ORIGINAL RESEARCH

Analysis of Comprehensive Nursing in the Treatment of Elderly Patients with Thoracolumbar Vertebral Body Compression Fractures by Percutaneous Vertebroplasty

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ABSTRACT

Objective • to explore and analyze the comprehensive nursing effect of percutaneous vertebroplasty (PVP) in the treatment of elderly patients with thoracolumbar vertebral compression fractures.

Methods • This study recruited elderly patients with thoracolumbar vertebral compression fractures who were diagnosed in Lujiang County People's Hospital from January 2020 to December 2022 and underwent PVP. Finally, a total of 80 cases were included in this study. All patients were randomly divided into two treatment groups: the observation group and the control group. The patients in the control group were given routine nursing measures, and the patients in the observation group were given comprehensive nursing intervention. The baseline characteristics of the two groups of patients were recorded thoroughly, and relevant indicators such as clinical indicators, functional recovery, pain relief, and occurrence of complications were observed and compared between the two groups.

Results • The recovery time of the patients in the observation group, including the time of getting out of bed and the time of hospitalization, was significantly shorter than that of the control group [OR = 0.61 (95%CI: 0.44 - 0.83); OR = 0.70 (95%CI: 0.51 - 0.96)] $P < .05$; the JOA score of the observation group was significantly higher than that of the control group after treatment (RR = 1.28 (95%CI: 1.16 - 1.42)); the vas scores of the patients at each time point were lower than those of the control group [OR = 0.60 (95%CI: 0.43 - 0.84); OR = 0.57 (95%CI: 0.41 - 0.80); OR = 0.61 (95%CI: 0.44 - 0.85); OR = 0.72 (95%CI: 0.52 - 0.99)]; the incidence of complications in the observation group was significantly lower than that of the control group OR = 0.27 (95%CI: 0.10 - 0.72).

Conclusion • The implementation of comprehensive nursing has a clear application effect on PVP in the treatment of elderly patients with thoracolumbar vertebral compression fractures. It can effectively speed up patients' movement speeds, reduce the overall length of hospitalization, and promote the recovery of thoracolumbar spine function. It can also relieve the patient's pain faster, reduce the possibility of complications, and have a positive impact on the patient's prognosis, which is worthy of clinical application. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

A thoracolumbar vertebral compression fracture is a common clinical orthopedic disease. Generally speaking, it is due to the compression and deformation of the front part of the vertebral body caused by the driving force, and the clinical manifestations are low back pain and limited mobility. Because the elderly are often accompanied by osteoporosis and their bones are more fragile, in daily life, activities such as bending over, washing face, brushing teeth, resting, and turning around may cause damage to the lumbar spine.[1] Therefore, they have a higher probability of thoracolumbar compression fractures, and they are the frequent population of thoracolumbar compression fractures.[2,3]

Percutaneous vertebroplasty (PVP) has the advantages of conservative treatment and traditional surgery, but it is irreplaceable. This is a minimally invasive treatment for thoracolumbar compression fractures under the guidance of an invasive surgery.[4,5] After decades of development, it has a certain effect: it can increase the strength and stability of the diseased vertebrae, relieve pain, and even partially restore the height of the vertebrae. It has small trauma and short operation time, is safe and effective, and has fast postoperative functional recovery and other advantages. This is the most commonly used method for the treatment of osteoporotic

thoracolumbar compression fractures at home and abroad.[6] However, elderly patients have decreased physical function, poor pain tolerance, and high psychological pressure. Usually accompanied by high blood pressure, myocardial injury, diabetes, and other diseases. PVP requires patients to lie prone for a long time, and local anesthesia is used in special cases such as surgery and difficulty recovering after recovery.[7,8] Therefore, it is necessary to implement active and effective nursing interventions for patients to improve recovery efficiency. Comprehensive nursing is a scientific, practical, and comprehensive nursing model, which refers to nursing procedures as the core, and the nursing work procedures are systematized. In terms of nursing concepts, nurses' responsibilities and evaluations, standardized nursing plans, patient training plans, etc., are interlocking and coordinated as a whole; integrating responsibility-based nursing and the advantages of group nursing can ensure the level and quality of nursing.[9] Some scholars have suggested that comprehensive nursing can promote the rapid recovery of elderly patients with vertebral compression fractures in view of the psychological and physiological particularities of the elderly.[10]

This study focuses on the analysis of the comprehensive nursing effect of PVP in the treatment of elderly patients with thoracolumbar vertebral compression fractures in order to contribute to the early improvement of self-care ability, quality of life, and early return to society for patients.

