Augmentation

Percutaneous Pedicle Screws
PMMA Augmentation

46 patients



Mousazzadeh N, et.al. Short-segment percutaneous pedicle screw fixaiotn with cement augmentation. Spine, 2015

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NOMSystemic Disease

- Patient can tolerate proposed procedure
- In conjunction with Oncologist and Internist

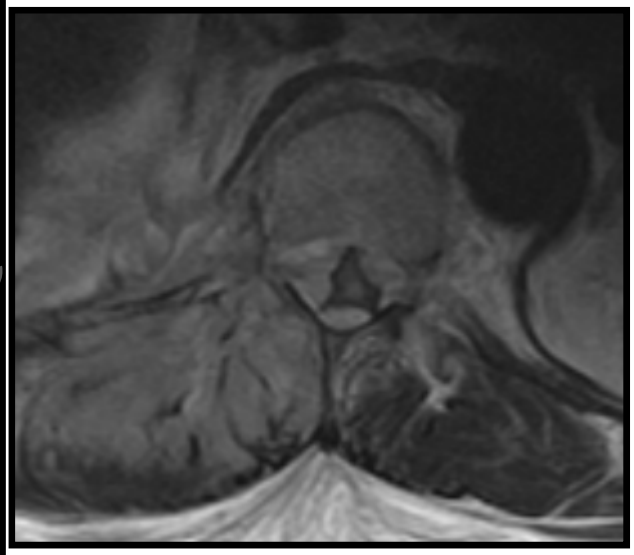
➢ EOD
  - ❖ PET, or CT CAP +/- bone scan
  - ❖ MRI complete neuraxis
  - ❖ Biopsy for confirmation

