



Kyphoplasty is not Superior to Vertebroplasty in Restoring Vertebral Height in the Long Term

Kifoplasti, Uzun Dönemde Vertebral Yüksekliği Geri Kazandırmada Vertebroplastiye Üstün Değildir

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ABSTRACT

Objective: The aim of this study was to evaluate whether kyphoplasty (KP) is superior to vertebroplasty (VP) in restoring spinal height in the long term.

Methods: The study encompassed a cohort of 33 patients aged between 42 and 90 years, with a follow-up period of at least 5 years, who had undergone either KP (n=16) or VP (n=17) for the diagnosis of osteoporotic vertebral fractures at our institution. Clinical comparisons were conducted on the basis of Oswestry scores, EuroQol-5 Dimension (EQ-5D), and visual analog scale (VAS) scores, while radiological assessments were performed considering fractured vertebral height and local kyphosis angle values. Evaluations were conducted across preoperative, postoperative, and last control radiographs.

Results: In both cohorts, the mean age was comparable, and there was no significant difference in the follow-up duration (p=0.126). Regarding radiological assessments during the early postoperative phase, KP patients exhibited a noteworthy enhancement in the anterior vertebral column height (mean, from 1.3471 mm to 2.0941 mm), middle vertebral column height (mean, from 1.3375 mm to 1.6437 mm), and local kyphosis angle improvement (mean, from 17.88° to 7.81°). However, the last control values demonstrated similar outcomes in both groups (KP patients: 1.4412 mm, 1.4063 mm, 13.69°; VP patients: 1.2813 mm, 1.3176 mm, 17.18°). In addition, there were no statistically significant differences in Oswestry scores, EQ-5D index, and VAS scores between the two groups.

Conclusion: According to our study, KP appears to be an effective method in the early treatment of painful collapsed vertebral fractures, but it was not observed to be superior to VP in the long term.

Keywords: Osteoporotic vertebral fracture, kyphoplasty, vertebroplasty, vertebral column height, local kyphotic angle

ÖZ

Amaç: Bu çalışmanın amacı, kifoplastinin (KP) uzun dönemde omurga yüksekliğini geri kazanmada vertebroplastiye (VP) üstün olup olmadığını değerlendirmektir.

Yöntemler: Çalışma, kurumumuzda osteoporotik vertebra kırığı tanısıyla KP (n=16) veya VP (n=17) uygulanan, takip süresi en az 5 yıl olan, yaşları 40 ile 90 arasında değişen 33 hastadan oluşan bir kohortu kapsamaktadır. Klinik karşılaştırmalar Oswestry skorları, EuroQol-5 Dimension (EQ-5D) ve VAS skorlarına göre yapılırken, radyolojik değerlendirmeler kırık vertebra yüksekliği ve lokal kifoz açısı değerleri dikkate alınarak yapıldı. Bu değerlendirmeler ameliyat öncesi, ameliyat sonrası ve son kontrol radyografileri üzerinden yapıldı.

Bulgular: Her iki grupta yaş ortalaması benzerdi ve takip süresinde anlamlı bir fark yoktu (p=0,126). Ameliyat sonrası erken dönemdeki radyolojik değerlendirmelerle ilgili olarak, KP hastaları ön vertebral kolon yüksekliğinde (ortalama 1,3471 mm'den 2,0941 mm'ye), orta vertebral kolon yüksekliğinde (ortalama 1,3375 mm'den 1,6437 mm'ye) ve lokal kifoz açısında (ortalama 17,88°den 7,81°ye) kayda değer bir iyileşme sergilemiştir. Bununla birlikte, son kontrol değerleri her iki grupta da benzer sonuçlar göstermiştir (KP hastaları: 1,4412 mm, 1,4063 mm, 13,69°; VP hastaları: 1,2813 mm, 1,3176 mm, 17,18°). Ayrıca, Oswestry skorları, EQ-5D indeksi ve VAS skorları açısından iki grup arasında istatistiksel olarak anlamlı bir fark bulunmadı.

Sonuç: Çalışmamıza göre, KP ağırlı çökmüş vertebra kırıklarının erken tedavisinde etkili bir yöntem gibi görünmektedir, ancak uzun vadede vertebroplastiye üstünlüğü gözlenmemiştir.

