Kyphoplasty versus Vertebroplasty for Increase in Vertebral Body Height: A Cadaveric Study

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Purpose

To prospectively compare height restoration with kyphoplasty and vertebroplasty in fresh cadavers using multi-detector row computed tomography (MDCT).

Materials and Methods

Cadavers

37 vertebrae from 4 females (mean age 82 years)

16 L-spine (L1 = 3, L2 = 4, L3 = 3, L4 = 3, L5 = 3)

21 T-spine (T2 = 1, T3 = 1, T4 = 1, T5 = 1, T6 = 2, T7 = 3, T8 = 2, T9 = 2, T10 = 2, T11 = 3, T12 = 3)

- Vertebrae with severe compression fracture or damages were excluded.
- Vertebrae were dissected free of surrounding paraspinal muscles and separated from each other.
- Compression fractures were created with a device of two pieces of wood connected with a hinge.

Materials and Methods

CT Imaging and Interpretation

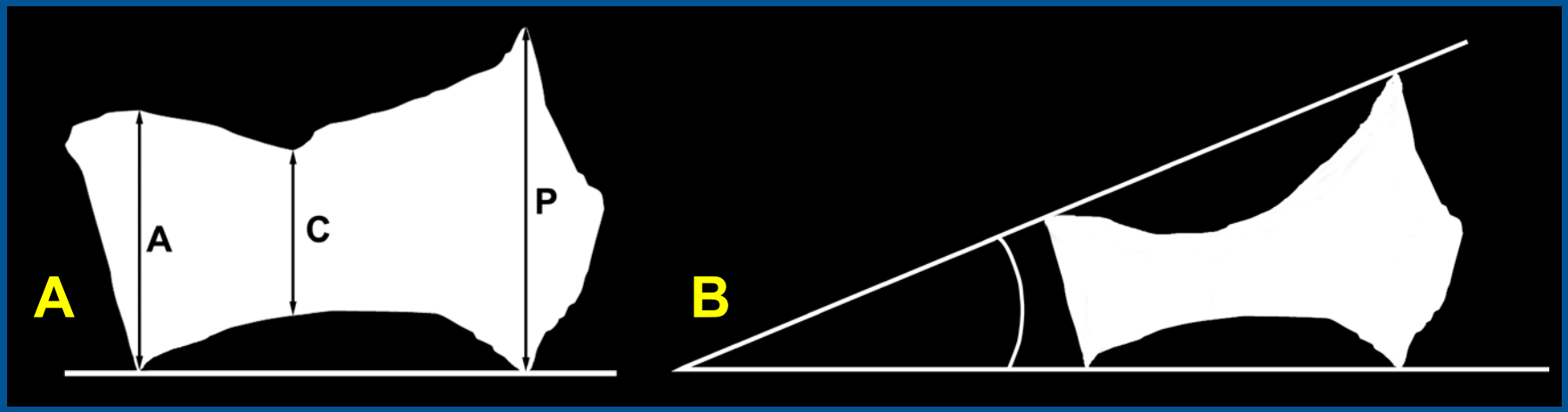


Figure 1: **Schematic illustration of the measurement (A - anterior, C - central, P – posterior). The vertebral body height (A) and wedge angle (B) was measured in mid-sagittal plane on reformatted CT scan.**

Materials and Methods

CT Imaging and Interpretation

CT imaging was performed initially, after compression fractures and after treatment.

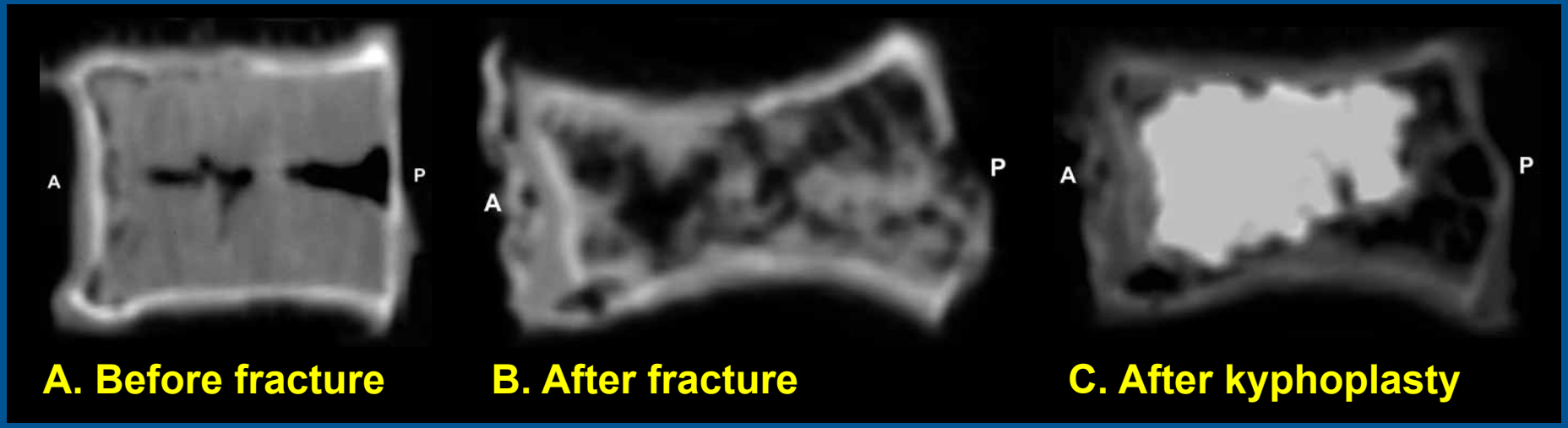
4-slice multi-detector CT (GE Lightspeed QX/i)