OBJECTS AND METHODS

Research objects

This study has been approved by the ethics committee of our hospital, and eligible for inclusion in this study were those diagnosed with thoracolumbar vertebral compression fractures who underwent PVP at Lujiang County People's Hospital from January 2020 to December 2022. The inclusion criteria encompassed elderly patients meeting the diagnostic criteria, while exclusion criteria were applied to eliminate unqualified patients. The selection criteria aimed to ensure the homogeneity of the study population and included aspects such as age, fracture type, and suitability for PVP. The randomization process was conducted using a computer-generated random number sequence. Each eligible patient was assigned a unique identification number, and randomization was performed by an independent researcher not involved in patient care. Patients were then allocated to either the observation group or the control group based on the randomization sequence. Each group included 40 patients. All the patients were adults, and there was no restriction on gender. All enrolled patients provided written informed consent, and all patients had voluntarily signed it.

Inclusion and exclusion criteria

Inclusion criteria: 1) all patients meet the relevant clinical diagnostic criteria and have been diagnosed with thoracolumbar vertebral compression fractures by x-ray, ct, or MRI imaging[11]; 2) all patients are over 55 years old, and there is no restriction on inclusion gender, complete clinical data; 3) Normal cognitive function is required, and patients should be able to cooperate with the prescribed treatment.

Exclusion criteria 1) Patients unable to tolerate surgery or with relevant treatment contraindications are excluded.; 2) Exclusion applies to individuals with blood system diseases, nerve root or spinal cord injuries, etc.; 3) Patients with malignant tumors or infectious diseases are ineligible for participation; 4) Individuals with mental illness or an inability to communicate effectively are excluded from the study.

Method

All patients underwent PVP intervention after admission, as follows: Instruct patients to adopt a prone position and intramuscularly inject 100 mg of piperidine (national pharmaceutical approval h63020016, Qinghai pharmaceutical factory co., ltd.), hydrochloric acid 30 minutes before the operation, pethidine analgesia, routine local disinfection, and anesthesia; fluoroscopy on the c-arm x-ray machine to determine the position of the broken vertebra and its pedicle, perform local infiltration anesthesia, and mark the outer edge of the pedicle oval cortex as the puncture point; routine after disinfection and draping, make a small incision about 0.5 cm along the marked point. Under the c-arm assisted fluoroscopy, the puncture point is inclined inward about 10-15° to enter about 1/3 of the vertebral body, and the opposite side is punctured in the same way; bone cement the amount of injection depends on the size of the vertebral body and the degree of compression of the vertebral body. The bone cement is perfused on both sides in sequence and slowly spreads to the cortical area. The injection situation is monitored and controlled to prevent the bone cement from leaking out of the vertebral body; after hardening, the puncture needle was pulled out, the wound was routinely compressed to stop bleeding, and bandaged; postoperatively, patients were routinely treated with antibiotics, anti-osteoporosis drugs, and nutritional support.[8,12]