➢ Medical
  - ❖ Cardiac, Pulmonary Function Tests, Dopplers

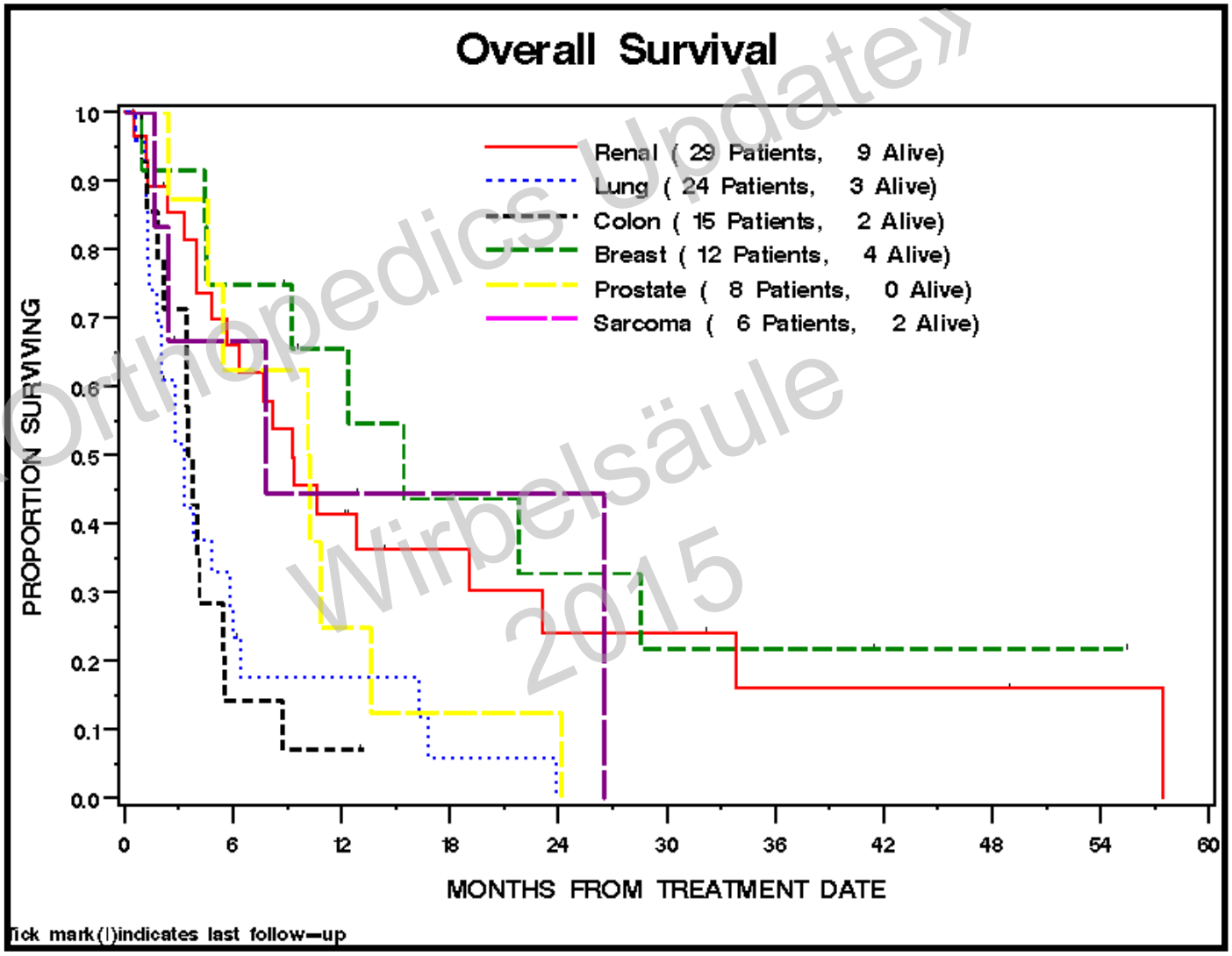
NOMSystemic Disease

Undifferentiated Sarcoma
18cm paraspinal tumor
ASIA C
IVC clot extending to R atrium

N: High-grade ESCC
O: RT-resistant
M: No instability
S: Risk of surgical mortality prohibitively high



Postoperative Survival by Histology



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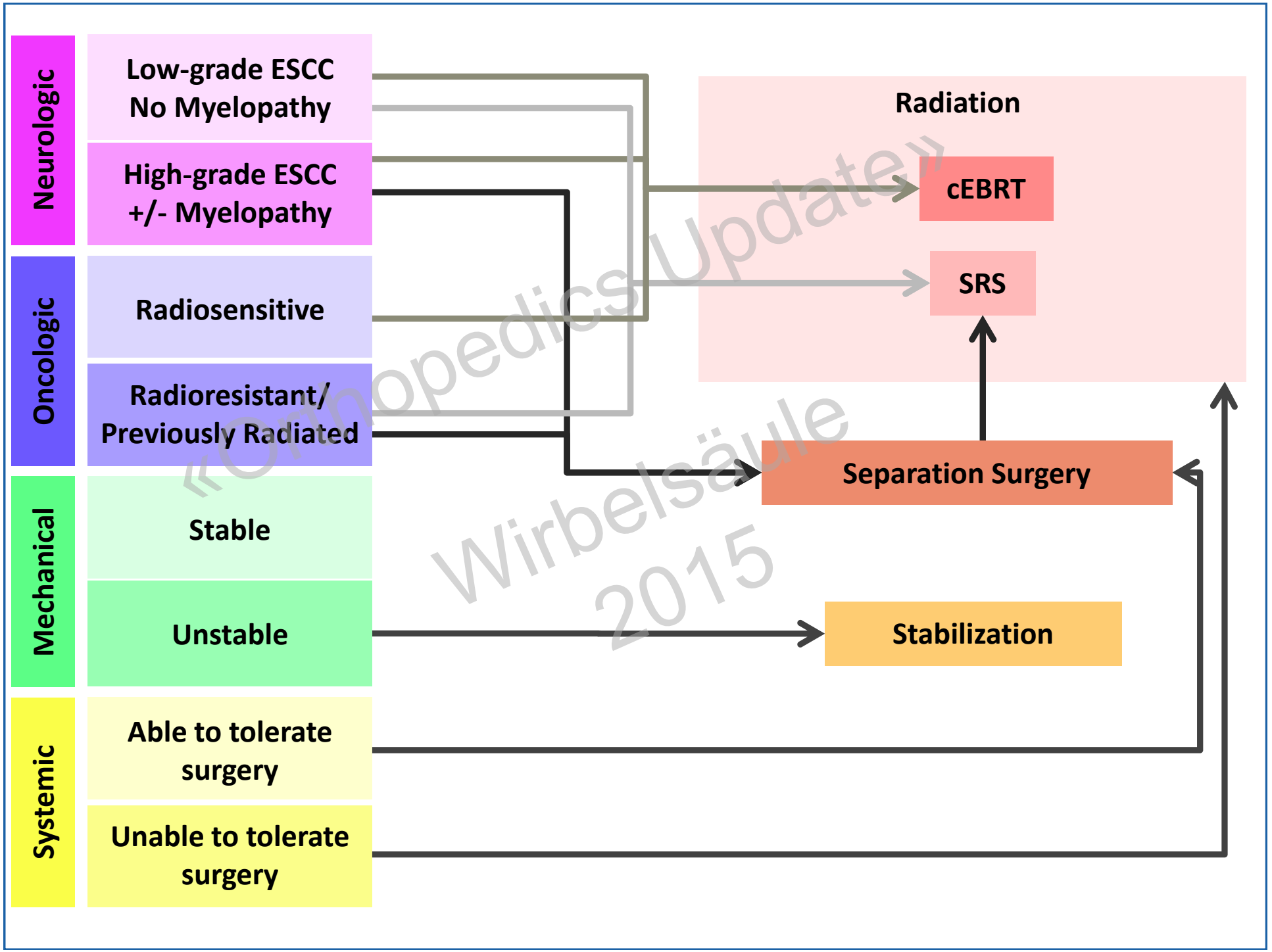
Neurologic
Low-grade ESCC
No Myelopathy
High-grade ESCC
+/- Myelopathy
Oncologic
Radiosensitive
Radioresistant/
Previously Radiated
Mechanical
Stable
Unstable
Systemic
Able to tolerate
surgery
Unable to tolerate
surgery
Radiation
cEBRT
SRS
Separation Surgery
Stabilization
«Orthopedics Update»
Wirbelsäule
2015

