

EVALUATION OF SURGICAL OUTCOMES OF OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURE PATIENTS TREATED BY KYPHOPLASTY, AT MILITARY HOSPITAL 105

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ABSTRACT

Purpose: To evaluate the surgical outcomes of osteoporotic vertebral fracture patients treated by kyphoplasty at Military Hospital 105.

Subjects and methods: A descriptive, retrospective study of 34 osteoporotic fractures patients who were treated by kyphoplasty at Military Hospital 105 from January 2021 to December 2021.

Results: Immediately post operation, 100% of patients had significant pain relief compared to preoperation (average VAS score after surgery 1.91 ± 1.22); 100% of patients had vertebral body height restored (with moderate level 36.4%, good level 39.4%); The kyphosis corrected spine has statistical significance compared to before treatment (with $p < 0.05$).

Keywords: Vertebral fracture, osteoporosis, kyphoplasty.

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1. INTRODUCTIONS

Osteoporosis is a disease of the skeletal system in which the mineral density of bones decreases, causing the bone's resistance and load-bearing capacity to decrease; bones become fragile, brittle, and easily collapsed [2], [6]. Vertebral compression fractures (VCFs) can occur due to many reasons, such as old injury, osteoporosis, vertebral body tumor...; Among them, osteoporotic VCFs is a fairly common clinical disease [2], [6]. Medical treatment of patients with osteoporotic VCFs often includes immobilization in bed, use of pain relievers and wearing a spinal brace. However, these therapies are not effective in correcting the height of collapsed vertebrae; furthermore, immobility increases the risk of bone mineral loss.

Indications for surgical treatment of patients with osteoporotic VCFs are very limited, usually only applied to a few cases of spinal instability or associated neurological damage. Vertebral augmentation procedures is a minimally invasive technique that helps patients relieve pain, return the spine to anatomical shape, and reduce disability rates [3]. Although vertebroplasty has been

successful in reducing pain for patients, however, this technique is not helpful in returning the height of collapsed vertebrae. The main limitation of this procedure is cement leakage. To limit this drawback, in 1990, Mark Reiley first proposed the idea of correcting collapsed vertebrae with a balloon cement pump (kyphoplasty). This method was widely used thereafter and achieved many good results for patients [1].

In Vietnam, kyphoplasty has been performed at many medical centers, with initial positive results. At Military Hospital 105, this technique has been applied to treat patients, but there has been no research to evaluate the results of surgery. Therefore, we carried out this project with the goal of evaluating the results of kyphoplasty to treat patients with osteoporotic VCFs at Military Hospital 105.

2. SUBJECTS AND METHODS

2.1. Subjects

34 osteoporotic fracture patients were treated by kyphoplasty at Military Hospital 105 from January 2021 to December 2021.

- Selection criteria: Patients with osteoporotic thoracolumbar vertebral fractures (T-score < -2.5); the spine is stable on X-ray, with no signs of nerve compression; there is an image of corresponding vertebral body edema on MRI; The patient has a particular medical record.

- Exclusion criteria: Patients with severe vertebral fractures (> 60% of vertebral body height); unstable, signs of compression and nerve damage on CT scanner and MRI; patients with vertebral body collapse not due to osteoporosis; patients had spinal fixation surgery; patients did not agree to participate in the study.

2.2. Methods

- Research methods: descriptive, retrospective study.

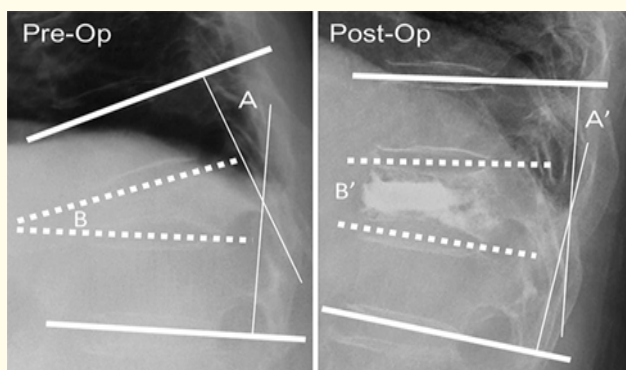
- Sample selection: select a convenient sample during the research period.

