Spinal canal encroachment caused by axial loading for osteoporotic thoracolumbar vertebral fractures involving the posterior vertebral wall

*Morphology of the injured posterior wall causing the instability*

Tetsuo Hayashi, Takeshi Maeda, Eiji Mori, Tsuneaki Takao, Keiichiro Shiba

*Department of orthopedic surgery,*

*Spinal Injuries Center, Fukuoka, Japan*
In elderly patients with delayed neurological deficits following osteoporotic vertebral collapse, influence of loading would be involved in spinal canal encroachment (SCE), however, the details are not well understood.
Purpose

✓ To elucidate the effect of the fracture pattern at injured posterior wall on instability of posterior wall and SCE, using CT myelography in supine and semi-sitting position
Methods

- 36 cases
- Mean age: $77.3 \pm 7.8$ years (range: 62-91)
- Female/male: 30/6
- Osteoporosis
- Vertebral fractures that occurred without trauma or with only minor trauma.
- Burst type fracture
- Insufficient bone union of the posterior wall
Dynamic CTM

- Supine
- Semi-sitting
Radiological assessment

Rate of dural compression:

\[ [1 - \frac{C}{(A+B)/2}] \times 100 \]

Ratio of occupation by bony fragments

\[ \frac{D}{E} \times 100 \]

Posterior vertebral body height ratio:

\[ \frac{H}{(F+G)/2} \times 100 \]
Subgroup
Morphology of fracture at the most compressed part

- Simple type: 19 cases
- Comminuted type: 17 cases

Bilateral side fracture
  2 lines
  Massive

Comminution or defect
  3 lines and more
  Comminuted
Significant correlations between collapse of posterior wall and protrusion of bony fragment were found at both groups.

*PVBHr: posterior vertebral body height ratio
OBFr: the ratio of occupation by bony fragments
## Comparison between simple type and comminuted type

<table>
<thead>
<tr>
<th></th>
<th>Simple</th>
<th>Comminuted</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of PVBHr(%)</td>
<td>4.8 ± 4.3</td>
<td>9.3 ± 6.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Change of OBFr (%)</td>
<td>8.2 ± 6.8</td>
<td>14.0 ± 7.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Change of DCr (%)</td>
<td>9.7 ± 9.7</td>
<td>19.4 ± 10.8</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*PVBHr: posterior vertebral body height ratio

OBFr: the ratio of occupation by bony fragments

DCr: dural compression ratio

Injured posterior vertebral wall with comminuted type would more likely to collapse and protrude into spinal canal with loading.

Comminuted type is more unstable.
**Discussion**

**Simple type**
- Supine
  - ✓ Less collapse
  - ✓ Less protrusion
  - Less instability
- Semi-sitting

**Comminuted type**
- Supine
  - ✓ More collapse
  - ✓ More protrusion
  - More instability
- Semi-sitting
Morphology of posterior wall affected the instability of the injured vertebrae

⇒ Morphology might affect palsy or bone fusion
Conclusion

✓ Collapse of the nonunited posterior vertebral wall and intracanal protrusion of vertebral fragments would occur simultaneously with axial loading, causing SCE.

✓ In cases with nonunion of the posterior wall with comminuted type, the development of severe canal encroachment is possible in a loading position.

✓ Morphology of the injured posterior wall is quite important to estimate the instability.

Disclosure

All authors have nothing to disclose.