Patients in the control group were given routine nursing measures, including strengthening the observation of vital signs after surgery, taking anti-osteoporosis drugs for patients according to the doctor's advice, guiding patients to leave the hospital, and guiding patients to return to the hospital for reexamination in time, etc. The patients in the observation group were intervened by comprehensive nursing, as follows: 1) psychological intervention: Actively communicate with patients, understand their psychology in detail, comfort them, and explain the discomfort and postoperative effect during PVP; health education, answering patients' doubts, informing patients of the purpose, method and benefits of PVP (for example, less trauma, high surgical safety, and rapid postoperative recovery) as well as the professional level of surgeons, so as to improve patients' awareness of surgery confidence; provide patients with necessary psychological guidance, comfort and encouragement to relieve their preoperative negative emotions, ease their psychological pressure, and enable patients to accept surgical treatment with a good attitude; by telling success stories, patients can

eliminate fear and anxiety. Worry, build confidence in overcoming the disease, and actively participate in treatment and care. 2) preoperative intervention: Guide patients to complete bed rest and help patients maintain a supine position; require patients to eat vitamin-rich and easy-to-digest foods and avoid foods that produce gas; encourage patients to drink plenty of water, maintain smooth stools and enema if necessary; measure their physiological indicators, such as blood pressure, body temperature, and heart rate, and help them perform various routine preoperative examinations, such as x-ray, coagulation function, blood routine, liver and kidney function tests, and urine routine; preoperative routine fasting and water, improve the preparation and cleaning of the skin in the surgical area and various drug tests. 3) intraoperative intervention: Help the patient maintain a correct and comfortable posture and place cotton pads under the shoulders and pelvis; closely monitor the patient's vital signs and oxygen saturation, help the patient maintain a stable posture during the puncture operation and notify the doctor in time detect abnormalities and help doctors manage them; maintain communication with patients, understand the sensation and movement of the waist and lower extremities, and relieve the patient's tension at the same time. 4) postoperative care: Lie flat on a hard bed and rest for 4 hours to completely harden the bone cement in the injured vertebrae; maintain electrocardiogram monitoring, and closely monitor changes in blood pressure, oxygen saturation and heart rate; the anesthetist will evaluate the patient, and take preventive drugs for patients with poor pain tolerance; within 24 hours after the operation, help the patient turn over on the bed, guide the patient to perform deep breathing training, and then gradually guide the patient to perform quadriceps isometric contraction training and right leg raising training , bedtime training, bed rest activities, enhance the strength of the quadriceps muscles, prevent the adhesion of the spinal nerve roots, and guide patients to gradually contract the back and waist muscles to enhance the stretch of the back and waist muscles and strengthen the protection of the spine; medical staff patrol, appease patients' emotions, provide psychological care in time, and relieve patients' pressure. 5) nursing of complications: Closely observe the patient's vital signs and the sensation and movement of the lower limbs, and immediately notify the doctor for symptomatic treatment if any abnormality is found, for example, if the patient develops postoperative symptoms such as tachycardia, shortness of breath, chest tightness, chest pain, cyanosis, and palpitations, the possibility of pulmonary embolism should be considered. At this time, the nurse should cooperate with the doctor who treated the patient to help the patient inhale oxygen in time, observe the blood and fluid leakage at the puncture site of the patient, and change the dressing regularly to keep it dry; venous thrombosis; encourage patients to take high-quality protein, vitamin-rich and digestible food to enhance body resistance and prevent complications, etc. 6) discharge guidance: Instruct patients to avoid weight-bearing, lift heavy objects, sit for a long time for 3 months, maintain a good sitting and walking posture, and continue to strengthen the muscles of the lower back; eat more calcium-rich nutrients and digestible foods; follow-up lasted at least 6 months.

Observation indicators

Clinical index: observation records the clinically relevant recovery time of the two groups of patients, including the time of getting out of bed and the time of hospitalization, and compares them between the two groups.

Functional recovery: The functional recovery of all patients before and after treatment was recorded and evaluated by the Japanese Orthopedic Association Thoracolumbar Spine score. The scale included subjective symptoms, clinical signs, limited daily activities, and bladder function, with a full score of 29, which is directly proportional to the function of the thoracolumbar spine.

Pain relief: observation records the pain sensation of all patients at different times (before treatment, 1 day after treatment, 1 week after treatment, 1 month after treatment, 3 months after treatment) and uses the vas (visual analog scale for pain) scale to evaluate. The scale score is in the range of 0-10 points, ≤3 Points represent mild pain, there is slight pain, but no impact on daily life, 4-6 points represent moderate pain, the pain is obvious but tolerable, ≥7 the score represents severe pain, which is unbearable, and the score is proportional to the degree of pain.

