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Does Lumbar Spine Alignment Play a Role in the Extent and Stability of Injury

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Introduction

Compression/burst fractures occur through direct axial loading. Force level determines fracture extent. Events such as falls results in compression/stable burst fractures. In some settings, more severe unstable fracture patterns are seen. Goals of this study are to determine the role of lumbar alignment on fracture patterns and stability.

Methods

Post Mortem Human Subjects were procured, x-rays obtained, and BMDs obtained from CT images, and thoracolumbar spinal columns were isolated. Specimens were fixed and six-axis load cells were attached at distal and proximal ends. They were positioned in a consistently aligned posture on a vertical accelerator to apply inferior-to-superior loading. Posttest CT were done. Sagittal and coronal T12-S1 cobb angles plus sacral slopes were measured. Interobserver and intraobserver analyses were done. Independent T-tests were used for statistical analysis.

Results

Mean age, stature, total body mass, and BMI of 14 males: 63.2±12.6years, 1.8±0.07m, 85±13kg, and 25.9±3.5kg/m2. Mean proximal and distal forces: 6.5 and 8.5kN. All specimens sustained injuries of isolated vertebrae or multi-levels: L1 only (n=6), L3 only (n=1), L1 and L2 (n=2), L1-L2 and L4-L5 (n=1), T12 and S1 (n=1); L1, L3 and L4 (n=1); L1-L4, S1, and sacrum (n=1); and, L1 and L3 (n=1). Injuries were compression-related mechanisms. 8 specimens developed unstable burst fractures which in real-life requires fixation/fusion. There was a significant difference (P= 0.004) in coronal angles among individuals with unstable fractures compare to others. No significant differences in sagittal T12-S1 cobb angles and sacral slopes.

Conclusions

Compression/burst fractures results from axial loading and the stability of the spine is related to the degree of fracture components. In our study of 14 male specimens with normal BMD, it was determined only coronal angle has a significant effect in determining fracture stability. Future study with larger sampler size is needed to further verify this novel finding.

References

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Learning Objectives

1. Importance of lumbar alignment in extent of fracture patterns

2. Possible consideration of coronal balance in fixation of deformity since it can contribute to extent of fracture