Kyphoplasty and Vertebroplasty: A Systematic Review of 26 Clinical Studies for Height Restoration in Osteoporotic Vertebral Compression Fractures

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Background – Back pain & OVCF

- Back pain is a leading cause of morbidity in older US adults, especially those with osteoporosis
- Osteoporotic vertebral compression fractures (OVCF) commonly occur in people with osteoporosis
- ~1/3 of OVCF are symptomatic with acute or chronic low back pain
- Annual US cases of osteoporosis with OVCF are ~700,000/year
- OVCF and osteoporosis cause high levels of morbidity, decreased functional independence, and chronic pain
- Conservative treatment for OVCF is often insufficient for many patients
- Insufficient vertebral height caused by OVCF can lead to spinal deformities, reduced pulmonary function, depression, reduced mobility, and lower quality of life
- Surgical correction is a viable option for increasing vertebral height in patients with OVCF

Background – Kyphoplasty & Vertebroplasty

- Kyphoplasty and vertebroplasty are vertebral augmentation therapies that can restore bone height for the alleviation of OVCF
- Both procedures involve injection of a polymer cement into sites of fracture
- Only kyphoplasty involves using an inflatable balloon to first make space for polymer injection.
- These minimally invasive procedures are recommended for patients who have OVCF but are refractory to conventional therapies.
- Also, patients with benign bone tumors or traumatic acute vertebral compression fractures with a local kyphotic angle greater than 15 degrees can benefit from these procedures.
- The aim of our systematic review was to identify the overall effectiveness of kyphoplasty and vertebroplasty
- Height restoration after treatment was used as the key indicator of therapeutic success
- Restoration of function and pain relief were also assessed

Methods

- We performed a systematic review per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Figure) [1]
- Level II randomized controlled trials assessing kyphoplasty and/or vertebroplasty were included
- Study selection inclusion criteria: patients > 18 years, in English, study of OVCF, active comparator vs placebo, outcome measure of height restoration, with pain relief and functionality as secondary outcomes
- Of 1248 individual articles, 48 articles were screened, and 26 were analyzed
- Of the 26 analyzed studies, 4 compared kyphoplasty to vertebroplasty