Complications: were observed and recorded in the two groups of patients without complications, including infection, bedsore, constipation, hematoma at the puncture site, bone cement leakage, and lower extremity venous thrombosis. The total incidence was calculated and compared between the two groups.

Statistics

GraphPad Prism 8 software was used to process images; data analysis software was spss 26.0 software; measurement data was expressed as (±s), and independent sample t was used for the test; count data was expressed as case number (%), and χ^2 was used for the test. $P < .05$ means the comparison is statistically significant.

Among the Independent Sample t-test, the parametric test was chosen for continuous measurement data as it is suitable for comparing means between two independent groups. It assumes a normal distribution, making it appropriate for analyzing data that are expected to follow a normal distribution. χ^2 test, for count data presented as case numbers and percentages, the chi-square test was employed. This non-parametric test is well-suited for analyzing associations between categorical variables.

RESULT

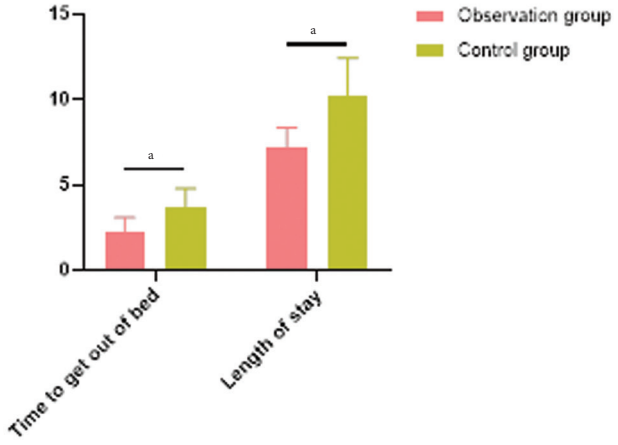
Baseline characteristics

Among the 40 patients in the observation group, there were 5 males and 35 females. The minimum age was 56, the maximum age was 85, and the average (72.20±6.34) years

Table 1. Baseline characteristics of patients in the two groups

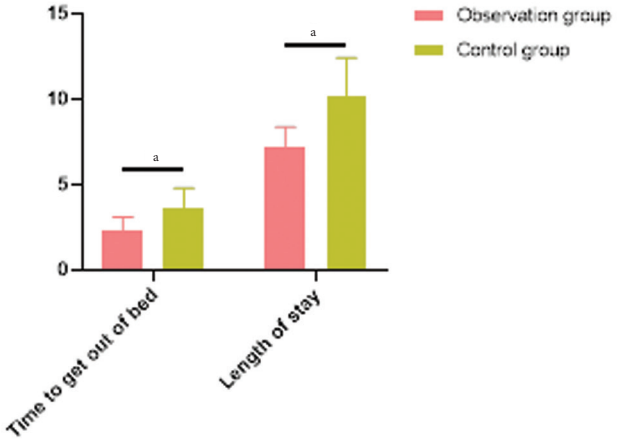
		Observation group	Control group	χ^2/t	*P* value
Number of cases		40	40	-	-
Gender	Male	5	6	0.105	.745
	Female	35	34	-	-
Age	Minimum value	56	62	-	-
	Maximum value	85	94	-	-
	Average	72.20±6.34	73.38±7.21		
Course of disease (d)	-	0.5-7	0.7-7	-	-
	Average	3.11±0.92	3.14±0.88		
Injury vertebra position	T_{12}	11	12	0.061	.805
	L_1	19	17	-	-
	L_2	10	11	-	-
Cause of injury	Car accident	18	15	0.464	.496
	Strike	8	9	-	-
	Fall	13	14	-	-
	Other	1	2	-	-
Basic illness	Hypertension	20	Twenty two	0.201	.654
	Diabetes	17	18	0.051	.822
	Hyperlipidemia	11	9	0.267	.606

Figure 1. Clinically relevant recovery times for patients in the two groups



[a]indicates that there is a difference between the two groups ($P < .05$)

