

Our Experience with Transpedicular Vertebral Intervention for Diagnostic and Therapeutic Purposes

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Abstract

Introduction: It is recommended that patients with low back and back pain not responding to conservative treatment, or who have accompanied by findings defined as 'red flag' (fever, night pain, weight loss, accompanying malignancy, etc.) should be evaluated radiologically. Transpedicular vertebral biopsy and vertebroplasty are spinal surgical procedures that have been performed for many years in patients with signs of bone collapse or infiltrative involvement, both for pathological diagnosis and treatment.

Methods: CT and MRI images, clinical and pathology records of 31 cases who underwent transpedicular vertebral biopsy and vertebroplasty in our clinic between 2018-2020 were reviewed retrospectively. The procedure, procedure level and pathological diagnoses for each patient were recorded.

Results: In 7 (23%) of our cases, biopsy was performed by transpedicular intervention only for the diagnosis of spondylodiscitis and for the determination of the causative agent. 24 (77%) of them had vertebral compression fractures and both diagnostic transpedicular biopsy and vertebroplasty were performed in the same session. The causative agent was detected in 3 (43%) of the patients with discitis findings (2 cases of staphylococcus aureus, 1 case of tuberculosis); in 4 (57%) the pathology and culture results were negative. While malignancy was detected in the histopathological examination of only 2 (8%) of our patients with compression fractures who underwent vertebroplasty (1 case GIS malignancy, 1 case multiple myeloma), osteoporotic compression fractures were found in the other 22 (92%) cases. In only one of the cases who underwent vertebroplasty, operation was performed at 2 levels (L1 and L2). Other levels were L1 (10 cases), L3 (5 cases), T11 (3 cases), L2 (2 cases), T9 (1 case), T12 (1 case) and L5 (1 case), respectively.

Discussion and Conclusion: Transpedicular vertebral biopsy can be safely performed in the detection of causative agent and pathological diagnosis of vertebral corpus lesions and infections. Vertebroplasty is an effective and reliable method for both pain control and increasing the stability of the vertebra in patients with pain due to osteoporotic bone collapse or metastatic vertebral involvement.

Keywords: Biopsy; transpedicular; vertebra; vertebroplasty.

Vertebral corpus lesions are of the pathologies that we can encounter in patients who apply to the outpatient clinic with the complaint of low back pain that does not go away with medical treatment^[1]. Computed tomography

(CT), magnetic resonance imaging (MRI) are often sufficient to detect these lesions. However, bone scintigraphy and PET are the examinations used to help the differential diagnosis, especially in lesions with a history of malignancy or with CT

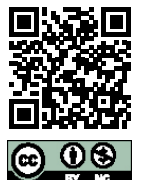
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and MRI images suggestive of malignancy^[2]. Despite all radiological studies in these patients, histological evaluation may be required for correct diagnosis. If there is no massive lesion extending to the posterior of the vertebra or there is no sign of serious neural compression that will cause regression in the neurologic status of the patient, vertebral biopsy is often sufficient without the need for decompressive surgery^[3,4]. Percutaneous transpedicular needle biopsy, which provides easy direct access to vertebral corpus lesions, has been applied for this purpose since 1933^[5]. Vertebroplasty or kyphoplasty can be performed in the same session with percutaneous transpedicular needle biopsy, both to strengthen the vertebra and to reduce the patient's pain, for pathological diagnosis in cases with compression in the vertebra or vertebral metastasis of a systemic cancer. Vertebroplasty procedure was first applied by Galibert in 1987 for the treatment of painful vertebral hemangiomas^[6]. Later, its use became widespread in the treatment of osteoporotic and neoplastic vertebral fractures^[7,8]. Vertebroplasty started to be used frequently in practice after it was observed that the pain was reduced by injection of polymethyl methacrylate (PMMA) into the vertebral body in patients with pathological vertebral fractures. In this study, we shared our percutaneous transpedicular needle biopsy results in cases with pathological or osteoporotic vertebral body compression or suspected infection, and our vertebroplasty intervention experiences in necessary cases under the title of 'transpedicular percutaneous vertebral procedures'.

Materials and Methods

CT and MRI images, clinical and pathology records of 31 cases who underwent transpedicular vertebral biopsy and vertebroplasty in our clinic between 2018-2020 were reviewed retrospectively. Retrospective study approval was obtained from the hospital's medical board. Patients who applied to our outpatient clinic due to low back and back pain who did not respond to medical treatment and who had collapsed vertebral corpus in their radiographic examinations (CT, MRI±PET), who had single or multiple lesions and pathological collapse, and underwent transpedicular percutaneous biopsy and vertebroplasty, were determined. Likewise, from patients with suspected discitis and osteomyelitis in their radiographic examinations, only the patients whose diagnosis was confirmed by transpedicular percutaneous biopsy and the causative agent was detected, were determined. For each patient, the procedure performed (biopsy ± vertebroplasty), the level of the procedure, presence of trauma and pathological diagnoses were recorded. Local anesthesia and light sedation were

applied during the procedure. In all cases, fluoroscopy was used during distance determination and procedure. Postoperative neurologic deficits did not develop in any of the cases. Postoperative control CT was performed in all cases. The cases were mobilized on the evening of the procedure, and were discharged on the 1st postoperative day without any problem and pain. Patients with severe spinal cord or nerve root compression and/or neurological deficits in radiographic evaluations were excluded from our study.

