

UTILITY OF ROUTINE NEEDLE BIOPSY DURING KYPHOPLASTY FOR OSTEOPOROTIC VERTEBRAL FRACTURES

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ABSTRACT

Objective: Pathologic vertebral fractures are most commonly caused by osteoporosis, and kyphoplasty is one of the most common minimally invasive surgical treatments. In osteoporotic vertebral fractures, the underlying pathology may not be recognized. Therefore, a needle biopsy may be essential during kyphoplasty. This study investigated the incidence of unsuspected malignancies in patients undergoing kyphoplasty for osteoporotic vertebral fractures.

Materials and Methods: Data from 56 patients (29 women, 27 men) who underwent kyphoplasty and had needle biopsy were retrospectively reviewed. Patients in whom no bone biopsy was performed and those in whom kyphoplasty was performed for reasons other than osteoporosis were excluded from the study. Patients who did not experience relief after medical treatment and who had a visual analog scale score of 6 were included in the study.

Results: Five patients not suspected to have malignant disease were diagnosed with malignancy after pathological examination. Two of them were thought to have metastases from a primary tumor (one breast cancer and one prostate cancer). The incidence of unexpected malignancy was 8.9%.

Conclusion: Percutaneous needle biopsy is a low-cost highly effective method. Therefore, we recommend routine needle biopsy during kyphoplasty.

Keywords: Osteoporosis, vertebral fracture, kyphoplasty, needle biopsy, malignancy

INTRODUCTION

Pathologic vertebral fractures (PVF) are often caused by osteoporosis and metastatic disease without preceding trauma. Osteoporosis is one of the most common causes of PVF, especially in the older population. PVF is defined as a reduction in vertebral body height of 20% or ≥ 4 mm⁽¹⁾. In osteoporotic VFs, back pain is the chief complaint. Depending on the severity of fractures, symptoms can range from functional limitations to impaired lung capacity. The initial treatment of PVFs includes conservative therapy. Patients who no longer respond to therapy are candidates for surgical intervention⁽²⁾. Vertebroplasty and kyphoplasty are the two most common minimally invasive surgical procedures⁽³⁾. Bone biopsy is not a routine procedure for kyphoplasty because of osteoporosis. Although most fractures in these patients are caused by osteoporosis, underlying pathologic conditions such as malignancies may be missed. Previous studies have used needle biopsies of the fractured vertebral body to determine whether unrecognized pathologies are associated with osteoporotic diseases⁽⁴⁻¹⁴⁾. In light of previous studies, we aimed to investigate the incidence of unsuspected malignancies in patients undergoing kyphoplasty for osteoporotic vertebral fractures (VFs).

MATERIALS AND METHODS

This retrospective study was performed at Ankara City Hospital. Ethical approval was obtained from the ethics committee of the Ankara City Hospital before the start of the study (approval date: 08/06/2022, approval no: E2-22-1949). The study protocol was performed according to the principles of the Declaration of Helsinki. Data of patients who underwent kyphoplasty between July 2019 and March 2022 were collected by retrospective review of hospital records. Fifty-six patients who underwent kyphoplasty and had a bone biopsy were included in the study. Of these patients, 29 were female and 27 were male. Patients who did not undergo bone biopsy and who underwent kyphoplasty for reasons other than osteoporotic VFs were excluded from the study. The results of preoperative radiologic imaging [radiographs and magnetic resonance imaging (MRI)-short tau inversion recovery (STIR) MRI in all cases and gadolinium-enhanced MRI in cases with suspected malignancy] were evaluated from the recorded data. None of the patients had a history of systemic steroid therapy. All patients had back pain consistent with radiological findings. The visual analog scale (VAS) score of the patients included in the study was ≥ 6 , and the patients had not experienced significant relief after back