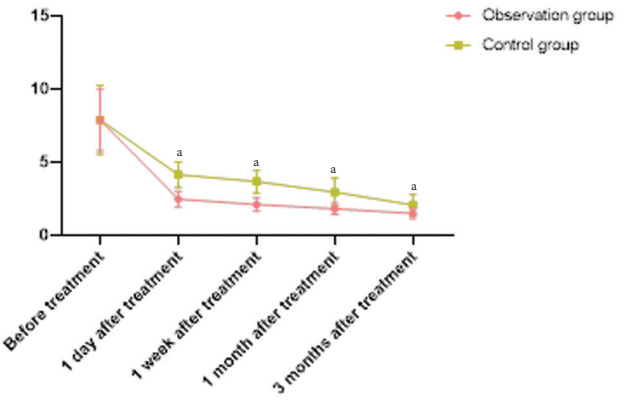
Figure 2. JOA scores of patients in the two groups before and after treatment



[a]indicates that there is a difference between the two groups ($P < .05$)

old.[1] The two groups were comparable, and there was no significant difference in gender, age, and other related baseline characteristics ($P > .05$). See table 1 for details.

Figure 3. VAS scores of two groups of patients at different times



[a]indicates that there is a difference between the two groups ($P < .05$)

Clinical indicators

The time of getting out of bed (2.25±0.84) and hospitalization time (7.14±1.23) of the patients in the observation group, the time of getting out of bed (3.68±1.11) and the time of hospitalization (10.18±2.25) of the patients in the control group. The time, including getting out of bed and hospitalization time, were shorter than those in the control group, $P < .05$. See Figure 1 for details:

Function Recovery

JOA score of the patients in the observation group before treatment (11.51±1.52) and after treatment (23.69±2.23), the JOA score of patients in the control group before treatment (11.47±1.35) and after treatment (18.52±2.17). There was no significant difference in the JOA score between the two groups before treatment ($P > .05$), but after treatment, the JOA score of the observation group was significantly higher than that of the control group ($P < .05$). See figure 2 for details:

Pain relief

The vas score of the patients in the observation group before treatment (7.91±2.10), the vas score 1 day after treatment (2.48±0.53), the vas score of 1 week after treatment (2.11±0.47), the vas score of 1 month after treatment (1.82±0.39), vas score 3 months after treatment (1.50±0.35), vas score of control group before treatment (7.90±2.35), vas score 1 day after treatment (4.15±0.88), vas score 1 week after treatment (3.68±0.79), treatment vas score 1 month after treatment (2.96±0.96) and vas score 3 months after treatment (2.08±0.74). In summary, there was no significant difference in vas scores between the two groups before treatment ($P > .05$). After treatment, in the observation groups, the vas scores of the patients at each time point were lower than those of the control group, $P < .05$. See Figure 3 for details:

Complication

In the observation group, there were 0 cases of infection, 0 cases of bed sores, 1 case of constipation, 1 case of

hematoma at the puncture site, 1 case of bone cement leakage, and 1 case of lower extremity venous thrombosis, 3 cases of constipation, 2 cases of hematoma at the puncture site, 2 cases of bone cement leakage, and 3 cases of lower extremity venous thrombosis, with a total incidence of 37.50%. In summary, the incidence of complications in the observation group was significantly lower than that in the control group, $P < .05$. See Table 2 for details.

Table 2. The incidence of complications in the two groups of patients

	Observation group	Control group	χ^2	*P* value
Number of cases	40	40	-	-
Infect	0	2	-	-
Bedsore	0	3	-	-
Constipate	1	3	-	-
Hematoma at the puncture site	1	2	-	-
Bone cement leakage	1	2	-	-
Lower extremity venous thrombosis	1	3	-	-
Total incidence	10.00	37.50	8.352	.004

