

# Comparison of Monosegmental Vertebroplasty and Kyphoplasty: A Propensity Score based Analysis

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# Conflict of Interest

- C. Röder and PF Heini are consultants for Synthes.



# Background

- Balloon kyphoplasty (BKP) and vertebroplasty (VP) have been gaining popularity for treatment of osteoporotic vertebral fractures. Several comparative studies were published on the two methods; however, there is still a lack of large patient series and unbiased comparisons. The current study therefore aimed at a propensity score matched comparison of two vertebroplasty and kyphoplasty cohorts from two separate observational studies.



# Methods

- The data on monosegmental kyphoplasty (n=276) and vertebroplasty (n=97) for osteoporotic vertebral fractures were compared in regards to 1) kyphotic realignment, 2) cement extrusions, 3) improvement of quality of life, 4) patient satisfaction 5) pain relief. Propensity score matching was used for balancing the confounders between exposure groups. The propensity score was derived from a multivariate logistic regression adjusted for different confounders. Five strata of the propensity score were used for minimizing selection bias and assessing the influence of treatment on each of the five outcomes.



# Propensity-Score models

Used co-variates for the analyses of different outcomes. The first propensity score model was built for realignment, the second for overall cement extrusions, and the third for improvement of QoL, patient satisfaction and pain relief.

Outcome	Co-variates
<b>1. Realignment</b> a) height gain of at least 1 category (>5°) b) height gain of at least 2 categories (>10°) c) no height loss	Gender, age, fracture level, cement volume, fracture type, kyphosis preop, cement extrusion
<b>2. Overall cement extrusion</b>	Gender, age, fracture level, cement volume, fracture type, kyphosis preop
<b>3. Improvement of QoL (minimum 0.25 EQ-5D points)</b>	Gender, age, fracture level, cement volume, fracture type, cement extrusion, EQ-5D score preop, preop pain level
<b>4. Patient satisfaction</b>	Gender, age, fracture level, cement volume, fracture type, cement extrusion, EQ-5D score preop, preop pain level
<b>5. Pain relief (minimum 18 VAS points)</b>	Gender, age, fracture level, cement volume, fracture type, cement extrusion, EQ-5D score preop, preop pain level



# Patient & treatment characteristics

	BKP (n=276)	VP (n=97)
Mean age (years)	74	76
Age range (years)	41-95	45-91
% females (%)	78	72
Fracture level (%)		
Th4-Th10	14.3	21.6
Th11-L2	67.4	74.2
L3-L5	18.3	4.2
Fracture type (%)		
A1.1	15.2	10.3
A1.2	52.2	65
A3.1	32.6	24.7
Cement volume (%)		
<3 ml	3.8	21.7
3-4.5 ml	28.6	26.8
4.6-6 ml	27.1	28.9
4.6-6 ml	18	7.2
> 7.5 ml	22.5	15.4



# Results I

- Both treatment groups showed significant pain relief and improvement of quality of life pre- to postoperatively. A total of 21.1% of patients in the BKP group and of 35.6% in the VP group did not show an appreciable height restoration. There were 1.4% of cases with symptomatic cement extrusion in the BKP and 1% in the VP group. There was no significant difference between the treatment groups in regards to the proportion of patients with no worsening of alignment, the proportion of patients with kyphotic realignment of 5°-10°, patient satisfaction, improvement of quality of life and pain relief.



# Results II

- The statistical model showed a 2.4-times higher likelihood (CI95% 1.28-4.66) for a cement extrusion in VP and a 0.23-times lower likelihood (CI95% 0.06-0.86) for a realignment of more than 10°, compared with BKP.



# Outcomes

	BKP	VP
No worsening of segment. kyphosis (%)	36.7	28.9
Height gain of 5-10° (%)	13.3	28.9
Height gain of more than 10° (%)	28.9	6.7
Height loss (%)	21.1	35.6
Patient based extrusion rate (%)	24.7	42.3
Patient based symptomatic extrusion rate (%)	1.4	1
Quality of life (EQ-5D score)		
Preoperative	0.215	0.358
Postoperative	0.685	0.685
Patient satisfaction (NASS; %)		
Postoperative	91.3	79.5
VAS (NASS)		
Preoperative	72.8	65.4
Postoperative	29.8	30.1



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# Outcome likelihoods and differences

Outcome	p-value	OR (VP vs BKP)	95CI%
No worsening of seg. kyphosis	0.227	0.60	0.26-1.37
Realignment of 5-10°	0.611	0.82	0.38-1.80
Realignment >10°	0.029*	0.23	0.06-0.86
Cement extrusions	0.007*	2.44	1.28-4.66
Quality of life improvement	0.056	2.14	0.98-5.94
Patient satisfaction	0.416	0.63	0.21-1.91
Pain relief	0.890	1.07	0.45-2.83

OR = odds ratio

95%CI = 95% confidence interval

\* Significant difference



# Discussion I

- Both treatments lead to significant pain relief, fracture stabilization without further height loss in the majority of patients, a significant improvement of quality of life and to patient satisfaction in around 4/5 of the surgeries.
- The more costly BKP can probably be recommended in cases where at least partial height restoration is a treatment goal.



# Discussion II

- In patients with little kyphotic deformity and minimal height loss the cheaper vertebroplasty leads to a similar effect as balloon kyphoplasty.
- Despite relatively high asymptomatic extrusion rates, both procedures appear as save treatment methods in regard to the proportion of severe adverse events.

