J Surg Med. 2020;4(1):29-32.
DOI: 10.28982/josam.670370

Research article
Araştırma makalesi

Journal of Surgery and Medicine
e-ISSN: 2602-2079

Imaging-guided percutaneous vertebral and paravertebral lesion biopsy: A single center experience

Görüntüleme eşliğinde perkütan vertebral ve paravertebral lezyon biyopsileri: Tek merkez deneyimi

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Ethics Committee Approval: Ethics committee approval was obtained from the Non-Interventional Research Ethics Committee of Sakarya University Faculty of Medicine.
Etik Kurul Onayı: Sakarya Üniversitesi Tıp Fakültesi Girişimsel Olmayan Araştırmalar Etik Kurulu'ndan etik kurul izni alınmıştır.

Conflict of Interest: No conflict of interest was declared by the authors.
Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.
Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Published: 1/20/2020
Yayın Tarihi: 20.01.2020

Abstract

Aim: Percutaneous needle biopsy has been used successfully in the diagnosis of vertebral, paravertebral and disc diseases in recent years as it is a minimally invasive, safe, and effective method. The aim of this study was to share our experience with imaging-guided percutaneous vertebral and paravertebral biopsies.

Methods: Images and data of 10 patients who underwent percutaneous vertebral and paravertebral biopsies between January 2018 and December 2019 were screened retrospectively through the hospital registry. The anatomical location of the lesion, guideline imaging method, number of samples taken, whether there were any complications after the procedure, needle diameter used, hemoglobin (Hb) values before and after the procedure were recorded.

Results: Among 10 patients included in the study, 3 (30%) were male and 7 (70%) were female. The mean age of the patients was 63.5 (8.6) years. Biopsies were performed under computerized tomography and ultrasound guidance in nine patients and one patient, respectively. The lesion was located at the thoracic level in 4 patients (40%) and at the lumbar level in 6 patients (60%). Two samples were obtained from all patients. There were no complications. The mean Hemoglobin (Hb) values before and after the procedure were 10 (1.1) mg/dL and 10.2 (1.4) mg/dL, respectively, which were similar (P=0.91). 18G needle was used in all patients.

Conclusion: Imaging-guided percutaneous vertebral and paravertebral biopsy is a safe and effective method which allows sampling for cytological, histological, and microbiological analysis. In the future, imaging techniques and biopsies will be increasingly used in the diagnosis of vertebral and paravertebral lesions.

Keywords: Percutaneous biopsy, Vertebrae, Imaging

Öz

Amaç: Bu çalışmadaki amacımız giderek daha yaygın olarak kullanılan görüntüleme eşliğindeki perkütan vertebral ve paravertebral biyopsi deneyimimizi paylaşmaktır.

Yöntemler: Ocak 2018 - Aralık 2019 tarihleri arasında görüntüleme eşliğinde perkütan vertebral ve paravertebral biyopsi yapılan toplam 10 hastaya ait görüntüler ve veriler hastane bilgi sistemi üzerinden retrospektif olarak tarandı. Lezyon anatomik lokasyonu, kılavuz görüntüleme yöntemi, örnek alınma sayısı, işlem sonrası komplikasyon olup olmadığı, kullanılan iğne çapı, işlem öncesi ve sonrası hemoglobin (Hb) değerleri kaydedildi.

Bulgular: Çalışmaya dahil edilen 10 hastadan 3'ü (%30) erkek, 7'si (%70) kadındı. Hastaların yaş ortalaması 63,5 (8,6) idi. 9 hastaya BT kılavuzluğunda, 1 hastaya ise USG kılavuzluğunda işlem yapılmıştı. 4 hastada (%40) lezyon torakal seviyede iken 6 hastada lezyon lomber seviyede idi (%60). Hastaların tamamından 2 kez örnek alınmıştı. Hiçbir hastada komplikasyon mevcut değildi. İşlem öncesi ortalama Hb değeri 10 (1,1) iken işlem sonrası Hb değeri 10,2 (1,4) olarak bulundu. İşlem öncesi ile sonrası saptanan Hb değerleri arasında anlamlı farklılık saptanmadı (P=0,91). Hastaların tamamında 18G iğne kullanıldı.