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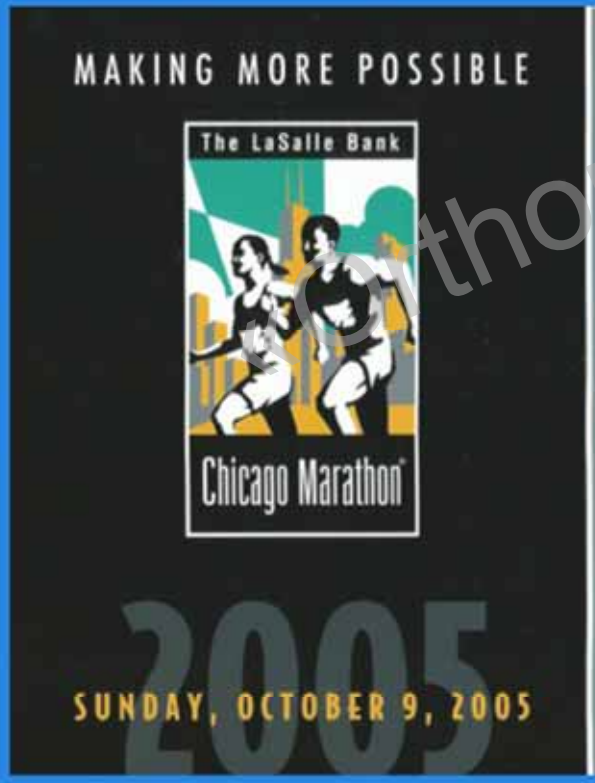
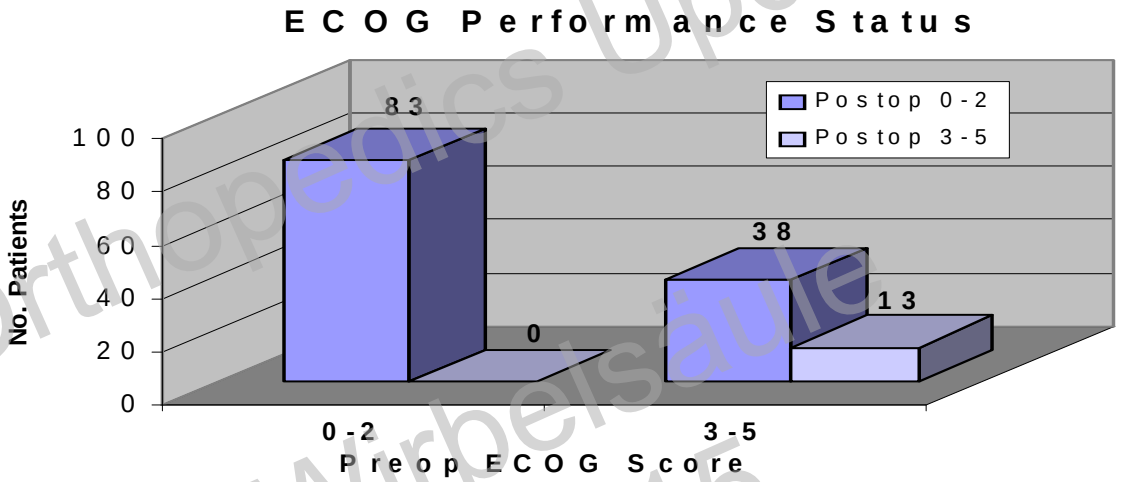
Thank You