DISCUSSION

With the aging of society, the elderly may suffer from compression vertebral fractures due to minor stress injuries. The clinical manifestations are mainly local tenderness and stroke pain, and the pain will be aggravated after changing the posture, and mobility will be seriously affected. Limit, which greatly reduces the quality of life.[13,14] Scholars such as Okamoto pointed out that the conservative treatment commonly used in the past can improve the clinical symptoms of patients to a certain extent, but its effect is limited, and it may aggravate bone loss. Therefore, surgery is usually used for clinical treatment, but the elderly are weak and cannot tolerate open surgery, and because of their osteoporosis, internal fixation parts are loose and easy to move, resulting in reduced grip strength, which leads to surgical failure. With the continuous improvement of the clinical medical level, PVP has gradually replaced the original open surgery and has become the first choice for the treatment of patients with thoracolumbar compression fractures. Studies have shown that PVP is a minimally invasive technique that can effectively treat patients with thoracolumbar compression fractures. It only causes minimal trauma and promotes quicker recovery after surgery, but it is always traumatic. The treatment is physical. Severe stress reaction[15,16]; in addition, there may be complications of bed rest, such as fall pneumonia, pressure sores, urinary tract infection, deep vein thrombosis of lower extremities, etc.[17,18]

Elderly and middle-aged people with osteoporosis are prone to compression fractures of the thoracic and lumbar spine under the action of external forces or large movements, especially postmenopausal women,[19,20] which is also reflected in the basic characteristics of the object. Nursing is an important part of helping patients pass the perioperative and surgical periods smoothly. Comprehensive and detailed information exchange and psychological comfort can help reduce patients' anxiety. Rehabilitation after fracture is a long process.[21] Selecting appropriate nursing interventions not only contributes to the continuity and effectiveness of patients' recovery but also enhances patients' confidence in recovery and improves their living conditions. Therefore, in this study, the observation group chose the comprehensive nursing intervention method and analyzed its application effect in the treatment of elderly patients with thoracolumbar vertebral compression fractures with PVP. The results confirmed that the recovery time of the patients in the observation group, including the time of getting out of bed and the time of hospitalization, was significantly shorter than that of the control group, and the JOA score after the intervention was significantly higher than that of the control group. The rate was significantly lower than that of the control group, with $P < .05$; that is, comprehensive nursing more comprehensively and effectively promoted the recovery of patients than conventional nursing intervention. PVP mainly uses minimally invasive techniques, injecting biomaterials (such as bone cement) into the injured vertebrae to restore the height of the injured vertebrae, improve the compressive strength of the injured vertebrae, avoid further deformation and collapse of the injured vertebrae, and improve injury the function of the vertebrae. However, because most elderly patients are ignorant of the disease and pay too much attention to the curative effect and other factors, they often have negative emotions such as fear, anxiety, depression, etc., and cannot actively cooperate with treatment and care in addition, most elderly patients with thoracolumbar compression fractures are resistant to low, mainly accompanied by underlying diseases that are difficult to treat such as hypertension and diabetes, so good nursing intervention is the prerequisite for successful treatment. Although the previous routine nursing has a certain effect, it is not comprehensive enough in comparison, and it only aims to ensure the smooth completion of the process, which leads to the nursing staff not paying attention to the patient's negative emotions or personal needs, and not paying attention to some doubts of the patient. There are timely answers, and so on. Comprehensive nursing is a scientific, practical, and comprehensive nursing model,[22,23] which adds psychological, diet, environmental, and other nursing interventions on the basis of basic nursing cooperation, which is conducive to improving the negative emotions of patients and making them actively compatible with clinical treatment and nursing work, improving patient efficiency and prognosis. At the same time, different intensities and different methods of functional training at different stages before and after surgery, and different training methods are gradually implemented according to the rehabilitation stage so as to realize the functional recovery training of the thoracolumbar spine scientific system and improve the rehabilitation effect; strengthening medical care consultation can effectively help elderly patients improve physical function, and provide comprehensive care and guidance in daily conditions, effectively help elderly patients improve physical function and help them recover as soon as possible. As for the faster and more effective pain relief of the patient, it is considered to be related to the preoperative preparation. Before the