Anahtar Sözcükler: Osteoporotik vertebra kırığı, kifoplasti, vertebroplasti, vertebral kolon yüksekliği, lokal kifotik açı

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INTRODUCTION

Osteoporotic vertebral compression fractures are a significant healthcare concern, affecting a substantial portion of the elderly population. These fractures often lead to chronic pain, decreased mobility, and diminished quality of life. Kyphoplasty (KP) and vertebroplasty (VP) are two minimally invasive surgical techniques widely employed for stabilizing these fractures and alleviating associated symptoms (1). Although both procedures have demonstrated efficacy in pain relief and fracture stabilization, there remains a debate regarding their comparative effectiveness. Some studies suggest that KP may be superior in reducing cement leakage and improving postoperative vertebral body height, although it is more expensive and time-consuming than VP (2). Other research indicates no significant differences in long-term pain and disability outcomes between the two methods, highlighting the need for further comparative studies (3).

Recent advancements in materials and techniques, including the use of alternative cements to polymethylmethacrylate (PMMA), have opened new avenues for improving the safety and efficacy of these procedures (4). Both methods are effective in controlling pain in patients with osteoporotic vertebral fractures. Although KP is a more effective method for restoring collapsed vertebral fractures, its long-term results are controversial.

In this study, we compared the long-term clinical and radiological outcomes of patients with osteoporotic vertebral fractures who underwent KP and VP and specifically evaluated whether KP was superior to VP in terms of long-term vertebral height restoration.

MATERIALS AND METHODS

Study Design and Population

Ethics committee approval was obtained from the Ethics Committee of Gazi University for this retrospective study (approval number: E-77082166-604.01.02-830153, date: 19.12.2023). This retrospective study encompassed 66 patients who underwent either KP or VP for vertebral compression fractures at Gazi University Hospital, Ankara, of whom 33 were excluded because of the lack of

pre- and postoperative clinical and radiological data. The final cohort comprised 33 patients who underwent both preoperative and postoperative assessments and maintained a follow-up period of at least 24 months. Patients with metastatic spinal fractures, those undergoing surgery for fractures and/or degenerative causes of the spine, and those with instrumentation in the spine were excluded from the study.

The 33 patients included in the study were divided into two groups according to the surgical procedure performed: KP (n=16) and VP (n=17).

Data Collection

Clinical assessments were performed using the Oswestry Disability Score, visual analog scale (VAS), and EuroQoL- 5 Dimension (EQ-5D) scores. Radiological evaluations encompassed the measurement of anterior and middle column height, along with the assessment of the kyphotic angle of the fractured vertebrae. All radiological evaluations were performed on plain radiographs of the spine taken in the standing position. The local kyphosis angle was obtained by measuring the Cobb angle between the inferior endplate of the vertebra above the fractured vertebra and the inferior endplate of the fractured vertebra. These evaluations were conducted at preoperative, early postoperative, and final follow-up visits (Figure 1-3). These measurements were obtained using the hospital's PACS system (ExtremePACS 2015 version 4.3).

The Oswestry Disability Index (ODI) is a scale used to assess disability in relation to back pain and quality of life. It consists of 10 questions. Each question has five possible answers, and a percentage of the answers is calculated. Patients with a score of 0-20 have mild back problems, whereas patients with a score of 80-100 have severe back problems and are bedridden. The EQ-5D is a preference-based measure of health-related quality of life that includes one question for each of 5 dimensions, including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The EQ-5D questionnaire also includes a Visual Analogue Scale (VAS), which allows respondents to report their perceived health on a scale from 0 (worst possible health) to 100 (best possible health) (5).