Results



- 63% improved overall
- 75% of non-ambulatory patients regain ability to walk
- Postop ECOG 0-2 = 90%

Wang JC, et.al. Single-stage posterolateral transpedicular approach for resection of epidural metastatic spine tumors involving the vertebral body with circumferential reconstruction; results in 140 patients. J Neurosurg (Spine 1) 2004;3: 287-298.

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Results

Complication	# Patients	% Patients
Wound dehiscence*	15	10.7%
Deep venous thrombosis	6	4.3%
Neurologic deterioration	5	3.6%
Pneumonia	2	1.4%
Radiculopathy	1	0.7%
Pulmonary embolism	1	0.7%
Stroke	1	0.7%
GI bleed	1	0.7%
Decubitus ulcer	1	0.7%
Death (< 30 days postop)	5	3.6%
	38	27.1%

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165 patients surgery post failed RT
WC: cEBRT 17% vs. IGRT 6%[1]

[1]Keam J, et.al .No association between excessive wound complications and preoperative high-dose,hypofractionated,image-guided radiation therapy for spine metastasis. J Neurosurg Spine 20(4):411-20, 2014

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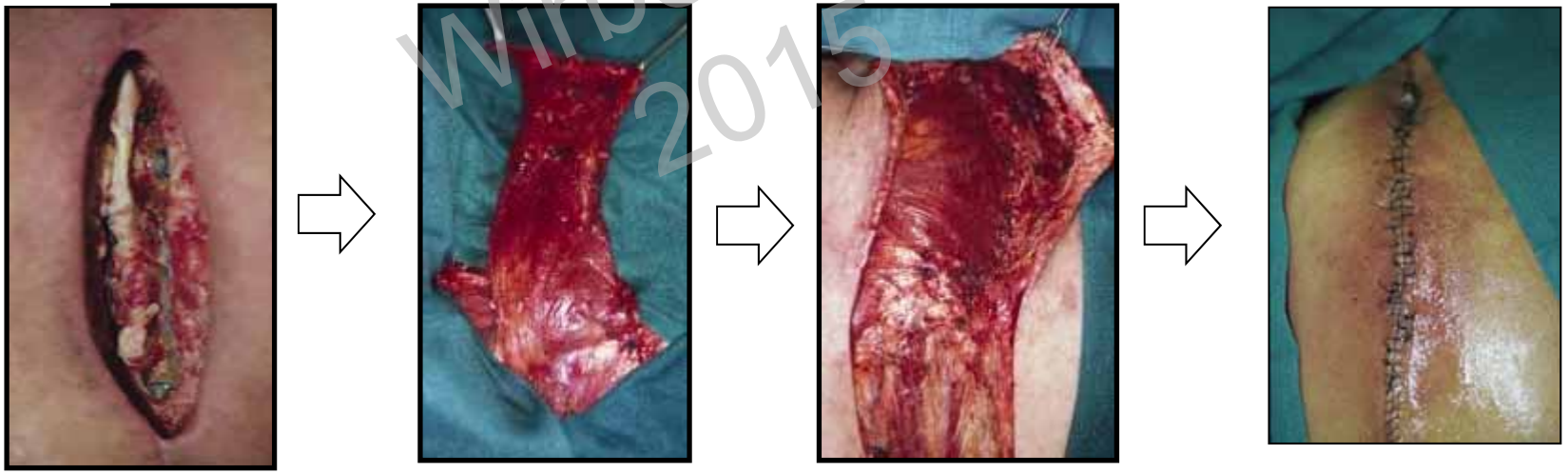
165 patients surgery post failed RT
WC: cEBRT 17% vs. IGRT 6%[1]

- **Repair of wound dehiscence[2]**
  - **Trapezius/latissimus rotation flap**
  - **100% wound healing**



[2]Vitaz TW, et.al. Rotational and transpositional flaps for the treatment of spinal wound dehiscence and infections in the degenerative and oncologic patient populations. J Neurosurg: Spine. (Spine 1) Jan 2004;100,46-51

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