operation, the patient received pulmonary function training according to the guidelines to improve the reduced lung volume caused by the thoracic spine fracture. At the same time, the prone position and defecation before the operation can help the patient adapt intraoperative and postoperative posture changes can relieve postoperative negative emotions and reduce worries about pain, and gradually transition from low-intensity training to high-intensity training after surgery can avoid severe pain caused by excessive exercise. Moreover, comprehensive nursing care can provide care from the psychological point of view of elderly patients, which can help elderly patients effectively resolve the negative emotions generated in their hearts and enable elderly patients to actively deal with the harmful effects of the disease with a positive attitude; in addition, the implementation of daily care mainly guides patients in their daily life. Under the guidance of nursing staff, elderly patients can effectively supplement their own nutrition through a good diet, which also helps patients recover from fracture diseases. Previous clinical studies have shown that comprehensive nursing intervention for elderly patients with thoracolumbar compression fractures during PVP can improve their preoperative negative emotions and reduce postoperative complications, which is consistent with the results of this study.

CONCLUSION

In summary, the implementation of comprehensive nursing has a clear effect on the application of PVP in the treatment of elderly patients with thoracolumbar vertebral compression fractures. Functional recovery, while faster relief of pain in patients, reduces the possibility of complications, has a positive impact on the prognosis of patients, and is worthy of clinical application.