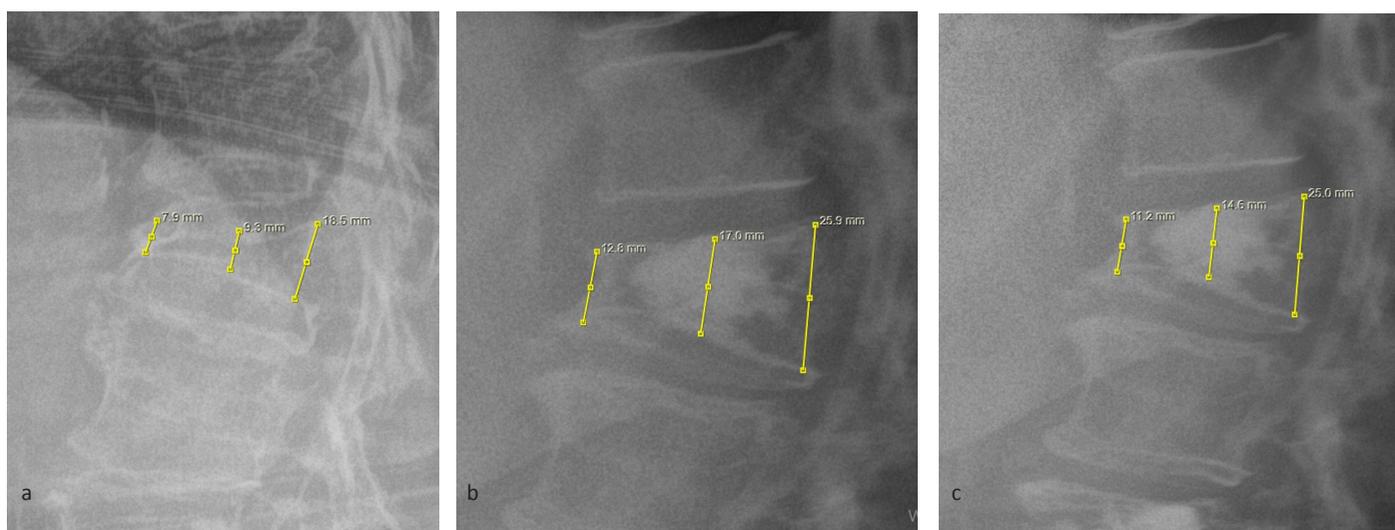


Figure 1. Radiological evaluation of the kyphoplasty patient (a) preoperative; (b) early postoperative; (c) last control.

Subsequent to data collection, rigorous statistical analyses were performed to draw meaningful conclusions. Comparative analyses were specifically conducted between the results obtained from the KP and VP patient groups.

Surgical Techniques

In KP, patients were positioned prone under general anesthesia.

The procedures were conducted under fluoroscopic guidance. For each targeted vertebra, a 1 cm skin and subcutaneous incision was made approximately 1.5-2 cm lateral to the pedicle. A trocar was inserted between the center and edge of the pedicle (between 1-3 o'clock on the right side pedicle and 9-11 o'clock on the left side pedicle). Under posteroanterior (PA) fluoroscopic guidance, the trocar was advanced approximately 2-3 cm, ensuring that it did not cross the medial line of the pedicle. Lateral fluoroscopic images of the vertebral column were obtained. Once it was confirmed that the tip of the trocar had passed the posterior wall of the vertebral corpus and was inside the corpus, the trocar was further advanced.

Upon reaching approximately one-fourth of the anterior part of the vertebral corpus, the trocar was removed, and its position within the corpus was confirmed using a probe. A working cannula was then placed in the trocar position. KP balloon instruments were inserted through the working cannula and inflated with contrast material. The expansion of the kyphotic vertebra was monitored by fluoroscopy. This procedure was performed bilaterally. After sufficient correction of the vertebra was observed, the KP balloon was deflated and removed. Before injection of PMMA cement, a contrast material was used to check for vascular leakage. Then, PMMA cement was slowly injected, ensuring that its consistency was not too fluid. Approximately 3-4 cc of PMMA cement was used in the thoracic region and 5-6 cc in the lumbar region. During the injection, both lateral and PA images were taken to ensure that the PMMA cement did not leak outside the corpus, especially into the spinal canal.

VP was performed similarly to KP under general anesthesia in the prone position and guided by fluoroscopy. Following the placement of the working cannula into the vertebral corpus, PMMA cement