Results

Of the 31 cases included in our study, 14 (45%) were male, 17 (55%) were female, and the mean age was 64±15 (Table 1). In 7 (23%) of our cases, vertebral biopsy was performed by transpedicular intervention only for the diagnosis of spondylodiscitis with the aim of determining the causative agent. Of the cases with discitis, 5 (71%) were female and 2 (29%) were male. Vertebral compression fractures were present in 24 cases (77%), and both diagnostic transpedicular biopsy and vertebroplasty were performed in the same session. The levels of the vertebrae we treated were as follows: L1 (10 cases), L3 (5 cases), T11 (3 cases), L2 (2 cases), T9 (1 case), T12 (1 case), L5 (1 case) and in 1 case, two levels (L1-L2) (Fig. 1). Of the patients with pathological compression

Table 1. Patient Characteristics

		Male	Female
Number of Patients	31	14 (45%)	17 (55)
Mean Age	64	64	64



Figure 1. (a, b) In contrast-enhanced MRI of the case with L1 compression, hyperintensity is observed in the corpus. Postoperative CT appearance of the case after vertebroplasty.

sion fractures, 9 (37%) were male and 15 (63%) were female. The causative agent was detected in 3 (43%) patients with discitis findings (2 cases of staphylococcus aureus, 1 case of tuberculosis); 4 (57%) of them had negative pathology and culture results (Fig. 2). While malignancy was detected in only 2 (8%) of our patients with compression fractures who underwent vertebroplasty (1 case GIS malignancy, 1 case multiple myeloma), osteoporotic compression fractures were detected in the other 22 (92%) cases (Table 2). Twelve (50%) of our patients with pathological compression fractures had a history of trauma. None of the cases had a known history of malignancy. Only one of the cases who underwent vertebroplasty has intervention at 2 levels (L1 and L2), rest of the cases had intervention at one level. Postoperative CT imaging revealed that cement had infiltrated into the disc space minimally in 7 cases and into the spinal canal in 1 case. However, there was no neurological deficit or pain in any of these cases.

Discussion

Percutaneous vertebral biopsy is a fast, effective and economical method with low complication risk, used for both histological diagnosis and treatment planning in vertebral corpus lesions (infectious, tumoral, etc.). It will be more practical and less invasive to perform percutaneous verte-

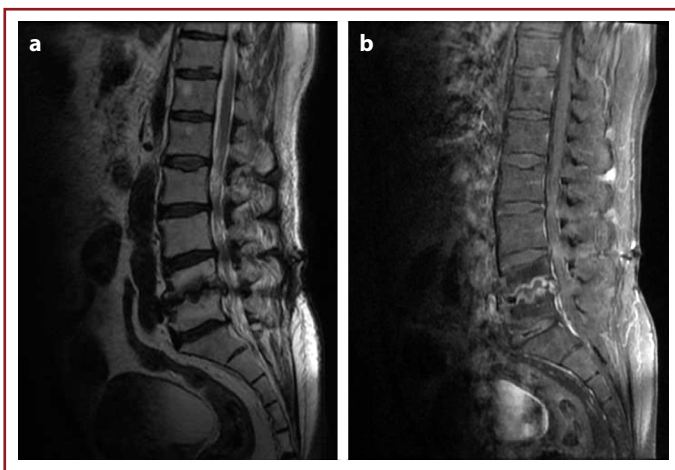


Figure 2. (a, b) Irregularity and discitis in the L4-5 intervertebral area in T2 sequence MRI and contrast-enhanced examinations.

bral biopsy instead of open, decompressive surgical procedures in selected cases without spinal cord compression findings.

Vertebral osteomyelitis or infectious spondylodiscitis is an inflammatory process that occurs with infectious involvement of the vertebral body or intervertebral disc. Patients with traumatic spinal injuries, spinal procedures (injection, surgery, etc.), immunosuppressive causes, use of intravenous agents, and chronic catheters are more prone to infectious spinal diseases^[9]. The causative microbial agents can be listed as; mostly staphylococcus aureus (40-60%), mycobacterium tuberculosis, brucella, fungal agents and other nonspecific causes^[10]. There is often hematological spread of the microbial agent; it is also possible to spread through the adjacent tissues^[9,10]. MRI is often diagnostic, but histopathological diagnosis may be required for antibiotic therapy selection. Although open surgery in these patients seems to be the gold standard for both decompression and the abundant amount of material taken for sampling, it is not recommended for most patients without neurological deficits^[11]. Transpedicular vertebral biopsy with CT or fluoroscopy is recommended and performed by most centers because it is simple, effective and economical. However, detection of the microbial agent with this method is at varying rates such as 36%-91%^[10,11]. This wide range depends on many factors such as whether the patient received antibiotic therapy before the procedure, the amount of material taken, the technique of the procedure, and the type of microbial agent^[9,12]. As a matter of fact, in our patient group, agent detection was possible at a rate of 43%. However, due to the small number of patients, it will be necessary to support these findings with studies with extended number of patients.