- Research targets:

+ Clinical characteristics: assess the level of pain according to the VAS scale (no pain: 0-1 points; mild pain: 2-3 points; moderate pain: 4-6 points; severe pain: 7-8 points; worst pain: 9-10 points).

+ Imaging diagnostics: assessed through X-ray images (location, VCFs level, kyphosis angle); CT scans (spinal stability, damage to the posterior vertebral wall, pedicle, bone defect), MRI (collapse location and image of collapsed vertebrae edema).

+ Treatment results: evaluate the level of pain improvement (according to the VAS scores); results of vertebrae correction (improvement of vertebral body height, vertebral body collapse angle, kyphotic angle, Cobb angle); complications during and after surgery.



Assessment of damage on X-rays, including location of collapsed vertebrae, classification of lesion morphology (wedge-shaped collapse,

biconcave collapse, compression of the vertebral body), degree of vertebral body collapse (mild), moderate, severe), degree of kyphosis of the spine (through vertebral body collapse angle, kyphotic angle, Cobb angle).

- Data processing: using SPSS 22.0 software.

- Ethical issues in research: the research is authorized by Military Hospital 105. All patient personal information is kept confidential and is only used for scientific research purposes. The research is guaranteed not to cause any conflicts of interest or incur any costs for patients.

3. RESULTS

Table 1. Pain status according to VAS scale before and after surgery (n = 34)

VAS	Preoperative	Postoperative	p
No pain	0	27 (79.4%)	0.041
Mild	2 (5.9%)	5 (14.7%)	
Moderate	27 (79.4%)	2 (5.9%)	
Severe	4 (11.8%)	0	
Worst	1 (2.9%)	0	
Average	6.60 ± 1.60	1.91 ± 1.22	

Before surgery, the patients had an average VAS score of 6.6 ± 1.6 points; The majority of patients have VAS scores ≥ 4 points (79.4% of patients have 4-6 VAS points). After surgery, the patient's VAS score decreased significantly (average 1.91 ± 1.22 points); 79.4% of patients had no pain with VAS 0-1 point, while 5 patients (14.7%) had mild pain and 2 patients (5.9%) had moderate pain. Postoperative pain relief was statistically significant with p = 0.041.

Table 2. Improve the height of the damaged vertebral body (n = 34)

Location		Height (mm)		p
		Pre-operative	Post-operative	
Anterior column	Min-max	7-23	13-25	< 0.001
	Average	14.1 ± 3.6	17.8 ± 2.6	
Middle column	Min-max	6-23	12-24	< 0.001
	Average	12.9 ± 3.3	17.4 ± 2.5	
Posterior column	Min-max	13-28	16-29	< 0.001
	Average	20.6 ± 3.4	21.5 ± 2.8	

The average height of the anterior column, middle column, and posterior column of the damaged vertebral body before surgery were 14.1 ± 3.6 mm, 12.9 ± 3.3 mm, 20.6 ± 3.4 mm, respectively. After surgery, it increased significantly, 17.8 ± 2.6 mm, 17.4 ± 2.5 mm, 21.5 ± 2.8 mm, respectively; the

difference is statistically significant ($p < 0.001$). In particular, the height of the anterior and middle columns improved much more than the height of the posterior column, the difference was statistically significant with $p < 0.001$.

Table 3. Effectively restores the height of the damaged vertebral body after surgery (n = 34)

Effectiveness	Recovery rate	No. of patients
Poor	$\leq 10\%$	8 (24.2%)
Moderate	11-20%	12 (36.4%)
Good	$> 20\%$	13 (39.4%)

Evaluating the effectiveness of restoring the height of the damaged vertebral body after kyphoplasty, it was found that 24.2% of patients with damaged vertebrae recovered $\leq 10\%$ of the height (poor effective), 36.4% of patients had moderate recovery. Surgical results were good and 39.4% of patients had good recovery.