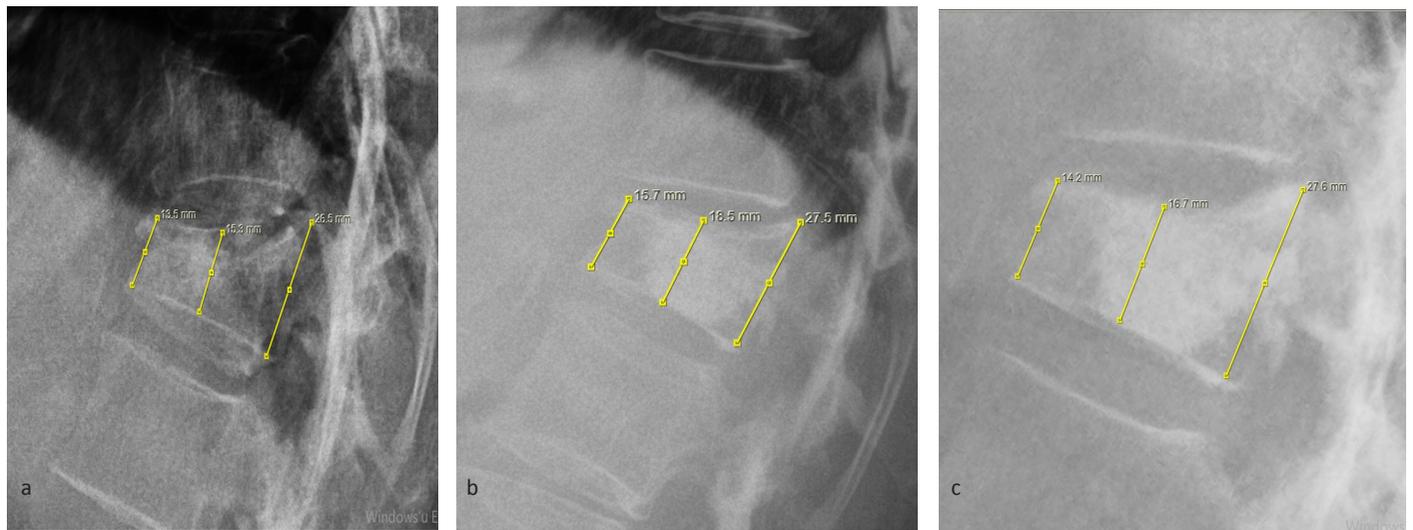


Figure 2. Radiological evaluation of vertebroplasty patient (a) preoperative; (b) early postoperative; (c) last control.

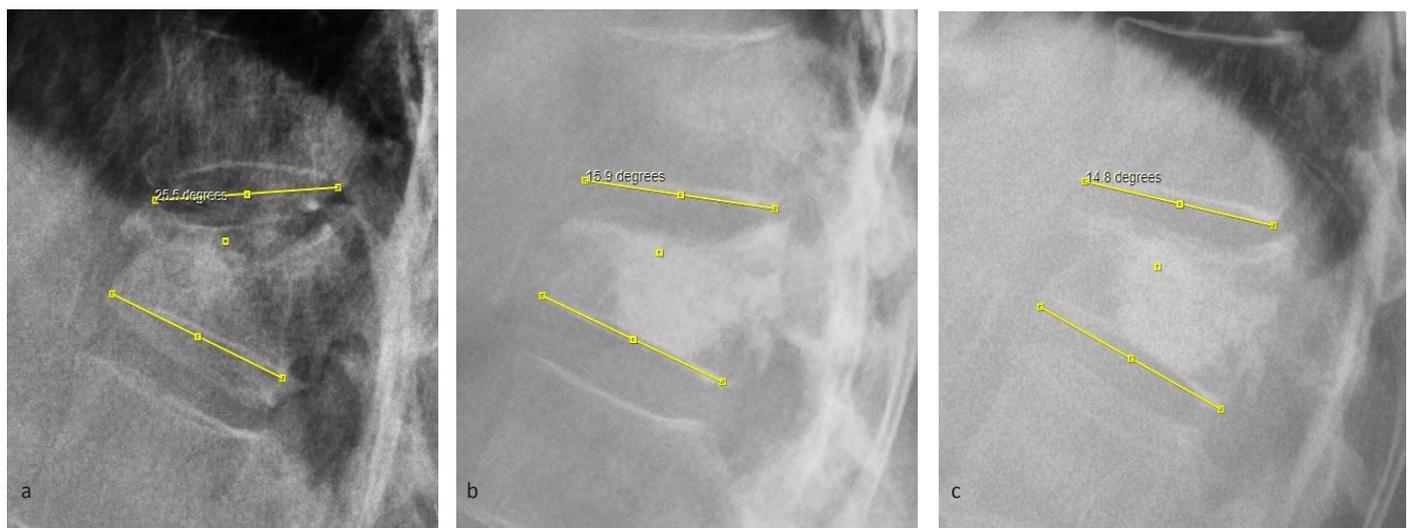


Figure 3. Radiological evaluation of the local kyphosis angle (a) preoperative; (b) early postoperative; (c) last control.

was directly injected without balloon KP. Care was taken to ensure that the PMMA cement did not leak, especially into the spinal canal, during fluoroscopic monitoring.

