Predictors of adequate percutaneous liver biopsy specimens: a single-center experience

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Background
Percutaneous liver biopsy is one of the widely accepted procedures to find any disorder, infection, and disease. Understanding the correlation between biopsy factors and adequacy rate will improvize efficacy and safety of biopsy.
Objectives
This study was carried out to find the effect of needle size on the adequacy rate of biopsy and also to establish the association of factors such as BMI, cumulative length, and the number of cores to adequacy rate of biopsy.
Materials and methods
This retrospective review study was carried out at King Abdul-Aziz Medical City, MNGHA, Jeddah, Saudi Arabia. The data were acquired on adult patients who underwent percutaneous liver biopsy for 2010–2016 time periods. The data were analyzed by using the statistical package for social sciences, version 23.
Results
No significant difference was observed in the adequacy rate of biopsy among samples of different needles (P=0.998). Similarly, BMI and guidance did not significantly (P=0.860 and 0.873) affect the adequacy rate. However, the number of cores ($P<0.001$) and cumulative length ($P<0.001$) had a significant effect on adequacy rate. Finally, only cumulative length (2.4 cm) was significantly correlated ($P<0.05$) to the adequacy rate of Percutaneous liver biopsy (PLB).
Conclusion
The adequacy rate significantly depends on cumulative length and the number of cores. However, further studies are required to establish a conclusive relationship between factors and adequacy rate.

Keywords:
adequacy rate, cumulative length, liver biopsy, number of cores

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Introduction

According to the Centers for Disease Control and Prevention, nowadays in the USA, liver disease is a major health burden. In 2011, it was the 12th leading cause of death [1]. Techniques for the investigation of liver diseases have progressed over the last decade. However, liver biopsy (LB) has remained an important tool for the pathological evaluation of liver diseases over the last 50 years [2,3]. It is used for the diagnosis, prognosis, and monitoring the therapeutic effects of liver diseases [3]. LB, however, is an invasive procedure and new investigation tools such as ultrasonography, computed tomography, and MRI have been introduced [3], not to mention the recent noninvasive fibrosis assessment tests (serum fibrosis markers and transient elastography). For these reasons, the rate of LB utilization has reduced nowadays [2,3]. Moreover, LB is limited by sample interpretation variability. Different scoring systems of grading and staging of liver diseases have been developed to minimize subjectivity of histology interpretation. However, interobserver variability remains a problem among the different scoring systems [4,5]. LB is still considered the gold standard procedure to measure the severity and nature of liver diseases [6,7]. It can assess the response of treatment in chronic hepatitis, and specifically for grading (necro-inflammatory activity), and staging (fibrosis) in most patients. It is also used for evaluating steatosis,; which facilitate the accurate diagnosis and the therapeutic outcome [8]. There are different methods to obtain liver tissue, among them percutaneous biopsy is the most commonly used. Other such as trans-jugular biopsy and laparoscopic biopsy are only used in certain specific situations [6,7]. A needle core LB samples only about 1/50 000 of the liver and thus is always vulnerable to

sampling variability. In 2013, The Royal College of Pathologists defined the adequacy of liver core biopsies for the evaluation of medical diseases into three categories: inadequate specimen measuring less than 10 mm length and/or had less than six portal tracts, compromised specimen measuring at least 10 mm length and had six portal tracts but less than 20 mm and 11 portal tracts, and adequate specimen measuring at least 20 mm length and had 11 portal tracts [9]. Another study done in 2009 stated that optimal LB specimen should be even longer than 20–25 mm and have more than 10 complete portal tracts for evaluating chronic viral hepatitis. It is difficult to be applied clinically because multiple percutaneous liver biopsy (PLB) passes should be made in order to reach the adequate sample size. This, in turn, will increase the risk of complication [10]. Another study in 2003 stated that thin needle biopsy (i.e. 20-G needles or smaller) could be used for the investigation of tumors and large needle biopsy (i.e. 19 G needles or larger) could be used for diffuse liver diseases [11].

Fryer *et al.* [9] stated that their lack of knowledge about needle gauge of their LB study was one of their limitations. Owing of this variability in opinions, our study aim is to find if there is a relationship between the needle gauge and the adequacy rate of the samples. At the same time, we aim to determine the association between cumulative length of the specimen and its ability to represent the disease process.

