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Do the needle type and the operator experience influence liver biopsy specimen quality?

Research Article

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Abstract: Aim: We evaluated the influence of the type of needle and the operator's experience on the quality of the specimen obtained at liver biopsy (LB). Material and method: We performed a multicentre, prospective study in four university hospitals, including LBs performed using either "cutting" (TruCut) or "suction" (Menghini) needles. According to their experience, we considered the operators as "junior" (<100 LBs) or "senior" (>100 LBs). Results: A total number of 745 LBs were evaluated, 413 performed with suction needles and 332 with cutting needles. Of all LBs, 473 where performed by "senior" and 272 by "junior" operators. The mean length of the fragment obtained was larger in LBs performed by senior (23.5±11.6 mm) vs. junior operators (15.9±9.8 mm, $p<0.001$) and also if modified Menghini needles were used (23.7±12.1 mm) vs. TruCut (13.0±5.2 mm, $p<0.001$). The number of portal tracts (PT) was higher in LBs performed by "senior" (14.3±8.8 PT) vs. "junior" operators (8.8±6.8 PT, $p<0.001$); and with Menghini needles (17.2±9.7 PT) vs. TruCut (8.6±5.0 PT, $p<0.001$).Conclusion: Our study demonstrates that optimal biopsy samples are obtained by two intrahepatic passages with Menghini needles and that "senior" operators obtain better tissue samples than "junior" ones.

Keywords: *Liver biopsy • Biopsy needle • Operator's experience • Specimen quality*

1. Introduction

Liver biopsy (LB) is still considered to be the gold standard method for assessing of hepatic involvement in chronic hepatopathies, despite the fact that non–invasive methods (serological markers and elastography) are being used more frequently.

The specimen obtained by LB represents roughly 1/50,000 of the liver and it is known that fibrosis is unevenly distributed through the liver. Another problem is how useful the fragment obtained by LB is considering its length and the number of portal tracts (PT) it includes. Liver samples 1-4 cm long are obtained by LB (preferably at least 15 mm) [1]. A liver specimen is considered to be adequate for pathological evaluation if it is longer than 25 mm, and if it includes more than 8 PT [2] (or more than 11 PT in the opinion of other authors [3]).

Colloredo et al. [4] showed that the shorter the liver sample obtained by LB, the greater the risk of underestimating the severity of fibrosis and necroinflammatory lesions. Thus the authors conclude that the liver sample must be at least 2 cm long in order to obtain a reliable pathologic assessment [4].

The aim of our study was to evaluate how the type of needle influences the quality of the liver specimen obtained by LB ("cutting" vs. "suction" needles), and if the operator's experience has any role.

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2. Materials and methods

We performed a prospective multicentre trial in four hepatology departments [Timişoara (TM), Iaşi (IS), Bucharest (B), Craiova (CV)] with substantial experience in performing LBs (more than 250/year). Our study included only echoguided or echoassisted LBs, performed using either "cutting" needles (core needles for "gun" devices: TruCut type - Autovac) or "suction" needles (Menghini modified needles - Hepafix kit).

We categorized the operators as "junior" or "senior" according to their experience in performing LB ("junior" - less than 100 LBs; "senior" - more than 100 LBs performed in daily practice) [5].

We evaluated the number of PT and the fragment's length in each liver sample. For the LBs performed in Timişoara, Iaşi and Bucharest the fragment's length was evaluated by the operator, immediately after the procedure, while for those performed in Craiova it was evaluated by the pathologist after it was introduced in formaldehyde. We therefore had to exclude the data regarding the fragment's length from this center since the tissue sample shrinks when exposed to formaldehyde.

We compared the fragment's length and the number of PT considering the operator's experience and the type of needle employed using the Bartlett homogeneity test. ANOVA or Mann-Whitney tests were used to compare mean values.

All subjects included in this study provided written informed consent. The study was approved by the local ethics committee in accordance with the Helsinki Declaration of 1975.

3. Results

A total number of 745 LBs were included in our study, details regarding the needle type and operator's experience are given in Table 1. The LBs performed in Timişoara used two intrahepatic passages, whilst all other centers used a single intrahepatic passage.

No serious complications or deaths occurred after LB in any of these centers during the study.

According to the type of needle used, 413 LBs (55.4%) were performed with modified Menghini needles and 332 (44.6%) with "cutting" needles.

According to the operator's experience, 473 LBs (63.5%) where performed by "senior" operators and 272 (36.5%) by "junior" ones.

When we analyzed the data globally, the mean fragment length obtained by LB was larger if performed by "senior" operators (23.5±11.6 mm) as compared to "junior" ones (15.9±9.8 mm, p<0.001 ES) and it was also larger if modified Menghini needles were used (23.7±12.1 mm rather than TruCut needles (13.0±5.2 mm, p<0.001, Table 2).

Table 1. Number of LBs, type of needle and operator's experience.

Center	Total number of biopsies	Senior operator	Junior operator
TM	216 (29%)	171 (79.2%) Menghini needle	45 (20.8%) Menghini needle
IS	97 (13%)	77 (79.4%) Menghini needle	20 (20.6%) Menghini needle
B	307 (41.2%)	100 (32.6%) Menghini needle	207 (67.4%) TruCut needle
CV	125 (16.8%)	125 (100%) TruCut Needle	-
Total	745 (100%)	473 (63.5%)	272 (36.5%)

Table 2. Mean fragment length and mean number of PT in different centers, correlated with the operator's experience and the type of needle used for LB.