To prevent possible complications, we evaluated venous extravasation by injecting contrast material before VP and KP. We also check the fluidity of PMMA and inject PMMA after it has a consistency similar to toothpaste.

Both KP and VP patients were mobilized at the 4th hour after surgery. None of the patients required the use of a brace.

Statistical Analysis

The analysis was conducted using SPSS version 27. Descriptive statistics were computed, and the Shapiro-Wilk test was used to evaluate the normality of distributions. Pearson's and Spearman's correlation analyses were performed as appropriate. The Wilcoxon signed-rank test assessed differences in vertebral height measurements preoperatively and postoperatively. The Mann-Whitney U test was used to compare the KP and VP groups in terms of measurements and scores.

RESULTS

The KP patients ranged in age from 43 to 84 years with a mean age of 62.81 [standard deviation (SD)=20.06] years and a mean follow-up of 95.65 (SD=39.80) months. The VP group ranged in age from 42 to 90 years with a mean age of 68.29 (SD=18.06) years and a mean follow-up of 89.72 (SD=43.75) months. There were no significant differences in the mean age and follow-up between KP and VP patients (Table 1). Fracture levels were generally located in the thoracolumbar region (Table 2).

Table 1. Demographic characteristics and basic information of patients

	KP (mean ± SD)	VP (mean ± SD)	p
Number of patients (n)	16	17	0.596
Age (years)	62.81±20.06	68.29±18.06	0.407
Gender F/M	7/9	9/8	0.336
Follow-up period (month)	95.65±39.80	89.72±43.75	0.126

KP: Kyphoplasty, VP: Vertebroplasty, SD: Standard deviation, F: Female, M: Male.

Table 2. Fracture levels of the vertebrae

	n	%
T6	1	3.0
T8	1	3.0
T9	1	3.0
T10	4	12.1
T11	5	15.2
T12	7	21.2
L1	6	18.2
L2	4	12.1
L3	1	3.0
L4	3	9.1

The mean functional status of the patients in the KP group as measured by the ODI was 26.88 (SD=13.31), indicating moderate disability. The quality of life, as assessed by the EQ-5D index, had a mean value of 0.865 (SD=0.099). Preoperative vertebral anterior column height measurements averaged 1.15 cm (SD=0.61), early postoperative measurements averaged 1.89 cm (SD=0.36) and at the last follow-up, 1.44 cm (SD=0.415). The vertebral mid-column height was 1.33 cm (SD=0.381) preoperatively, 1.91 cm (SD=0.322) early postoperatively, and 1.40 cm (SD=0.312) at the last follow-up (Table 3).

In the VP group, the ODI indicated a higher level of disability with a mean score of 31.53 (SD=21.02), whereas the EQ-5D index was comparable to the KP group with a mean score of 0.871 (SD=0.100). The preoperative vertebral measurements in this group averaged 1.25 cm (SD=0.55), the early postoperative measurements demonstrated a significant increase, averaging 1.27 cm (SD=0.362) and at the last control 1.28 cm (SD=0.34). The vertebral mid-column height was 1.41 cm (SD=0.478) preoperatively, 1.61 cm (SD=0.488) early postoperatively, and 1.41 cm (SD=0.483) at the last control (Table 3).

There was no significant change in vertebral posterior column height in either group preoperatively, early postoperatively, or at final follow-up.

For both groups, the collected scores and measurements displayed a range of distributions, with some variables exhibiting non-normal distribution characteristics, as indicated by their skewness and kurtosis values. This data variability underscores the heterogeneity within the patient population and the outcomes of the surgical procedures.

Normality of the Data

Shapiro-Wilk tests showed that most variables in the KP and VP groups did not deviate significantly from a normal distribution. However, certain variables in each group, such as age distribution and specific preoperative and postoperative measurements, showed significant deviations from normality (Table 4).

Correlation Analysis

Pearson correlation analyses within the KP group indicated significant negative correlations between age and specific postoperative measurements and strong relationships between disability, quality of life, and pain levels. The VP group showed similar patterns, with age negatively correlated with certain preoperative and postoperative measurements and significant interrelations among disability, quality of life, and pain scores.

