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ORIGINAL ARTICLE

Ultrasound-guided liver mass biopsy

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ABSTRACT

Objective: This study aimed to present the histopathological results and demographic characteristics of patients who underwent an ultrasound-guided liver mass biopsy.

Material and Methods: Medical information of patients who underwent a liver mass biopsy in the interventional radiology clinic between September 2016 and September 2021 were retrieved retrospectively from the hospital data processing system and the interventional radiology archive. Baseline demographic characteristics of the patients and the technical success and the complication rate of the biopsy procedure were investigated.

Results: A total of 283 liver mass biopsies were performed on 162 women and 121 men, with a mean age of 52.3 years. All biopsies were performed under ultrasound guidance with an 18 gauge fully-automatic Tru-Cut biopsy needle. After the biopsy, the histopathological diagnosis was malignant in 95.4% (n=270) and benign in 4.5% (n=13) of the masses. The most common malignant diagnosis was breast cancer metastasis (25.8%) and the most common benign diagnosis were cirrhotic nodule (1.4%) and granulomatous inflammation (1.4%). The technical success rate was 100% in this study. The most common complications were a subcapsular hematoma (n=5) and pain (n=2). There was a significant relationship between subcapsular hematoma formation and the histopathological diagnosis ($p<0.05$). The subcapsular hematoma was more common in patients with hepatocellular cancer and cirrhotic nodules. No massive bleeding, pneumothorax, or death occurred.

Conclusion: An ultrasound-guided liver mass biopsy is a safe and effective method because of low complication rates and adequate tissue sampling.

Keywords: complication, epidemiology, liver mass biopsy, Tru-Cut biopsy.

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INTRODUCTION

Incidental detection of both benign and malignant liver masses has increased with the common clinical use of ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).[1] In addition to laboratory tests and imaging methods, a percutaneous biopsy is frequently performed for the diagnosis of liver lesions. Radiographic images and enhancement patterns of solid primary liver lesions such as hemangioma, adenoma, focal nodular hyperplasia (FNH), and hepatocellular cancer (HCC) are pathognomonic in many patients.[1–3] However, a biopsy may be necessary for benign lesions with atypical radiological appearance and lesions with suspected malignancy.[4,5] Ultrasonography-guided Tru-Cut biopsy is the most widely used liver biopsy technique because it is easily accessible, needle tracing can be followed in real-time, and it does not contain ionizing radiation.[6,7]

Although aspiration biopsy has a lower risk of complications, a larger piece of tissue can be obtained in the Tru-Cut biopsy.[8] For this reason, the Tru-Cut biopsy is more frequently preferred in the diagnosis of liver masses. Many centers in the literature share their liver mass biopsy experiences. Because the incidence and etiology of liver masses vary geographically.[9]

This study aimed to present the histopathological results and demographic characteristics of patients who underwent an ultrasound-guided liver mass biopsy.

MATERIAL AND METHODS

After receiving approval from the local Medical Ethics Committee for this retrospective study (no: 2021/237), informed consent was collected from patients or their legal representatives.

Patients

Patients who underwent an ultrasonography-guided liver mass biopsy in the interventional radiology clinic between September 2016 and September 2021 were reviewed retrospectively. The baseline demographic characteristics (age, gender) and medical histories of patients, reasons for biopsies, and post-biopsy complications were reviewed using the hospital data processing service and the interventional radiology archive. Complications resulting in morbidity and mortality were considered major complications. Other complications were considered minor complications. Histopathological diagnoses were reviewed. It was investigated whether an adequate tissue sample was obtained to make a histopathological diagnosis. An inadequate tissue sample or incorrect sampling was considered a failed biopsy.

Biopsy Procedure

A percutaneous liver mass biopsy was performed under ultrasound guidance in all patients. In our department, we usually perform the twice-puncture of the index lesion to reduce bleeding complications and insufficient tissue rates. Before the biopsy, ultrasound imaging was performed on all patients by the surgeon, who would perform the procedure. Thus, the safest route for the biopsy needle was determined. After local site cleaning and local anesthesia, a sample was taken from the lesion, following the previously determined needle route. An 18 gauge (G) full automatic needle (ESTACORE or VESCUT, Geotek Healthcare Products, Ankara, Turkey) was used in all biopsy procedures (Fig. 1). The recommendations on coagulation parameters in the Society of Interventional Radiology guidelines were closely followed to reduce the risk of periprocedural bleeding.[10] Ultrasonography was performed immediately following the biopsy, and any occurrence of potential complications was investigated. After the biopsy, all patients were hospitalized for at least 4 h, and their vital signs including arterial blood pressure, pulse rate, and pain were monitored.