Transpedicular vertebral biopsy is helpful in the diagnosis of many spinal pathologies. Histological diagnosis is required in most cases in pathological corpus collapses. Transpedicular vertebral biopsy is a technique that we use frequently in practice in patients who do not have neurological deficits and who do not have significant spinal cord and/or nerve root compression. In most of these cases, pain control and biomechanical stability of the spine are

Table 2. Distribution of Patients by Cases

	Total	Male	Female	Pathology result		Trauma status	
				Normal	Pathology present	Present	Absent
Number of patients with discitis	7 (23%)	5 (71%)	2 (29%)	4 (57%)	3 (43%)	0 (0%)	0 (0%)
Number of vertebroplasty patients	24 (77%)	9 (37%)	15 (63%)	22 (92%)	2 (8%)	12 (50%)	12 (50%)

required as well as histological diagnosis. For this purpose, vertebroplasty is performed with PMMA injection to the collapsed vertebra. Osteoporotic collapse, vertebra fractures due to low-energy trauma, metastatic involvement, benign spine tumors (hemangioma, eosinophilic granuloma, giant cell tumor, etc.) constitute the indications for vertebroplasty^[2,13]. Vertebroplasty can be performed if a patient with osteoporosis is hospitalized for more than one week due to severe pain, has pain due to compression and has not been relieved by medical treatment for 8 weeks, has progressive compression in one or multiple vertebrae^[3,13]. In 93% of the cases, both pain reduction and contribution to stabilization are observed. In the presence of multiple-level collapse in moderate osteoporosis, acute compression vertebroplasty is usually sufficient, but in severe osteoporosis, multi-level intervention will be more effective in terms of pain control and stabilization^[13]. Cement injection can be applied in low-energy traumatic compression fractures, in cases whose pain does not go away within 45 days with corset and supportive treatment, or in cases where compression increases^[14]. While malignancy was detected in only 2 (8%) of our patients with compression fractures who underwent vertebroplasty, osteoporotic compression fractures were detected in the other 22 (92%). In only one of our cases, 2 levels were treated, the others were had single level intervention.

Metastatic vertebral involvement is 40 times more common than primary tumors of the spine. Thoracic, cervical, sacral and lumbar regions are the vertebral regions where systemic metastases are most common, respectively. Metastatic lesions involve 50–80% of the vertebral body. 36% of the patients have no symptoms, 36% have low back pain, and 20% have signs of cord and/or nerve root compression^[15]. The most important complaint of these patients is pain and the pain increases progressively. Surgical decompression and stabilization should be performed in patients with signs of cord and/or nerve root compression. Vertebroplasty is performed by percutaneous transpedicular access to the corpus vertebra. Cement injection is made by using a 20 cm guide wire with a diameter of 2 mm and a large diameter cannula of 8 gauge. The cannula is advanced up to 1/3 anterior of the vertebra. C-arm fluoroscopy is required for posterolateral and lateral scan. The patient is placed on the operating table in the prone position and supported by pillows. The patient is placed in the hyperextension position and the correction of the compressed part is provided. Often local anesthetics, sedatives and analgesics are sufficient during the procedure^[13,14,15]. Injection is relatively easy in osteoporosis and an average

of 3-6 cc of cement is injected at each level. If injection is to be made at multiple levels, it is preferred to inject from one side. Although rare, there are complications in the vertebroplasty procedure. During the intervention to the thoracic vertebra, costal fracture and subsequent pneumothorax, as well as pedicle fracture, pulmonary embolism, cord compression, acute radiculopathy, venous extravasation, infection and leakage of cement into soft tissue are complications that may be encountered^[17]. Rarely, the cement may escape into the spinal canal and neural foramen and cause compression of the cord or nerve root. Emergency surgical decompression may be required when cord and root compression develops. Pain control is achieved quickly, patients can exercise and return to daily life after successful applications. No serious complication developed in any of our cases and early mobilization was achieved.

Conclusion

Transpedicular vertebral biopsy can be safely performed in the detection and pathological diagnosis of vertebral corpus lesions and infections. Based on the pathological results of our cases' biopsies, it should be kept in mind that the causative agent may not always be detected in these cases. Vertebroplasty is an easy and reliable method applied both to control the pain and to increase the stability of the vertebra in patients with pain due to pathological vertebral compression. The advantages of this method are that patients receive local anesthesia, their rapid mobilization, and low risk of complications.

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