Wilcoxon Signed-Rank Tests

In the KP group (n=16), a Wilcoxon signed-rank test revealed significant changes in vertebral measurements from the preoperative to postoperative stages. There was a significant increase in early postoperative vertebral anterior column height measurement (Z=-2.699, p=0.007) and vertebral mid-column height measurement (Z=-3.319, p=0.001), but no significant change in vertebral posterior column height measurement (Z=-0.586, p=0.558). A significant decrease was observed in the postoperative local kyphosis angle measurement (Z=-3.527, p<0.001) (Table 5).

Table 3. Descriptive statistics were computed separately for patients who underwent kyphoplasty and vertebroplasty

		Minimum	Maximum	Mean	SD
KP	Oswestry	10	54	26.88	13.306
	EQ-5D index	0.703	1.000	0.86463	0.098828
	VAS	50	90	73.75	12.042
	Preop VACH	0.40	1.30	1.1471	0.61842
	Postop VACH	0.50	1.70	1.8941	0.36423
	Last Control VACH	0.70	1.60	1.4412	0.41508
	Preop VMCH	0.60	1.80	1.3375	0.38101
	Postop VMCH	0.70	2.30	1.9137	0.32243
	Last control VMCH (mm)	0.70	1.80	1.4063	0.31298
	Preop VPCH	2.50	3.30	2.9750	0.25690
	Postop VPCH	2.50	3.40	2.9938	0.23514
	Last control VPCH	2.5	3.3	2.919	0.2287
	Preop LKA	11	22	17.88	2.872
	Postop LKA	5	12	7.81	2.257
Last control LKA	8	20	13.69	3.027	
VP	Oswestry	10	78	31.53	21.018
	EQ-5D index	0.699	1.000	0.87065	0.100091
	VAS	30	100	69.41	17.843
	Preop VACH	0.60	1.40	1.2500	0.55466
	Postop VACH	0.70	1.50	1.2750	0.36231
	Last control VACH	0.60	1.40	1.2813	0.34294
	Preop VMCH	0.30	1.60	1.4118	0.47812
	Postop VMCH	0.70	1.70	1.6188	0.48870
	Last control VMCH	0.50	1.60	1.4176	0.48378
	Preop VPCH	2.20	3.40	2.9647	0.29779
	Postop VPCH	2.20	3.50	2.9471	0.33563
	Last control VPCH	2.0	3.4	2.824	0.3270
	Preop LKA	8	29	17.82	5.480
	Postop LKA	7	25	16.76	4.893
Last control LKA	6	26	17.18	5.637	

VACH: Vertebral anterior column height (cm), VMCH: Vertebral mid-column height (cm), VPCH: Vertebral posterior column height (cm), LKA: Local kyphosis angle (°), VAS: Visual analog scale, KP: Kyphoplasty, VP: Vertebroplasty, SD: Standard deviation, Preop: Preoperative, Postop: Postoperative.

In the VP group (n=17), the test also indicated significant changes. There was a significant increase in the postoperative vertebral anterior column height measurement ($Z=-3.461$, $p=0.001$) and vertebral mid-column height measurement ($Z=-2.126$, $p=0.033$), whereas no significant change was observed in the vertebral posterior column height measurement ($Z=-0.577$, $p=0.564$). A significant decrease was noted in the postoperative local kyphosis angle measurement ($Z=-2.812$, $p=0.005$) (Table 6).

Mann-Whitney U Test Findings

The Mann-Whitney U test demonstrated significant differences between the KP and VP groups in terms of ODI scores, postoperative anterior column, mid-column height, and local kyphosis angle. No significant differences were found between the groups in other

variables, including age, EQ-5D index, VAS, and various preoperative and postoperative measurements (Table 7).

DISCUSSION

Our study compared the outcomes of KP and VP in terms of restored vertebral height, quality of life, disability, and pain scores. The findings indicate that both procedures are effective in managing vertebral compression fractures although there are nuanced differences between them.