Table 4. Results of kyphosis correction

Basis for assessment		Size (°)		p
		Preoperative	Postoperative	
Angle of vertebral body collapse	Min-max	7-25	1-15	< 0.001
	Average	14.9 ± 3.9	7.1 ± 3.4	
Cobb angle	Min-max	4-27	1-20	< 0.001
	Average	12.6 ± 5.2	6.9 ± 3.6	
Kyphotic angle	Min-max	3-18	1-11	< 0.001
	Average	8.4 ± 3.3	6.2 ± 4.7	

The average vertebral body collapse angle, Cobb angle, and kyphotic angle before surgery were $14.9^\circ \pm 3.9^\circ$, respectively; $12.6^\circ \pm 5.2^\circ$; $8.4^\circ \pm 3.3^\circ$ and decreased significantly after surgery (respectively $7.1^\circ \pm 3.4^\circ$; $6.9^\circ \pm 3.6^\circ$; $6.2^\circ \pm 4.7^\circ$), the difference is statistically significant with $p < 0.001$.

4. DISCUSSIONS

To evaluate the patient's pain level, we rely on the VAS scores. The preoperative average VAS score of patients was 6.6 ± 1.6 points, the majority of patients had a VAS score of 4 points or more (79.4% of patients had a VAS score of 4-6 points). After surgery, the average VAS score of patients was 1.91 ± 1.22 points, most patients were pain free with 79.4% of patients having a VAS score of 0-1 point. This result is similar to Nguyen Ngoc Thuc's study (the average VAS score of VCFs patients is 7.89 ± 1.92 ; the proportion of patients with VAS scores from 1-2 is 2.6%, from 5-6 points is 31.6%, from 7-8 points is 31.6%, from 9-10 points is 34.2%,

no case is painless) [8]. However, our results are different from Masto Nakano's study (86.4% of VCFs patients had a VAS score of 7-9 points, no case had a VAS score ≤ 5) [9].

In this study, we found that 33/34 patients had vertebrae damage located in the D12-L2 segment (of which, 14 patients had damage to the T12 vertebra and 14 patients had damage to the L1 vertebra). The main lesions were wedge-shaped collapse (61.8%), compression collapse of the vertebral body (26.5%), and all collapsed firmly, with corresponding vertebral body edema. This result is consistent with the research of Nguyen Ngoc Thuc and Masto Nakano (mainly with damage to the D12-L2 vertebra) [8], [9]. When comparing the collapsed vertebrae height before and after cement injection, we found a statistically significant difference with $p < 0.001$ on the measurements of all vertebral columns. Evaluating the effectiveness of restoring vertebral body height after surgery,

we recorded that 24.2% of vertebrae had poor restoration effect, 36.4% of vertebrae had moderate restoration effect and 39.4% of vertebrae had good restoration effect. has very good recovery effect. This result is similar to the study of Jung-Hoon Lee and colleagues who performed balloon cement injection in 158 vertebrae in 137 patients (the average collapse rate of collapsed vertebrae before cement injection was 24.97%; The average rate of height restored after pumping is 17.8%, difference with $p < 0.001$; 45.5% of vertebrae achieved good recovery effect, 35.4% of vertebrae achieved moderate recovery effect and 19% of vertebrae achieved poor recovery efficiency [5]).

Our study also shows that the results of correction of collapsed vertebrae are very positive with a kyphosis angle correction coefficient of 2.2° and a collapsed angle of 7.8° ($p < 0.001$). The average vertebral body collapse angle, Cobb angle, and kyphotic angle before cement injection were 14.9° , 12.6° , 8.4° , respectively, and after cement injection were 7.10° , 6.90° , respectively, 6.20° . This result is consistent with Jung-Hoon Lee's research (kyphoplasty method resulted in a postoperative kyphosis angle of 1.94° , a statistically significant difference compared to the preoperative kyphotic angle is 3.24° ; $p < 0.001$ [10]). In Kyeong-Sik Ryu's study, the correction of the kyphotic angle from $16.06 \pm 5.24^\circ$ to $8.84 \pm 3.89^\circ$ [4], similar to our study in terms of good vertebral body height restoration results.

5. CONCLUSIONS

Kyphoplasty treating thoracic-lumbar osteoporotic VCFs brings very positive results, restoring height and correcting kyphosis, specifically:

- Treatment effectiveness: 100% of patients had pain relief immediately postoperative, the average VAS score after surgery was 1.91 ± 1.22 points, a statistically significant decrease compared to before surgery.

- Effectiveness of restoring vertebral body height and correcting kyphosis: 100% of damaged vertebrae have restored vertebral body height with good recovery rate is 36.4%, very good is

39.4%; the kyphosis corrected spine has statistical significance ($p < 0.05$).

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