Neoplastic spinal instability

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— Spine Surgery in Elderly
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INSTABILITY IN PATIENTS WITH SPINAL NEOPLASM

Multidisciplinary problem

- GENERAL ONCOLOGICAL INSTABILITY (ONCOLOGIST)
- NEUROLOGICAL INSTABILITY (NEUROSURGEON)
- ORTHOPEDICAL INSTABILITY (ORTHOPEDIC)
In general, spinal stability is defined as the ability of the spine to resist physiologic loads without progressive deformity, incapacitating pain, or damage to neural elements.

Restoration or maintenance of spinal stability is an important objective in the surgical management of patients with spinal neoplasms.

Fournery DR, Gokaslan ZL. Neurosurg Focus. 2003 Jan 15;14(1):e8

MAIN FACTORS CORRELATE WITH NSI

• Localization within the spinal column
• Level of mechanical pain
• Lesion type
• Spinal alignment
• Vertebral body collapse
• Posterolateral involvement


LOCATION

- Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)

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- Mobile spine (C3–C6, L2–L4)
- Semirigid (T3–T10)
LOCATION

- Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)
- Mobile spine (C3–C6, L2–L4)
- Semirigid (T3–T10)
- Rigid (S2–S5)

PAIN

- Local
- Mechanical
- Radicular

• Lytic

• Blastic

DEFORMITY

- Kyphosis
- Scoliosis
- Subluxation
- Translation
CORELATION OF BODY COLLAPSE & NEUROLOGICAL DISFUNCTION

- Cervical spine >50%
- Thoracic spine >50–60%
- Thoracolumbar and lumbar spine >35–40%


FACTORS AFFECTED THE BODY COLLAPSE

- Tumor size
- Cross-sectional area of bone defect
- Anticipated force of spinal loading
- Decreased bone density
- Posterior location of the tumor within the vertebrae
- Destruction of the costovertebral joint
- Pedicle destruction
- Spinal deformity

There is a fourfold increase in fracture risk with >80%


POSTEROLATERAL INVOLVEMENT

Unilateral or bilateral lesion

- Pedicles
- Facet joints
- Costovertebral joints
## COMPONENTS OF SINS

<table>
<thead>
<tr>
<th>Location</th>
<th>Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)</th>
<th>Mobile spine (C3-C6, L2-L4)</th>
<th>Semirigid (T3-T10)</th>
<th>Rigid (S2-S5)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>3</td>
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<td>2</td>
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<td>1</td>
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<td></td>
<td></td>
<td></td>
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<td>0</td>
</tr>
<tr>
<td>Pain</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Occasional pain but not mechanical</td>
<td></td>
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<td>1</td>
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<tr>
<td></td>
<td>Pain-free lesion</td>
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<tr>
<td>Bone lesion</td>
<td>Lytic</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mixed (lytic/blastic)</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Blastic</td>
<td></td>
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<td>0</td>
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<tr>
<td>Radiographic spinal alignment</td>
<td>Subluxation/translation present</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>De novo deformity (kyphosis/scoliosis)</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Normal alignment</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
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<tr>
<td>Vertebral body collapse</td>
<td>&gt; 50% collapse</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&lt; 50% collapse</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No collapse with &gt; 50% body involved</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
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<tr>
<td></td>
<td>None of the above</td>
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<td></td>
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<tr>
<td>Posterolateral involvement of</td>
<td>Bilateral</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td>spinal elements</td>
<td>Unilateral</td>
<td></td>
<td></td>
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<td>1</td>
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<tr>
<td></td>
<td>None of the above</td>
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<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

IATROGENIC INSTABILITY

- Laminectomy without stabilization in the presence of neoplastic involvement of the anterior or middle columns.
- Radiation therapy negatively impacts bone.
- Involvement of adjacent levels.