Comparative Efficacy in Pain and Disability Management

The results of our study align with those found in previous research. A systematic review and meta-analysis included 29 studies with 2,838 patients, and found no significant differences in mean pain scores

Table 4. Normality analysis of vertebroplasty and kyphoplasty was performed separately using the Shapiro-Wilk test

	KP			VP		
	Stat.	df	p	Stat.	df	p
Age	0.817	16	0.005	0.824	17	0.004
Oswestry	0.935	16	0.287	0.963	17	0.681
EQ-5D index	0.929	16	0.239	0.915	17	0.122
VAS	0.922	16	0.180	0.946	17	0.399
Preop VACH	0.478	16	0.000	0.917	17	0.132
Postop VACH	0.872	16	0.029	0.398	17	<0.001
Last control VACH	0.907	16	0.104	0.400	17	<0.001
Preop VMCH	0.876	16	0.033	0.946	17	0.395
Postop VMCH	0.877	16	0.035	0.929	17	0.211
Last control VMCH	0.900	16	0.081	0.943	17	0.354
Preop VPCH	0.916	16	0.147	0.907	17	0.089
Postop VPCH	0.943	16	0.387	0.963	17	0.682
Last control VPCH	0.897	16	0.071	0.902	17	0.075
Preop LKA	0.946	16	0.426	0.983	17	0.978
Postop LKA	0.899	16	0.077	0.962	17	0.674
Last control LKA	0.946	16	0.427	0.959	17	0.620

VACH: Vertebral anterior column height (cm), VMCH: Vertebral mid-column height (cm), VPCH: Vertebral posterior column height (cm), LKA: Local kyphosis angle (°), VAS: Visual analog scale, KP: Kyphoplasty, VP: Vertebroplasty, Preop: Preoperative; Postop: Postoperative, p-value of significance, Stat.: Shapiro-Wilk test statistical value, df: Degrees of freedom.

postoperatively and at 12 months between the KP and VP groups. This study also reported similar disability scores postoperatively and at 12 months for both groups (3). These findings suggest that both KP and VP are equally effective in managing pain and disability associated with vertebral compression fractures. In another study from Türkiye, both KP and VP were found to be effective in improving functional recovery and pain relief in patients with osteoporotic vertebral fractures. While KP showed slightly better radiological outcomes, this difference was not clinically significant, leading the authors to recommend VP for its simpler management (6).

A study examining long-term outcomes over a 5-year period showed only subtle differences between KP and VP, suggesting the use of VP over KP considering treatment costs (7). Another study assessing KP outcomes over 3 years found significant improvements in pain and mobility compared with controls, as well as a reduced risk of new vertebral fractures (8). Additionally, a study evaluating VP outcomes over a 29-month period reported significant reductions in pain and disability scores, with less intense analgesic use compared with conservative therapy (9). In our study, the mean follow-up time was 96 (SD=39.80) months, which is consistent with the results of other long-term studies. Our findings show that there were no significant differences in pain and quality of life scores between patients undergoing both KP and VP procedures.

Table 5. Wilcoxon signed-rank test results for the kyphoplasty group

	Preop/Postop VACH	Preop/Postop VAMH	Preop/Postop VPCH	Preop/Postop LKA
Z	-2.699 ^c	-3.319 ^c	-0.586 ^c	-3.527 ^d
p	0.007	0.001	0.558	<0.001

^cBased on negative ranks. ^dBased on positive ranks. p: Asymptotic significance, Z: Wilcoxon test statistics, Preop: Preoperative, Postop: Postoperative, VACH: Vertebral anterior column height, VMCH: Vertebral mid-column height, VPCH: Vertebral posterior column height, LKA: Local kyphosis angle.

Table 6. Wilcoxon signed-rank test results for the vertebroplasty group

	Preop/Postop VACH	Preop/Postop VAMH	Preop/Postop VPCH	Preop/Postop LKA
Z	-3.461 ^c	-2.126 ^c	-0.577 ^d	-2.812 ^d
p	0.001	0.033	0.564	0.005

^cBased on negative ranks. ^dBased on positive ranks. p: Asymptotic significance, Z: Wilcoxon test statistics, Preop: Preoperative, Postop: Postoperative, VACH: Vertebral anterior column height, VMCH: Vertebral mid-column height, VPCH: Vertebral posterior column height, LKA: local kyphosis angle.