splinting and medical treatment. Preoperative images showed 14 L1, one L1 + L3, one L1 + L3 + L4, one L2 + L3, eight L2, nine L3, three L4, two L5, one T11, one T11 + T12, two T12 + L2, 10 T12, one T5, one T5, T6, one T7, and one T9 compression fractures. Five of the patients had a history of malignancy (two breast cancer, one prostate cancer, one Wilson tumor, and one lung cancer). Demographic characteristics and final pathologic diagnosis were recorded. Percutaneous kyphoplasty was performed under local anesthesia in the prone position under the guidance of a scopist. All patients received prophylaxis with 1 g intravenous cefazolin sodium before the procedure. An 11-gauge Jamshidi needle was inserted into the fractured portion of the vertebral body through a transpedicular approach. A cannula was then inserted into the vertebral body. Bone biopsy was obtained via an obturator. The bone samples were sent to the hospital pathology department for histopathological examination. A bone biopsy was taken in a single plane from each patient. After the biopsy, a drill was inserted into the fractured vertebral body by rotation, and a balloon catheter was placed. Kyphoplasty surgery was performed accordingly.

Statistical Analysis

Statistical analyzes were performed using the Statistical Package for the Social Sciences (SPSS) package program (IBM SPSS Statistics 24). Descriptive statistics were used to interpret the results. Results were presented as mean + standard deviation.

RESULTS

In all patients, radiological imaging findings were compatible with osteoporotic VFs. The radiologic images left no doubt about malignancy. Five patients were diagnosed with pathologic malignancy based on the biopsy specimens. Two of them were metastases of a primary tumor (one breast cancer and one prostate cancer). The unexpected malignancy incidence was 8.9%. The demographic and clinical characteristics of the patients are shown in Table 1. Results of the pathological examination revealed two cases of breast cancer metastases, one prostate cancer metastasis, one carcinoma metastasis, and one lung cancer metastasis. Nine of the specimens were unsuitable for pathological evaluation. The remaining 42 specimens had osteoporotic bone features. None of the patients experienced complications related to the surgical procedure.

DISCUSSION

VFs may be associated with several diseases other than osteoporosis. However, the underlying pathology cannot always be accurately determined before surgery. MRI, computed tomography, and other imaging modalities can help in differentiating benign from malignant spinal lesions. Acute VFs show as hypointensity on T1 images and hyperintensity on sequenced MRI with STIR. Pathologic conditions other than osteoporosis may produce an osteoporosis-like appearance on

MR images. Uzunoglu et al.⁽¹⁵⁾ claimed that MRI changes occur in Paget's disease depending on the disease stage. Thus, acute fractures are isohypointense on T2-weighted MRI, whereas chronic ones are hyperintense. In another study, T1/T2-weighted MRI was found to depict plasmacytoma as hypointense, whereas STIR-weighted images showed hyperintensity⁽¹⁶⁾. In this study, all MR images showed hypointensity on T1-weighted images and hyperintensity on T2-weighted images. The preoperative MR images of a patient with osteoporosis (Figure 1) and a patient with breast cancer (Figure 2) were comparable. In the past, MRI has been claimed to detect malignant lesions in the preoperative period with a success rate of up to 98%⁽¹⁷⁾.

Table 1. Demographic and clinical characteristics of the patients

Variables	Patients (n=56)
Age (years, mean ± SD)	67.29±8.01
Gender (n, %)	
Male	27 (48.21%)
Female	29 (51.79%)
Biopsy results (n, %)	
Breast cancer	2 (3.57%)
Prostat cancer	1 (1.79%)
Carcinoma	1 (1.79%)
Lung cancer	1 (1.79%)
VAS score (mean ± SD)	
Preoperative	7.44±1.4
Postoperative	3.82±0.86

SD: Standard deviation, VAS: Visual analog scale



Figure 1. The preoperative MRI images of the osteoporotic patient
MRI: Magnetic resonance imaging