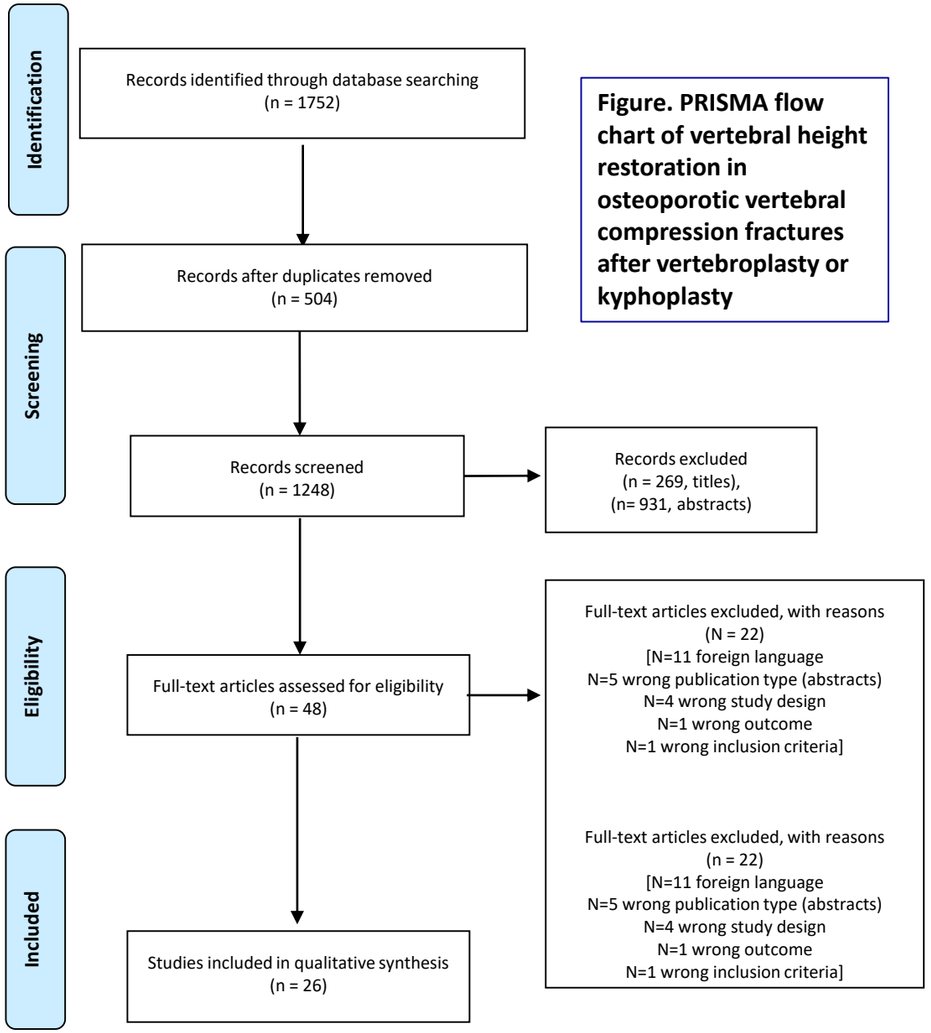

Figure. PRISMA flow chart of vertebral height restoration in osteoporotic vertebral compression fractures after vertebroplasty or kyphoplasty

References

1. Shamseer, L.; Moher, D.; Clarke, M.; Ghersi, D.; Liberati, A.; Petticrew, M.; Shekelle, P.; Stewart, L. A., Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ : British Medical Journal* **2015,** *349*, g7647.

*All other references of studies included in this review can be available upon request via email: patelnimesh112@gmail.com

Results

Vertebral Height Restoration.

- Of 11 studies that investigated vertebroplasty, 2 showed less height loss after vertebroplasty, 1 showed no improvement after vertebroplasty as measured by Becks index, 4 showed improvements as percent change ratio, and all 4 studies that measured absolute vertebral height gain showed improvements.
- Of 19 studies that assessed vertebral height restoration with kyphoplasty, none reported vertebral height loss, 10 reported vertebral height restoration, and 9 reported absolute restored vertebral height.
- Of the few studies that compared kyphoplasty head-to-head with vertebroplasty, 1 study did not show significant anterior height restoration ratio post-operatively at 3 months for either procedure, 1 study showed significantly more vertebral body height restoration from kyphoplasty, and 1 did not find any significant increase in vertebral body height for either procedure.

Wedge Angle, Kyphosis Angle, and Cobbs Angle Restoration.

- Of the 4 studies that investigated wedge angle after vertebroplasty, all showed significant post-operative improvement. One study that measured kyphoplasty showed improved but not statistically significant post-operative wedge angle.
- While there were no studies that directly compared kyphoplasty to vertebroplasty regarding kyphosis angle restoration, 1 study reported significant improvement from vertebroplasty, and 7 studies showed improvement from kyphoplasty.
- For Cobbs angle restoration, there were no reports that assessed vertebroplasty, but 7 studies of kyphoplasty showed significantly improved Cobbs angle, some with lasting changes up to 3 years.

Pain reduction.

- Of 9 studies that looked at preoperative and postoperative VAS scores for patients who received vertebroplasty, 7 studies reported all patients having had reduced postoperative pain scores.
- Of 19 studies that measured kyphoplasty, all patients had reduced postoperative pain scores, with long-term follow-up showing sustained reductions in pain at 12 months and 24 months.
- Of the 4 studies that directly compared kyphoplasty and vertebroplasty, all reported statistically significant sustained reduction in pain, with no difference between the procedures.

Restoration of functionality.

- Functionality was assessed by the Oswestry Disability Index (ODI) in most studies. Of the 5 studies that looked at pre- and post-operative ODI after vertebroplasty, all showed improved functionality. For kyphoplasty, 13 of the 19 studies showed improved functionality. Only 1 study measured functionality as a comparison of both procedures and showed that all patients improved.

Conclusions

- Both kyphoplasty and vertebroplasty are effective treatments for OVCF and are viable options for OVCF patients
- Both treatments restored some vertebral body height, reduced kyphosis angle, improved Cobbs angle, and improved wedge angle
- Both treatments showed similar benefits of pain reduction and improved functionality
- It was unclear whether fracture type or age of fracture influence procedure outcomes
- Kyphoplasty has the possibility of cement leakage, which can lead to negative outcomes
- It was not possible to conclude whether one approach was superior