RESULTS

There were a total of 283 patients. Of the patients, 162 were women and 121 were men, with a mean age of 52.3 (min–max: 21–86) years. Of the biopsied samples, the smallest mass diameter was 13 mm in diameter and the largest one was 62 mm. There were 18 different histopathologically identified subgroups. The results are summarized in Table 1. Biopsies were performed in 71.3% (n=202) of the patients because of liver metastasis. The most common origin of metastasis was breast cancer with a rate of 36.1% (n=73). The histopathological diagnosis was a benign lesion in 5.6% (n=16) of the patients. Intense necrosis-necrobiotic tissue was the diagnosis in 6.4% (n=18) of the patients. Samples were collected from the mass in all patients. No parenchymal sampling or extrahepatic organ sampling was performed. The technical success in this study was 100%. An inadequate tissue sample or incorrect sampling was not observed.

Complications

The overall complication rate was 2.5% (n=7) in this study. A self-limiting subcapsular hematoma and pain requiring medication occurred in 1.8% (n=5) and 0.7% of the patients (n=2), respectively. Of the patients with a subcapsular hematoma, 4 (80%) had a primary liver lesion with concomitant liver parenchymal disease (3 patients had HCC and 1 patient had a cirrhotic nodule) and 1 (20%) had breast cancer metastasis. The frequency of subcapsular hematoma was statistically significantly higher in patients with HCC and cirrhotic nodules compared with other patients (n=4 vs n=1; p<0.001). There were no major complications or biopsy-related deaths in this study.

DISCUSSION

Our study results showed that (a) the majority of liver masses that required tissue biopsy are malignant lesions and (b) atypical liver microsteatosis and granulomatous infections may exhibit a mass-like appearance. The most common cause of malignancy was metastasis in our study. The most common origins of metastasis were breast cancer, colorectal cancer, and lung cancer.

Histopathological diagnosis globally remains to be the gold standard in the diagnosis of liver diseases.[6] Liver biopsies are routinely performed in many centers both for the diagnosis and follow-up of liver parenchymal diseases and in the diagnosis of lesions that cannot be diagnosed by imaging modalities. HCC is the most common primary malignancy of the liver and is closely associated with cirrhosis, chronic hepatitis, and alcohol use, with impaired hepatocyte function.[11] Another primary liver malignancy is intrahepatic cholangiocellular carcinoma (ICCC). ICCC is a rarer primary liver malignan-

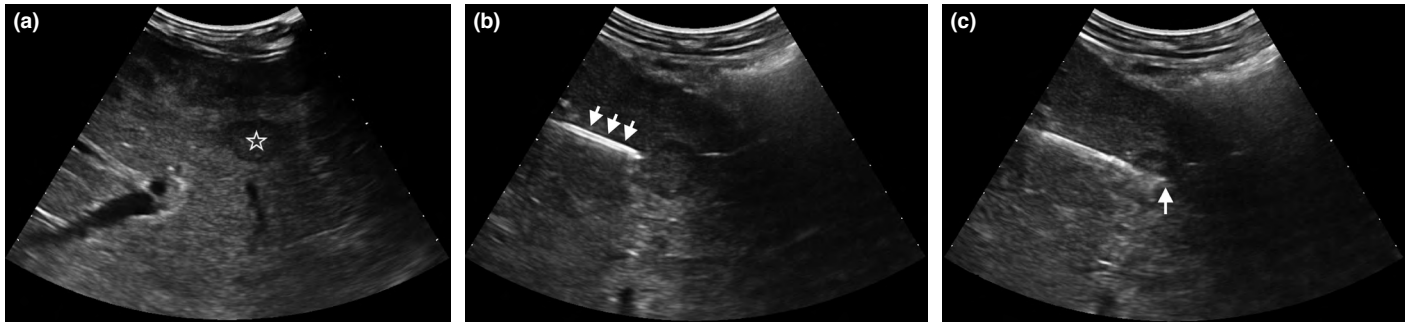

Figure 1: A 49-year-old patient with liver metastasis of colorectal carcinoma. A rounded and well-defined hypoechoic lesion (star) in the liver segment 5 **(a)**. Parking of an 18 Gauge fully automated Tru-Cut biopsy needle toward the lesion (arrows: echogenic shaft of the biopsy needle) **(b)**. Shooted Tru-Cut needle into the lesion (arrow: cutting cannula) **(c)**.