dose	120 kVp,150 mAs
collimation	1.25 mm
table speed	3.75 mm/rotation
field-of view	16 cm

Sagittal Reconstructions

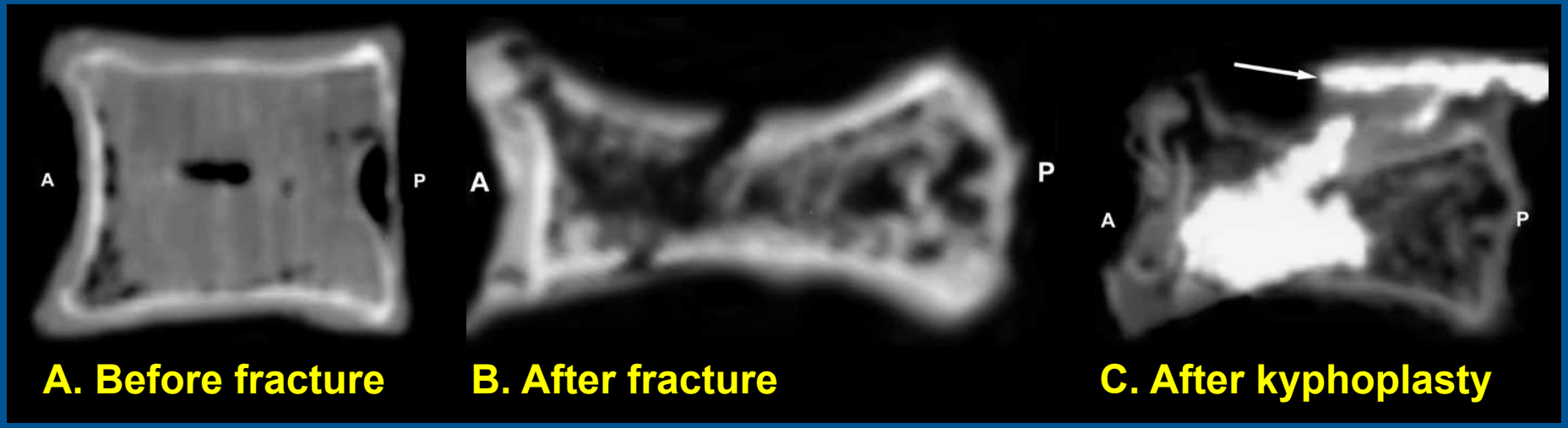
1.25 mm slice thickness / 0.625 mm overlap

Figure 2: L3 vertebral body treated by kyphoplasty.



- Sagittal reconstructed CT image from the middle portion of the vertebral body (A – anterior, P – posterior).
- Kyphoplasty increases vertebral height, 4 mm in anterior and central portions and less than 1 mm in posterior portion of the vertebral body.
- Wedge angle decreases from 8º to 2º.

Figure 3: L4 vertebral body treated by vertebroplasty.



- Sagittal reconstructed CT image from the middle portion of the vertebral body (A – anterior, P – posterior).
- Vertebroplasty increases vertebral body height 1 mm in anterior and central portions. No significant height increase is noted in posterior portion.
- Wedge angle change is less than 1º. There is leakage of the cement superiorly (arrow).

Treatments

1. **Kyphoplasty (n = 19)**
   bi-pedicular approach
   Kyphoplasty kit (KyphX)

2. **Vertebroplasty (n = 18)**
   bi-pedicular approach
   bone biopsy needles (Osteo-site)
   polymethylmethacrylate (Cranioplastic)
   barium sulfate (Bryan)

Results

1. **Height Restoration**
   - There was no statistically significant difference in vertebral body height before and after fracture ($P > .05$)
   - On average, kyphoplasty increased vertebral height (5.1 mm) which was statistically more than vertebroplasty (2.3 mm) ($P < .05$).
   - Kyphoplasty also restored the original vertebral body height (93%) better than vertebroplasty (82%) ($P < .05$).
2. **Wedge angle**
   - Kyphoplasty decreased wedge angle (3.1º) more than vertebroplasty (1.6º) without statistical difference ($P = .15$).
3. **Amount of cement**
   - There was no difference in cement injected ($P = .98$).

Conclusion

Kyphoplasty increased vertebral body height more than vertebroplasty in our experimental model on fresh cadavers with created compression fractures. The differences in height restoration between the two techniques were small and the clinical importance remains to be documented.