Table 7. Mann-Whitney U tests showing differences between the kyphoplasty and vertebroplasty groups

	Age	Oswestry	EQ-5D index	VAS	Preop VACH	Postop VACH	Last control VACH			
Mann-Whitney U	113.000	80.000	133.500	118.000	118.000	126.000	135.500			
Z	-0.829	-2.019	-0.090	-0.665	-0.650	-0.362	-0.018			
p	0.407	0.123	0.928	0.506	0.515	0.018	0.986			
	Preop VMCH	Postop VMCH	Last control VMCH	Preop VPCH	Postop VPCH	Last control VPCH	Preop LKA	Postop LKA	Last control LKA	
Mann-Whitney U	119.000	122.000	121.500	132.500	129.000	111.000	132.000	17.500	73.500	
Z	-0.618	-0.508	-0.527	-0.128	-0.256	-0.931	-0.145	-4.288	-2.259	
p	0.536	0.011	0.598	0.898	0.798	0.352	0.885	0.000	0.064	

p: Asymptotic significance, Z: test statistics (measure of the magnitude of difference between two groups), Preop: Preoperative, Postop: Postoperative, VACH: Vertebral anterior column height, VMCH: Vertebral mid-column height, VPCH: Vertebral posterior column height, LKA: Local kyphosis angle.

Vertebral Height Restoration and Kyphosis Reduction

Our findings on vertebral height restoration are particularly noteworthy. We observed significant changes in both vertebral height measurements and local kyphosis angle in the early postoperative period in the KP group. This is consistent with another study, which found that KP was superior to VP in terms of increasing postoperative vertebral body height (2,10). Although the final follow-up radiographs of KP patients showed better results in terms of both vertebral height and local kyphosis angle, there was a significant loss of both vertebral height and local kyphosis angle in KP patients compared with early postoperative values. Biomechanical studies also support the initial superiority of KP in increasing vertebral body height and reducing kyphosis although these gains may diminish with repetitive loading (11).

Complications and Cost-Effectiveness

There were no serious intraoperative or early postoperative complications in either group of patients. Two patients who underwent KP had adjacent vertebral fractures at 3 and 6 months postoperatively. Three patients who underwent VP had adjacent vertebral fractures at 8 and 13 months of age. None of the patients underwent surgery for an adjacent vertebral fracture. The fractures healed conservatively during follow-up. With the exception of adjacent vertebral fractures, no complications were observed in the patients included in this study.

While KP has advantages in vertebral height restoration, it is important to consider the balance of benefits and risks. KP is associated with lower odds of new fractures and less extraosseous cement leakage than VP. However, the more complex nature of KP, including its higher cost and longer operative time, raises questions about its cost-effectiveness, especially when the differences in pain and disability outcomes between the two procedures are statistically insignificant (2,3). Complications related to cement extravasation, such as compression of neural elements and venous embolism, are rare but more common with VP (11). In our study, no serious complications related to PMMA cement leakage were observed. Cement leakage into the intervertebral disk space occurred in one patient who underwent KP and in three patients who underwent VP. However, because these patients did not exhibit any clinical problems during follow-up, no additional procedures were necessary. This finding highlights the relative safety of both procedures in terms of cement leakage, with clinical outcomes remaining unaffected despite this occurrence.

Study Limitations

One of the main limitations of our study is that it was retrospective and the number of patients included in the study was relatively small. The lack of data on patients' body mass index, comorbidities, and bone mineral density are also limitations of the study. In addition, the wide age range of the patients included in the study and the inability to classify them according to age are also important limitations of our study.

CONCLUSION

In conclusion, our study contributes to the ongoing debate on the comparative efficacy of KP and VP. While both procedures are effective in managing pain and disability, KP appears to offer better outcomes in terms of vertebral height restoration and reduced complications related to cement leakage. However, its higher cost and longer operative time necessitate further research to establish its cost-effectiveness. Future studies should focus on long-term outcomes and identify specific patient subgroups that may benefit more from one procedure than the other. This would enable more personalized treatment approaches and optimize outcomes for patients suffering from vertebral compression fractures.

Ethics

Ethics Committee Approval: Ethics committee approval was obtained from the Ethics Committee of Gazi University for this retrospective study (approval number: E-77082166-604.01.02-830153, date: 19.12.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: A.C.B., F.A., A.A., A.Ş., Concept: A.C.B., F.A., A.Ş., Design: A.C.B., A.A., A.Ş., Data Collection or Processing: M.F.T., M.M.C., C.İ.G., Analysis or Interpretation: A.A., M.F.T., M.M.C., Literature Search: A.A., Writing: A.C.B., F.A., A.A.

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