Table 1: Patient and lesion characteristics

	n	%	Age (years)	Gender	Size (mm)
Benign liver lesions					
Cirrhotic nodule	4	1.4	44 (21–57)	1F–3M	18 (14–22)
Granulomatous inflammation	4	1.4	46.2 (34–75)	2F–2M	22.2 (13–35)
Microvesicular steatosis	3	1.1	46.6 (42–56)	2F–1M	41 (36–45)
FNH	1	0.4	31	0F–1M	33
Drug reaction	1	0.4	35	1F–0M	37
Primary malignant liver lesions					
Hepatocellular cancer	24	8.4	56 (43–76)	8F–16M	29.5 (21–54)
Cholangiocellular carcinoma	23	8.1	58.5 (35–76)	10F–13M	38.3 (21–55)
Sarcomatoid carcinoma	3	1.1	51.6 (42–67)	2F–1M	40.6 (34–45)
Metastatic liver lesions					
Breast cancer	73	25.8	49.5 (34–73)	71F–2M	35.1 (18–56)
Colorectal carcinomas	37	13.1	51.2 (34–78)	11F–26M	34.7 (23–62)
Lung cancer					
Nonsmall cell	16	5.6	56.8 (39–71)	6F–10M	27.5 (19–34)
Small cell	14	4.9	54.2 (42–86)	3F–11M	24.7 (18–34)
Pancreatic cancer	22	7.8	53.6 (34–72)	14F–8M	28.6 (17–41)
Gastric cancer	16	5.6	61 (48–76)	9F–7M	28.3 (16–42)
Prostate cancer	4	1.4	63.2 (59–70)	0F–4M	24.7 (19–32)
Gynecological malignancies	5	1.8	51.4 (45–59)	5F–0M	39.4 (29–55)
Cancer of unknown primary	9	3.1	52.6 (37–71)	2F–7M	45.2 (33–56)
Nasopharyngeal cancer	4	1.4	54 (44–69)	1F–3M	28.7 (23–36)
Bladder cancer	1	0.4	56	0F–1M	16
Malignant melanoma	1	0.4	33	1F–0M	28
Necrobiotic tissue	18	6.4	45.8 (31–61)	13F–5M	35.7 (23–52)
Total	283	100	52.3 (21–86)	162F–121M	32.8 (13–62)

F: Female; M: Male; FNH: Focal nodular hyperplasia.

cy compared with HCC.[12] However, the number of patients with the diagnosis of both of these primary liver malignancies were almost equal in our study. This might have resulted from the role of imaging techniques that took part in the diagnosis of HCC. Unlike other malignancies, a biopsy is not always necessary for the diagnosis of HCC.[13] In many cases, laboratory tests and imaging findings may suffice

to diagnose HCC.[11,13] Dynamic contrast-enhanced CT and/or MRI findings reduce the need for a biopsy to make the definite diagnosis of HCC. This condition was reflected in our study results too.

The liver is one of the most common organs for metastasis. Colorectal cancer, pancreatic cancer, lung cancer, breast cancer, and malignant melanoma are the most common causes of liver metastasis.[14] The prevalence of colorectal cancers is increasing in developed countries in association with dietary habits. Colorectal cancers are the second leading cause of cancer-related deaths.[15] The rate of liver metastasis in colorectal cancers at the time of diagnosis is reported to be 15%.[16] Breast cancer is the most common cause of cancer-related deaths among women globally.[17] Liver metastases are present in 1.2% of women with breast cancer at the time of initial diagnosis.[18] A liver biopsy is usually performed to rule out metastases in female breast cancer patients with liver lesions.[19] Moreover, in some cases, a liver metastasis biopsy may be performed to determine whether the genotypic characteristics of the tumor have changed.[20] Lung cancer is globally another leading cause of cancer-related death. The liver is one of the most common organs, to which lung cancer metastasizes.[21] The rate of liver metastasis in small cell lung cancer can be as high as 35%.[21] In our study, the etiologies of metastasis were breast cancer, colorectal cancer, and lung cancer in decreasing order of frequency. In a comprehensive review study, which investigated the epidemiology of liver metastases, the two most common causes of metastasis were reported as breast and colorectal cancers, respectively.[22] It is reported that of liver metastases, 21% originate from breast cancer, 15% from colorectal cancer, and 6% from lung cancer.[23] Khalifa et al.[24] reported liver mass biopsy results of 246 patients in their study with metastases from breast cancer, colon cancer, and lung cancer at rates of 11%, 11%, and 9%, respectively. In our study, there were breast cancer metastases, colorectal cancer metastases, and lung cancer metastases at rates of 25.8%, 13.1% (5.6% nonsmall cell lung cancer and 4.9% small cell lung cancer), and 10.5%, respectively. These findings may have resulted from the distribution of the patient population. The frequency of malignancies varies from one country to another depending on genetics, environmental factors, and dietary habits. Consequently, variations occur in the incidence of metastases too. Another potentially underlying reason for our study findings could be the higher need for the identification of tumor genetics by a biopsy from metastatic liver lesions in breast cancer patients compared with other malignancies. Therefore, relatively more biopsies may be performed for liver metastases of breast cancer compared with other types of primary malignancies. However, there is a need for further studies.