Fourney DR, Gokaslan ZL. Neurosurg Focus. 2003 Jan 15;14(1):e8

NONOPERATIVE MANAGEMENT

- Involvement of bone without collapse or instability
- No significant neurologic involvement
- Responsive to radiation and chemotherapy
- Poor general condition (Karnofsky’s performance <40%, laboratory and clinical data).
- Poor survival prognosis (aggressive tumors, multiple vertebral lesions, visceral metastases, poor overall health, and neurological deficit)

### Compartment characteristic of radiotherapy efficiency vs. surgery in spinal MTS & stable spine

<table>
<thead>
<tr>
<th>Study</th>
<th>N of patients</th>
<th>Improvements (%) (pre op. plegia)</th>
<th>Improvements (%) (pre op. paresis)</th>
<th>Local status stability (%)</th>
<th>Survival rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>255 ♂ ♀ RT</td>
<td>11,1</td>
<td>59,8</td>
<td></td>
<td>1 year - 28%</td>
</tr>
<tr>
<td>Patchell R, et all, 2003 **</td>
<td>50 ♂ ♀ RT+ Surg</td>
<td>56</td>
<td></td>
<td></td>
<td>129 days</td>
</tr>
<tr>
<td></td>
<td>51 ♂ ♀ RT</td>
<td>19</td>
<td></td>
<td></td>
<td>120 days</td>
</tr>
<tr>
<td>Rades D, et all, 2010 ***</td>
<td>108 ♂ ♀ RT+ Surg</td>
<td>27</td>
<td>30</td>
<td>90</td>
<td>1 year - 47%</td>
</tr>
<tr>
<td></td>
<td>216 ♂ ♀ RT</td>
<td>26</td>
<td>26</td>
<td>91</td>
<td>1 year - 40%</td>
</tr>
</tbody>
</table>


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<th>Local status stability (%)</th>
<th>Survival rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundaresan N, et al, 1995 *</td>
<td>101 ♂ ♀ RT+ Surg NB! 47% after not effective RT</td>
<td>82</td>
<td></td>
<td></td>
<td>16 month; 2 years - 47%</td>
</tr>
<tr>
<td>Regine WF, et all, 2003*</td>
<td>50 ♂ ♀ RT+ Surg</td>
<td>62</td>
<td>84</td>
<td></td>
<td>129 days</td>
</tr>
<tr>
<td></td>
<td>51 ♂ ♀ RT</td>
<td>19</td>
<td>57</td>
<td></td>
<td>120 days</td>
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SURGICAL MANAGEMENT

Goals of surgical treatment

• Preservation of neurological function
• Reduction of pain
• Ensuring mechanical stability

SURGICAL MANAGEMENT

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• Excisional procedures (complete resection of the involved vertebrae or the tumor, followed by reconstruction of the vertebrae using spinal instruments or implants)

• Palliative procedures (posterior decompression and stabilization using spinal instrumentation to decrease the pain or paralysis)


Case

♀ 83 D: Multiple MTS breast cancer, ThX pathological fracture with stenosis & spine cord compression

Pre op.:

VAS 8
Frankel C
Tokuhashi 10
SINS 15
Case

MISS decompression + PC SPS + PMMA
Case

MISS decompression +
PC SPS + PMMA

Pre op.
VAS –
Frankel -

8
C

1 y. Post op.

3
D
TAKE HOME MESSAGES

• The assessment of stability is a key component in the treatment decision-making for spinal oncology patients.

• Other key components are: patient general health, tumor histology, prognosis, neurology, and patient choice.

• Many patients are managed without surgery.

• The crucial problem remains that of recognizing the critical point of impending vertebral body collapse which only surgery can prevent.
Excellence in Spine

drptashnikov@yandex.ru
CLINICAL EXAMPLES
Female 72

2010 RCC

2013 MTS L3

pre op.

VAS 7

Frankel C

Tokuhashi 11

SINS 12
♀/72

2010 RCC

2013 MTS L3

pre op.

VAS 7

Frankel C

Tokuhashi 11

SINS 12
Perinephric fusion L1,2,4,5, laminectomy L3 post op. VAS 2, Frankel D
2010 Multiple myeloma, 2013 MTS L2,3

pre op. VAS 9
Frankel D
SINS 14
Female / 74

Fusion T12, L1, 4, 5
post op. VAS 3, Frankel D
2012 Brest cancer
03.2012 MTS L2
pre op.
VAS 7
Frankel D
Tokuhashi 12
SINS 14
2012 Brest cancer
03.2012 MTS L2
pre op.
VAS 7
Frankel D
Tokuhashi 12
SINS 14
Percutaneous fusion T12, L1, 3, 4, anterior corporectomy L2. Post op. VAS 4, Frankel D
2007 Multiple myeloma, MTS L5, S1, 2
pre op. VAS 9, Frankel D, SINS 12
2007 Multiple myeloma, MTS L5, S1, 2
pre op. VAS 9, Frankel D, SINS 12
Fusion L3,4,5,SIPS with PMMA, laminectomy L5,S1,2,3. Post op. VAS 3, Frankel D