Materials and methods

A retrospective review study among all patients who underwent PLB at King Abdul-Aziz Medical City, MNGHA, a tertiary center at Jeddah, Saudi Arabia, from 2010 to 2016. The data were collected by reviewing all patient characteristics and pathological reports done in the specified period. Data collection process was done by the main investigators, using a data collection sheet, which was reviewed and approved by the ethics committee. The data were analyzed by using the statistical package for social sciences, version 23 (IBM, Armonk, New York, USA). Descriptive statistics were used to describe the patient characteristics of the study participants. Median [interquartile range (IQR)] and mean (SD) are reported for continuous variables. Frequencies with proportions were reported for categorical variables. One-way analysis of variance and Pearson's χ^2 test were used to assess and establish the correlations. Statistical significance was set at *P* value less than 0.05. Only a single type of needle was used in this study. According to the Royal College of Pathologists, LB should be at least 20 mm in length and contain 11 portal tracts to be considered as adequate.

Results

A total of 308 patients were included in this study, 176 (57.1%) were men with median age at diagnosis to be 53 years (IQR, 33–67 years) and median BMI to be 24 kg/m^2 (IQR, 19.2–29.1 kg/m^2) (Table 1). The adequacy rate of PLB specimens was 73.4%, with 98.4% being performed under ultrasound guidance (Table 1). Table 2 shows that 136 (70.1%) of the biopsies were done with a needle gauge of 18 mm and the majority (more than 80%) with two or three number of cores. Patients BMI had no influence on the adequacy rate, *P* value more than 0.05 (Tables 2 and 3). However, large cumulative length (≥2, mean, 2.4) had a higher rate of adequacy rate (Tables 2 and 3). There was significant relation between length of biopsy specimen as well as the number of cores and the number of portal tracks with a *P* value of 0.00 and 0.01, respectively. The number of complications in those patients where multiple punctures were performed was not statically different from those with single puncture (*P*=0.81).

Discussion

PLB is one of the extensively used, safe, and simple technique to diagnose and manage liver-related disorders. Notably, ultrasound guidance has improvized the efficacy and safety of PLB [12]. The guidance of biopsy by ultrasound is extensively used as it is economical, simple, and has no risk of exposure to radiation [12]. This study was carried out to determine

Table 1 Patients and biopsy characteristics

Variables	*n* (%)
Gender	
Male	176 (57.1)
Female	132 (42.9)
Age at performance (years)	
Median (IQR)	53 (33–67)
BMI (kg/m^2)	
Median (IQR)	24 (19.2–29.1)
Adequacy	
Adequate	226 (73.4)
Inadequate	14 (4.5)
Suboptimal	68 (22.1)
Biopsy guidance	
Ultrasound	303 (98.4)
CT	5 (1.6)
Cumulative length	
Median (IQR)	2.2 (1.2–2.8)

CT, computed tomography; IQR, interquartile range.

Table 2 Relationship between adequacy rate and other variables

Variables	Adequate (SD)	Inadequate (SD)	Suboptimal (SD)	*P* value
Needle gauge (mm)				
17	1 (0.5)	0 (0)	0 (0)	0.998
18	136 (70.1)	7 (63.6)	38 (70.4)	
19	1 (0.5)	0 (0)	0 (0)	
20	54 (27.8)	4 (36.4)	16 (29.6)	
22	1 (0.5)	0 (0)	0 (0)	
23	1 (0.5)	0 (0)	0 (0)	
Number of cores				
1	7 (3.5)	2 (20)	16 (27.1)	<0.001
2	117 (58.2)	5 (50)	27 (45.8)	
3	50 (24.9)	2 (20)	13 (22)	
4	23 (11.4)	0 (0)	2 (3.4)	
5	4 (2)	1 (10)	1 (1.7)	
BMI (kg/m^2)				
<18.5	47 (21.4)	2 (15.4)	14 (21.2)	0.860
18.5–24.9	68 (30.9)	5 (38.5)	24 (36.4)	
25–29.9	62 (28.2)	3 (23.1)	13 (19.7)	
>30	43 (19.5)	3 (23.1)	15 (22.7)	
Guidance				
US	222 (98.2)	14 (100)	67 (98.5)	0.873
CT	4 (1.8)	0 (0)	1 (1.5)	
Cumulative length				
<2	72 (31.9)	12 (85.7)	63 (92.6)	<0.001
≥2	154 (68.1)	2 (14.3)	5 (7.4)	