REFERENCES

1. Pazos Mohri A, Puente Sánchez L, Diez Ulloa MA. La radiografía en bipedestación inmediata predice el colapso final de la vértebra fracturada en pacientes añosos con fractura estallido toracolumbar. *Rev Esp Cir Ortop Traumatol*. 2023;67(1):68-74. doi:10.1016/j.recot.2022.07.021
2. Yin Y, Cao S, Wang C, Liu Y, Zhang H. Effect of Core Stability Training on Unstable Support Surfaces in Postoperative Rehabilitation of Thoracolumbar Vertebral Compression Fractures in the Elderly. *Comput Math Methods Med*. 2022;2022:4480349. doi:10.1155/2022/4480349
3. Liu H, Xu JW, Sun GR, Shi WF, Xiang LM, Chen S. Minimally invasive pedicle screw fixation, including the fractured vertebra, combined with percutaneous vertebroplasty for treatment of acute thoracolumbar osteoporotic compression fracture in middle-aged and elderly individuals. *Medicine (Baltimore)*. 2022;101(10):e29011-e29011. doi:10.1097/MD.0000000000029011
4. Buchbinder R, Johnston RV, Rischin KJ, et al. Percutaneous vertebroplasty for osteoporotic vertebral compression fracture. *Cochrane Database Syst Rev*. 2018;4(4):CD006349. doi:10.1002/14651858.CD006349.pub3
5. Filippiadis DK, Marcia S, Masala S, Deschamps F, Kelekis A. Percutaneous Vertebroplasty and Kyphoplasty: Current Status, New Developments and Old Controversies. *Cardiovasc Intervent Radiol*. 2017;40(12):1815-1823. doi:10.1007/s00270-017-1779-x
6. Al-Nakshabandi NA. Percutaneous vertebroplasty complications. *Ann Saudi Med*. 2011;31(3):294-297. doi:10.4103/0256-4947.81542
7. Wang B, Zhao CP, Song LX, Zhu L. Balloon kyphoplasty versus percutaneous vertebroplasty for osteoporotic vertebral compression fracture: a meta-analysis and systematic review. *J Orthop Surg Res*. 2018;13(1):264. doi:10.1186/s13018-018-0952-5
8. Kushchayev SV, Wiener PC, Teytelboym OM, Arrington JA, Khan M, Preul MC. Percutaneous Vertebroplasty: A History of Procedure, Technology, Culture, Specialty, and Economics. *Neuroimaging Clin N Am*. 2019;29(4):481-494. doi:10.1016/j.nic.2019.07.011
9. Grace PJ, Zumstein-Shaha M. Using Ockham's razor to redefine "nursing science". *Nurs Philos*. 2020;21(2):e12246. doi:10.1111/nup.12246
10. Su SF, Lin SN. Effects of comprehensive geriatric care on depressive symptoms, emergency department visits, re-hospitalization and discharge to the same residence in older persons receiving hip-fracture surgery: A meta-analysis. *Int J Nurs Pract*. 2022;28(6):e13099. doi:10.1111/ijn.13099
11. Wang B, Cao J, Chang J, et al. Effectiveness of Tirobot-assisted vertebroplasty in treating thoracolumbar osteoporotic compression fracture. *J Orthop Surg Res*. 2021;16(1):65. doi:10.1186/s13018-021-02211-0
12. Anselmetti GC, Muto M, Guglielmi G, Masala S. Percutaneous vertebroplasty or kyphoplasty. *Radiol Clin North Am*. 2010;48(3):641-649. doi:10.1016/j.rcl.2010.02.020
13. Pazos Mohri A, Puente Sánchez L, Diez Ulloa MA. [Translated article] Immediate standing X-ray predicts the final vertebral collapse in elderly patients with thoracolumbar burst fracture. *Rev Esp Cir Ortop Traumatol*. 2023;67(1):T68-T74. doi:10.1016/j.recot.2022.10.009
14. Hiwatashi A, Yoshiura T, Noguchi T, Togao O, Yamashita K, Honda H. Percutaneous vertebroplasty. *Fukuoka igaku zasshi = Hukuoka acta medica*. 2007;98(9):337-345. Accessed March 19, 2024. https://kyushu-u.elsevierpure.com/en/publications/percutaneous-vertebroplasty
15. Hiwatashi A, Yoshiura T, Noguchi T, Togao O, Yamashita K, Honda H. [Percutaneous vertebroplasty]. *Fukuoka Igaku Zasshi = Hukuoka. Acta Medica (Cordoba)*. 2007;98(9):337-345. Accessed March 19, 2024. https://pubmed.ncbi.nlm.nih.gov/17974077/
16. Schofferman J. Percutaneous vertebroplasty: fractured opinions. *Pain Med*. 2010;11(11):1585-1586. doi:10.1111/j.1526-4637.2010.00984.x
17. Zhang H, Xu C, Zhang T, Gao Z, Zhang T. Does Percutaneous Vertebroplasty or Balloon Kyphoplasty for Osteoporotic Vertebral Compression Fractures Increase the Incidence of New Vertebral Fractures? A Meta-Analysis. *Pain Physician*. 2017;20(1):E13-E28. https://pubmed.ncbi.nlm.nih.gov/28072794/ doi:10.36076/ppj.2017.1.E13
18. Hsu SW, Lee CH, Hueng DY. Percutaneous vertebroplasty. *J Neurosurg Spine*. 2012;16(2):210-211. doi:10.3171/2011.8.SPINE11223
19. Filgueira ÉG, Imoto AM, da Silva HEC, Meves R. Thoracolumbar Burst Fracture: McCormack Load-sharing Classification: Systematic Review and Single-arm Meta-analysis. *Spine*. 2021;46(9):E542-E550. doi:10.1097/BRS.0000000000003826
20. Iwata A, Kanayama M, Oha F, Hashimoto T, Iwasaki N. Does spinopelvic alignment affect the union status in thoracolumbar osteoporotic vertebral compression fracture? *Eur J Orthop Surg Traumatol*. 2017;27(1):87-92. doi:10.1007/s00590-016-1844-1
21. Cook WL, Brasher PMA, Guy P, et al. Comprehensive Geriatric Care to Improve Mobility after Hip Fracture: an RCT. *Gerontology*. 2020;66(6):542-548. doi:10.1159/000510903
22. Prestmo A, Hagen G, Sletvold O, et al. Comprehensive geriatric care for patients with hip fractures: a prospective, randomised, controlled trial. *Lancet*. 2015;385(9978):1623-1633. doi:10.1016/S0140-6736(14)62409-0
23. Pioli G, Davoli ML, Pellicciotti F, Pignedoli P, Ferrari A. Comprehensive care. *Eur J Phys Rehabil Med*. 2011;47(2):265-279. Accessed March 19, 2024. https://pubmed.ncbi.nlm.nih.gov/21597436/