Sonuç: Görüntüleme eşliğinde perkütan vertebral ve paravertebral biyopsiler güvenli ve etkin bir yöntem olup sitolojik, histolojik ve mikrobiyolojik analiz için örnek alınmasına imkan sağlamaktadır. Gelecekte görüntüleme yöntemleri ve biyopsi sistemlerinde yaşanacak gelişmelerle birlikte görüntüleme eşliğinde yapılan biyopsiler vertebral ve paravertebral lezyonların tanısında giderek daha fazla tercih edilecektir.

Anahtar kelimeler: Perkütan biyopsi, Vertebra, Görüntüleme

How to cite / Atıf için: Taydaş O, Ateş ÖF, Kındır O. Imaging-guided percutaneous vertebral and paravertebral lesion biopsy: A single center experience. J Surg Med. 2020;4(1):29-32.

Introduction

Percutaneous needle biopsy has been used successfully in the diagnosis of vertebral, paravertebral and disc diseases in recent years as it is a minimally invasive, safe, and effective method. Thanks to the advances in needle technology from past to present, enough specimens have been obtained for pathological examination. In addition, multiple biopsies can be obtained from the same site thanks to the coaxial technique. Guiding imaging methods include fluoroscopy, computed tomography (CT), ultrasonography (US) and magnetic resonance imaging (MRI) [1].

Although advances in technology in imaging modalities increase lesion detectability, due to the low specificity of these methods, histological confirmation is still required in many uncertain cases [2]. In addition, the presence of specific gene mutations in metastatic lesions or the detection of microbial agents in infective pathologies change treatment plans and prognosis [3]. Advantages of percutaneous biopsies include lower morbidity and mortality rates compared to open surgical biopsies, being cheaper and taking shorter. In that regard, imaging-guided percutaneous biopsy should be the first method for tissue sampling. Percutaneous biopsy of bone lesions can be performed under the guidance of various imaging methods such as fluoroscopy, computed tomography (CT), ultrasonography (US) and magnetic resonance (MR). CT is the most widely used guide imaging method in spinal biopsies [4].

The aim of this study was to share our experience with imaging-guided percutaneous vertebral and paravertebral biopsies, which are more widely used every day.

Materials and methods

This retrospective cohort study has been approved by the local ethics committee (Sakarya University Faculty of Medicine Ethics Committee, 26/12/2019, E16091) and conducted in accordance with the Declaration of Helsinki (2000). Informed consent was waived because of the retrospective nature of the study.

Images and data of 10 patients who underwent percutaneous vertebral and paravertebral biopsy performed in the interventional radiology department of Sakarya University Training and Research Hospital between January 2018 and December 2019 with various indications were reviewed retrospectively on the hospital registry. The anatomical location of the lesion, guideline imaging method, number of samples taken, whether there were any complications after the procedure, needle diameter used, hemoglobin (Hb) values before and after the procedure were recorded.

Biopsies were performed under CT or US guidance. Modality selection was made according to the location of the lesion. Before the procedure, routine blood tests and bleeding parameters were requested from the patients. Patients were all monitored during the procedure. 2% prilocaine was used for local anesthesia (Citanest, AstraZeneca, Turkey).

CT-guided biopsies were performed on a 64-detector device (Aquilion64, Toshiba Medical Systems, Japan). Prebiopsy images were obtained after the patient was placed on the table in prone form. According to this image, radiopaque grid was placed on the patient's skin. Local anesthesia was administered after the site was cleaned. All biopsies were performed with the coaxial bone biopsy system (Ostycut, Bard Biopsy, USA). The specimens were fixed with formalin. US-guided biopsy was performed using a 3.5MHz convex probe with the Esaote MyLab 50 device (Esaote S.p.A, Italy). Biopsy was obtained with 18G fully automatic biopsy needle (Geotek, Turkey). The specimens were fixed with formalin.