CT, computed tomography; US, ultrasound.

the effect of different factors on the adequacy rate of PLB at King Abdul-Aziz Medical City, MNGHA, Jeddah. This study also established the association of adequacy rate to other factors such as needle gauge, cumulative length of the specimen, and number of cores. Table 1 summarizes the patients and biopsy characteristics. The adequacy rate was 73.4% for LB and 98.4% biopsy were guided by ultrasound. Needle gauge did not show any significant difference (P=0.998) on the adequacy rate of biopsy (Table 2). A study carried out reported similar result to our study and found no significant effect of needle size on the adequacy of LB [8]. However, in a recent study 19 G reported better biopsy results as compared with 18 G percutaneous needles [13]. In another study, a better safety of suction needles (Menghini) than cutting needles such as Tru-cut, etc. has been reported [14].

However, some study reported that Tru-cut needles are safer than Menghini needles [15,16]. Excessive bleeding is the most common biopsy-related complication, and the safety of the PLB depends on factors such as technical compatibility, needle length, number of pass, and availability of guidance [8]. Furthermore, our study found a significant effect of number of cores (P<0.001) on adequacy rate, while other factors such as the type of guidance and BMI had no significant effect on the adequacy rate of LB.

Table 3 Relationship between adequacy and means of BMI and cumulative length

Adequacy	BMI [mean (SD)]	Cumulative length [mean (SD)]
Adequate	24.6 (7.2)	2.4 (1)*
Inadequate	24.3 (7.6)	0.8 (1)
Suboptimal	24.0 (6.7)	1.5 (0.9)

*P value less than or equal to 0.05.

Another study carried out by Harwood *et al.* [17] found that obesity did not create any hindrance or complication during blind PLB and it also demonstrated a similar efficacy among nonobese children. Increase in BMI is correlated to the increase in risk of nonalcoholic fatty liver disease/ nonalcoholic steatohepatitis (NASH) and weight control is an integral part of nonalcoholic fatty liver disease or NASH management. Another UK-based study also reported the increased risk of liver cirrhosis with increase in BMI among women [18]. Further, it was found that adequacy rate was significantly correlated (P<0.05) with cumulative length (Table 3). Proper samplings of liver tissues (size and number) are required for determining the liver-related disorder or disease precisely. In a recent prospective study, it was reported that ultrasound-guided 18-G and 16-G core biopsies are safe; however, needle gauge did not have any significant effect on specimen adequacy [19]. The numbers of portal tracts are essential along

with the size of core; and previously, a good relationship has been established between core size and numbers of portal tracts [20]. Recently, Coral *et al.* [21] also implied that accuracy of LB is correlated with the size of liver specimens and the number of portals present in the sample. Further, our study found that if the cumulative length of the specimen is higher than or equal to 2 cm, the adequacy rate of PLB of the specimen was higher. For effective diagnosis in LB, the suggested core size of the specimen should be in the range of 10, 2.20, or 25 mm [22–24]. Similar to our study, another study has shown that NASH in one core was less prevalent (37%) as compared with core LB (57%, $P<0.001$). However, there was no significant difference observed in two-cores or three-core biopsy [25].

Conclusively, this study found a relationship of PLB adequacy rate to the cumulative length and number of cores among patients of King Abdul-Aziz Medical City, MNGHA, Jeddah (Saudi Arabia), which will help to improvize the PLB adequacy rate at the hospital. However, further studies are required to establish the correlation of adequacy rate to the number of portal tracts and core size. In all, 303 cases were done under ultrasound guide. Ultrasound by itself is well known as an operator-dependent procedure in addition to the tissue-obtaining process. However, this point had not been studied in our research. Further studies are needed to assess this important point. Moreover, the association between core size and numbers of portal tracts also need to be established to reach any definite conclusion.

Conclusion

The adequacy rate significantly depends on cumulative length and the number of cores. However, further studies are required to establish a conclusive relationship between factors and adequacy rate.

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Conflicts of interest

There are no conflicts of interest.

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