Despite this high rate, unexpected results may occur in clinical practice after pathologic examination. One systematic review found that transpedicular biopsies revealed unexpected malignancy of vertebral compression fractures (VCFs) in 0.4-6% of cases^(11,12,15,18-20). Therefore, most authors recommend routine transpedicular bone biopsies during kyphoplasty, whereas some authors recommend performing biopsies only in patients with strong suspicion^(13,21). In the present study, five malignant pathologic findings were detected in 56 (8.9%) patients, with findings consistent with a primary malignancy in two patients. All malignancies were metastases, two of which were breast cancer, one prostate cancer, and one lung cancer, which are among the most common malignancies in the older population. Previously, Uzunoglu et al.⁽²²⁾ found 15 malignant tumors among 269 biopsies from 201 patients. The pathologic diagnosis was six gastrointestinal adenocarcinomas, three gynecologic adenocarcinomas, three breast cancers, and two lung adenocarcinomas. In another study, three malignant tumors were found among the biopsy results of 67 patients, two of which were multiple myelomas and one was renal cell carcinoma metastasis⁽²³⁾. Li et al.⁽¹²⁾ reported that among 151 biopsies from 97 patients, two cases were multiple myeloma, one was Paget's disease, and one was chronic osteomyelitis. Metastasis of a malignant tumor found in vertebral biopsy revealed an advanced stage of cancer. However, among the cancers that most commonly metastasize to the spine, some cases of breast and prostate cancers can be successfully treated even at advanced stages. Therefore, even considering the cost-benefit ratio and possible complications, a transpedicular biopsy is relatively inexpensive, has high sensitivity and specificity and very low morbidity^(12,24), and can help improve

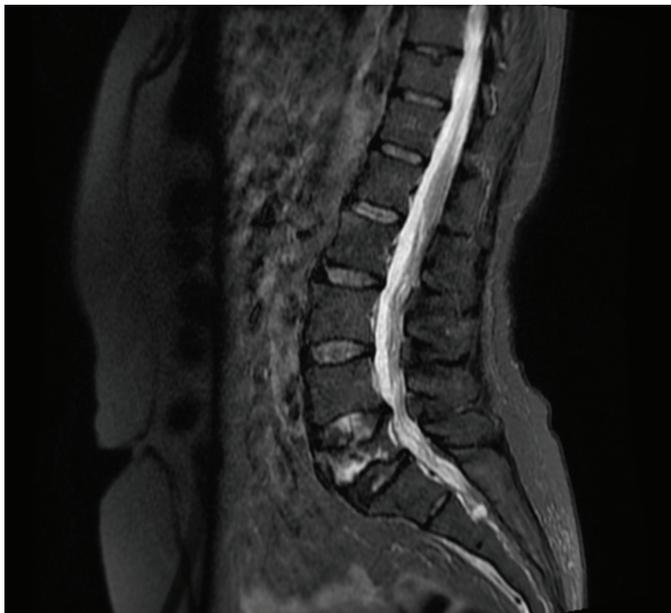


Figure 2. The preoperative MRI images of the patient with breast cancer

MRI: Magnetic resonance imaging

the prognosis of malignant disease by providing a relatively early diagnosis. In this study, the mean preoperative VAS score of patients was 7.44, whereas it was 3.82 postoperatively; no complications related to the procedure occurred. The mean VAS score decreased by approximately half. Regardless of the etiology, we can claim that kyphoplasty is a useful technique to cure VF-related back pain. Obtaining appropriate specimens by percutaneous needle biopsy is not always possible. In our study, there were 9 (16%) inadequate biopsy specimens for pathologic evaluation, similar to previous studies^(8,9). We performed a single-stage biopsy in all patients. In the literature, most authors perform biopsies in multiple stages^(9,14). In their study, Li et al.⁽¹²⁾ performed biopsies in all the levels they operated and found osteoporosis and malignancy at different levels in one patient. Therefore, they advised biopsies from all levels of VCFs. Taking multiple specimens may improve the diagnostic accuracy of the procedure.

Study Limitations

The main limitation of this study is the relatively small number of patients. Another limitation is that a biopsy was performed at one level rather than at multiple levels.

CONCLUSION

The results of this study revealed that a considerable number of unexpected malignant findings can be detected by percutaneous needle biopsy during kyphoplasty in osteoporotic VFs. Because of its low cost, low complication rate, and high efficacy, we recommend routine biopsy during kyphoplasty.

Ethics

Ethics Committee Approval: Ethics Committee approval was received from Ankara City Hospital (approval date: 08/06/2022, approval no: E2-22-1949).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.Ö., G.G., D.D., A.E.S., U.K.G., B.S., D.B., A.D., Concept: Ö.Ö., A.D., Design: D.B., A.D., Data Collection or Processing: G.G., A.E.S., U.K.G., B.S., Analysis or Interpretation: D.B., A.D., Literature Search: D.D., U.K.G., B.S., Writing: Ö.Ö., A.D.

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