Statistical analysis

MedCalc (Medcalc ver.12, Ostend, Belgium) was used for statistical analysis. Descriptive statistics were presented as median (minimum – maximum) and mean (standard deviation). Categorical variables were stated as frequencies and percentages. Correlation analysis was performed using the Pearson correlation coefficient. The Independent samples t-test was used for comparison of continuous variables with normal distribution in the Kolmogorov-Smirnov and Shapiro-Wilk tests. A value of $P<0.05$ was considered statistically significant.

Results

Among 10 patients included in the study, 3 (30%) were male and 7 (70%) were female. The mean age of the patients was 63.5 (8.6) years. Nine patients underwent CT-guided and 1 patient underwent US-guided percutaneous lesion biopsy (Figure 1, 2). The lesion was at the thoracic level in 4 patients (40%) and the lumbar level in 6 patients (60%). Two samples each were obtained from all patients. There were no procedure-related complications in any patient. The mean Hb values before and after the procedure were 10 (1.1), 10.2 (1.4) mg/dL, respectively, which were similar ($P=0.91$). 18G needle was used in all patients. The indication for biopsy was spondylodiscitis in 6 patients (60%) and metastasis in 4 patients (40%). Patient data are summarized in Table 1.

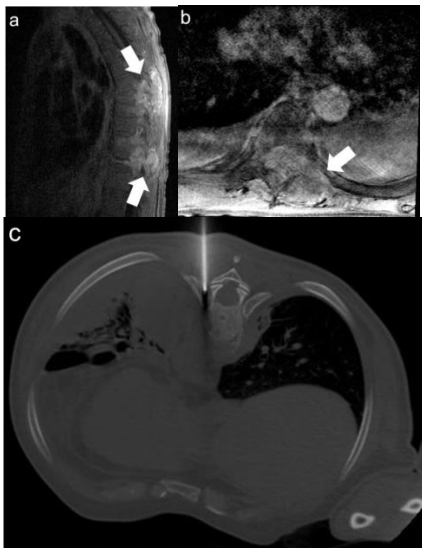

Figure 1: Sagittal (a) and axial (b) postcontrast fat-suppressed T1-weighted magnetic resonance images show contrast enhancement at two different levels (arrows). The same patient underwent computed tomography-guided percutaneous biopsy (c)

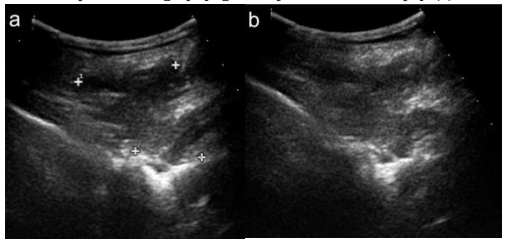

Figure 2: Ultrasonographic image of the paravertebral mass (a) and percutaneous biopsy procedure (b).

Table 1: Patient data

Patient no	Age	Gender	Modality	Location	Indication
1	67	F	CT	T10-11	Spondylodiscitis
2	54	F	CT	L4-5	Spondylodiscitis
3	56	F	CT	L3-4	Spondylodiscitis
4	80	F	CT	L2	Spondylodiscitis
5	62	F	CT	L3-4	Suspected metastasis
6	63	M	CT	T8-9	Suspected metastasis
7	66	M	CT	L3-4	Spondylodiscitis
8	79	F	CT	T12-L1	Spondylodiscitis
9	59	F	CT	L1-2	Suspected metastasis
10	64	M	US	T11	Suspected metastasis

CT: Computed tomography, US: Ultrasonography

Discussion

The most important result in our study was that there were no complications after the procedure and no decrease in hemoglobin compared to pre-procedural values. Percutaneous biopsy of the musculoskeletal system has a lower complication rate than open biopsies [1]: Complications are less than 1% in percutaneous vertebral biopsies [5]. Most of the complications occur in the thoracic vertebra due to the proximity of major vascular structures, pleura, lung and posterior mediastinum [6]. Percutaneous biopsy of vertebral, paravertebral and disc diseases may cause hemorrhage due to vascular structures such as the aorta and its branches (such as vertebral arteries, segmental arteries) and venous plexuses (internal and external venous plexuses, azygos system). In addition, spinal root injuries and adjacent organ (lung, kidney, etc.) injuries, fractures, bone and soft tissue infections, pneumothorax, spinal cord injury, meningitis may also be seen [7].