In our study, data about pseudotumors with mass-like radiological characteristics were also presented. In some benign liver lesions, a radiological examination may be sufficient. The typical contrast enhancement pattern may be pathognomonic in some lesions such as a hemangioma, an adenoma, FNH, and a hydatid cyst.[25] However, an atypical appearance or an atypical contrast enhancement pattern indicates the need for a biopsy. In our study, only one patient with a pathological diagnosis of FNH had undergone a biopsy because the diagnosis could not have been made based on imaging findings. Another benign pathology with a mass-like appearance is nodular steatosis. Multifocal nodular fat infiltration may mimic liver metastasis.[26] Dreifuss et al.[26] demonstrated in a case report from a patient that multiple echogenic liver lesions may, albeit very rarely, mimic metastasis. In our study, we performed biopsies in three patients because focal steatosis in these individuals had a tumor-like appearance. The histopathological diagnosis was microvesicular steatosis in all of these patients. Another rare tumor-like benign lesion is inflammation. Yoshida et al.[27] emphasize the necessity for performing a biopsy in their case report from a patient because while the findings in the radiological imaging test have suggested a malignant mass, a biopsy has revealed an inflammatory pseudotumor. In our study, the histopathological diagnosis was a granulomatous infection in four patients, who underwent a biopsy because the images obtained in radiological tests suggested metastasis. Rare pathologies with a tumor-like appearance such as steatosis and inflammation are rare and presented in case reports in the literature. However, such lesions were more common in our study compared with the reports in the literature. The pathophysiology of the mass-like appearance rarely observed in multifocal nodular steatosis and granulomatous infection is unclear. However, personal genetic differences, differences in the blood supply pattern to the liver, and environmental factors such as the presence of endemic agents leading to granulomatous infection may result in regional differences in the incidence of liver pseudotumors. Further comprehensive studies are needed on this subject.

Several complications were classified as minor in our study. Khalifa et al.[24] reported pain at a rate of 14% and a self-limiting hematoma at a rate of 1% as minor complications after a liver mass biopsy. Howlett et al.[28] reported mild pain at a rate of 8.4% and severe pain at a rate of 1.7% following a liver mass biopsy in 1220 cases. Mueller et al.[29] reported the rate of minor bleeding as 0.7% in focal liver lesions. Minor complication rates in our study were consistent with the literature. There were no major complications or deaths in our study. There are some risk factors for the occurrence of both minor and major complications. Thicker needles (14 and 16 G needles compared with 18 G needles), the Tru-Cut biopsy technique, the presence of a lesion smaller than 1 cm, cirrhosis, and a low level of experience of the surgeon are risk factors for the development of complications associated with liver mass biopsies.[28,29] In our study, a subcapsular hematoma was more prevalent in patients with HCC and cirrhotic nodules compared with others. Our results are self-explanatory in the sense that parenchymal disease of the liver may result in impaired coagulation. The results of our study were compatible with the information in the literature.

This study had several limitations that should be mentioned. The experience was shared in this study from only one center and this can be listed as a limitation. Because it is a single-center study, our results cannot be attributed to the whole population. Another limitation was that needles of varying thicknesses were not used to better assess the risk of complications. However, we believe that these limitations do not detract from the value of our study because the number of patients, the diversity of diagnoses, and the data on pseudotumors, which are rare lesions of the liver, will all contribute to the Turkish literature.

In conclusion, the ultrasound-guided liver mass biopsy is an effective and safe procedure with high technical success, diagnostic accuracy, and low complication rates. HCC and liver parenchymal disease may be risk factors for bleeding complications. Further studies about this subject are needed.

Statement

Ethics Committee Approval: The Gaziantep University Clinical Research Ethics Committee granted approval for this study (date: 03.11. 2021, number: 2021/237).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – ABB; Design – MO; Supervision – MO; Resource – ABB; Materials – ABB; Data Collection and/or Processing – MO; Analysis and/or Interpretation – ABB; Literature Search – MO; Writing – ABB, MO; Critical Reviews – MO.

Conflict of Interest: The authors have no conflict of interest to declare.

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