There are many studies in the literature about percutaneous vertebral biopsies performed with the help of imaging. In a recent study by Yang et al. [4], including 247 spinal tumor biopsies, the diagnostic success rate was 80%. This rate was 77% in the study of Wu et al. [8] and 77.14% in the study of Puri et al. [9]. The factors affecting diagnostic success were listed as size, bone matrix and definitive diagnosis of lesion in the study of Yang et al. [4]. In the study of Gul et al. [10], the success rate was found to be 80% and the only factor that had a significant relationship with success was reported as lesion histopathology. In a recent study by Kasalak et al. [11], which included 64 patients with suspected spondylodiscitis, only 31.3% had culture positivity. However, 96.9% of culture positive patients were treated appropriately. Therefore, the importance of biopsy has been emphasized in guiding the treatment [11]. In the meta-analysis performed by Pupabiool et al. [12], the sensitivity and specificity of the imaging-guided biopsies performed for spontaneous vertebral osteomyelitis were reported as 52.2% and 99.9%, respectively. Therefore, it can be considered that this method should be used especially in the presence of strong clinical suspicion.

As with all biopsies, the most crucial step in vertebral biopsies is correct planning. Meticulously planned and performed biopsy is essential for accurate diagnosis. Before the procedure, the patient and all imaging studies should be evaluated in detail. Additional imaging studies should be performed if necessary. As a result of these evaluations, the necessity of biopsy should be decided by considering the right indication and contraindicated conditions or profit-loss ratio. After the biopsy decision is taken, the most appropriate biopsy site should be determined with convenient imaging modality [13]. The approach depends on the location of the lesion, which should be adapted for each patient. The patient should be informed about the procedure and detailed information should be given before, during, and after the procedure and written consent must be obtained. Laboratory parameters related to coagulation of the patient should be at optimal values and the anticoagulant used should be discontinued before the procedure. If necessary, preprocedural sedation should be administered [14].

Depending on the localization of the pathology, in vertebral biopsies, the patient is usually placed in the prone position on the processing table. CT images are obtained, and a radiopaque marker is placed on the skin above the localization of the pathology. To reach the pathology, the optimal cross-section and angle away from the neurovascular bundle is determined over the skin. This area is cleaned and covered. After local anesthesia, a small skin incision is performed. The biopsy needle is directed towards the lesion under CT control. The type of needle used depends on the character of the lesion and the preference of the treating physician. In general, the needle should be of sufficient length to reach the lesion and of sufficient diameter to receive a sufficient amount of sample. Coaxial technique is generally used for sampling. Thus, multiple samples can be made using the same entry point. The distance of the needle to adjacent tissues should be checked by CT to avoid possible complications. Once the lesion is reached, sampling should be performed with aspiration or tru-cut needles [12,15].

Limitations

There were some limitations of our study: The first was the small number of patients included in the study, and the second was its retrospective nature. More comprehensive and prospective studies can be planned with regards to this subject. Another important limitation is that the biopsy and microbiological results of the patients could not be obtained, hence, could not be included in the study.

Conclusion

Imaging-guided percutaneous vertebral and paravertebral biopsies are safe and effective methods which allow sampling for cytological, histological, and microbiological analyses. The teamwork of patients, interventional radiologists, pathologists, oncologists, and surgeons is important in the application of this method. In the future, imaging techniques and biopsies will be increasingly used in the diagnosis of vertebral and paravertebral lesions.

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This paper has been checked for language accuracy by JOSAM editors.
The National Library of Medicine (NLM) citation style guide has been used in this paper.

Suggested citation: Patrias K. Citing medicine: the NLM style guide for authors, editors, and publishers [Internet]. 2nd ed. Wendling DL, technical editor. Bethesda (MD): National Library of Medicine (US); 2007-[updated 2015 Oct 2; cited Year Month Day]. Available from: http://www.nlm.nih.gov/citingmedicine