Center	"Senior" operator		"Junior" operator	
	Mean length of the liver fragment	Mean number of PT	Mean length of the liver fragment	Mean number of PT
	1	2	3	4
TM (A) (2 intrahepatic passages)	32.41±8.08 Menghini needle	20.84±10.09 Menghini needle	32.22±11.35 Menghini needle	19.42±9.58 Menghini needle
IS (B) (1 intrahepatic passage)	8.53±4.71 Menghini needle	8.55±4.82 Menghini needle	9.00±4.75 Menghini needle	7.15±3.21 Menghini needle
B (C) (1 intrahepatic passage)	19.98±4.79 Menghini needle	10.25±3.60 Menghini needle	13.01±5.27 TruCut needle	6.72±3.46 TruCut needle
CV (D) (1 intrahepatic passage)	-	12.12±5.87 TruCut needle	-	-

For A1-A3, A2-A4, B1-B3, B2-B4, B4-C4 p>0.05 (NS), for B3-C3, B2-C2, C2-D2 p<0.01 (S), for C1-C3, C2-C4, C4-D2, A1-B1, A1-C1, B1-C1, A3-B3, A3-C3, A2-B2, A2-C2, A2-D2, B2-D2, A4-B4, A4-C4 p<0.001 (ES).

The number of portal tracts (PT) was higher in LBs performed by "senior" (14.3±8.8 PT) vs. "junior" operators (8.8±6.8 PT, p<0.001); and with Menghini needles (17.2±9.7 PT) vs. TruCut needles (8.6±5.0 PT, p<0.001, Table 2).

The best biopsy samples, regarding both the fragment length and the number of portal tracts, were obtained by two intrahepatic passages with Menghini needles (Table 2).

4. Discussion

Very recently, Poynard et al. [6] suggested that LB is not the gold standard for liver diseases' assessment, partly due to the insufficient length of the specimen obtained by LB or to the specimen's fragmentation. In another study in which LB was compared to FibroTest, the same author demonstrated that the discordance between the two methods (18% of cases) was generated especially by biopsy failure, mostly due to the small fragment length [7].

From this point of view, in order to maintain LB as gold standard for liver assessment, it is essential to obtain a useful sample by percutaneous LB, i.e. one that is long enough (more than 20 or 25 mm) and includes a sufficient number of PT (usually more than 8) [2,3].

But do we always obtain liver samples adequate for pathological assessment? A multicentre study performed in France showed that the median fragment length obtained by LB was 15 mm [8]. Two further French studies [8] showed that from 323 and 1257 LBs analyzed, in 49 (15.2%) and 132 cases (10.5%) respectively the fragments were considered uninterpretable by the pathologist.

Two types of biopsy needles are used for performing LB: "cutting" needles (TruCut, Vim-Silverman) and "suction" needles (Menghini, Klatzkin, Jamshidi). There are only a few published studies which evaluated whether the type of the needle used for LB had any influence on the quality of the liver sample obtained. According to how the needle is used, the LB can be performed manually or with an automatic (gun) system. Percutaneous LB can be done blind, echoassisted or echoguided, depending on the use of an ultrasound machine during the procedure.

In a Dutch study [9] that compared the standard TruCut needle with a new automatic biopsy "gun" (Acecut), the performance of the automatic needle was superior and more consistent with respect to tissue yield, but post-biopsy pain and post-biopsy use of analgesics was greater after automatic biopsy gun. The authors conclude that the automatic ("gun") TruCut needle offers an advantage, particularly for physicians with no or limited experience in performing LB.

We found that the operator's experience had an influence on the quality of the sample obtained by LB. The mean fragment length was larger in LBs performed by "senior" operators. If the hepatic specimen must be at least 20 (or 25) mm long for adequate pathological assessment [2,3], then the specimens obtained by "senior" operators are optimal, while those obtained by "junior" ones are inadequate (mean length 15.9 mm). In our center, in Timişoara, we decided to visually inspect the specimen immediately after the biopsy, and if we consider that it is not long enough (at least 20 mm), we perform a second LB in the same session, using the same sedation (in our center the patient is sedated with midazolam during LB). Using this protocol we avoided obtaining uninterpretable tissue samples.

During their training period, it is essential that all fellows in gastroenterology perform all gastroenterological procedures, including percutaneous LB. The fellow should perform them under the supervision of a senior gastroenterologist, and if the visual inspection of the fragment does not reveal an adequate sample, the senior shall immediately perform a second LB (to reduce the number of needle passes into the liver).

Regarding the number of PT included in the liver samples, we similarly found that higher numbers of PT were obtained in LBs performed by "senior" operators and with Menghini needles. Thus, not only does the operator's experience play a role in the fragment quality, but also the type of the needle, the results being superior for "suction" (Menghini) needles, especially with 2 liver passages.

The stratified statistical analysis regarding the type of needle and the operator's experience showed that when Menghini needles are used, the operator's expertise does not significantly improve the fragment length (Table 2: A1-A3 p>0.05, B1-B3 p>0.05) or the number of PT (Table 2: A2-A4 p>0.05, B2-B4 p>0.05). On the other hand, the differences between centers in which Menghini needles are used (TM, IS), in both "junior" and "senior" operators, regarding both the fragment length (Table 2: A1-B1 p<0.001, A3-B3 p<0.001) and the number of PT (Table 2: A2-B2 p<0.001, A4-B4 p<0.001), could be explained by the number of passages through the liver: two in TM and only one in IS and B. But we must not forget that the number of LBs analyzed is rather small.

Regarding the use of TruCut needles, the operator's experience had a definite role in obtaining samples with a higher number of PT (Table 2: D2-C4 p<0.001).

If we compare the quality of the fragment considering the type of needle that was used, LBs performed

with Menghini type needles (2 passages) obtained better fragments, regarding both the length (Table 2: A3-C3 p<0.001) and the number of PT (Table 2: A4-C4 p<0.001, A2-D2 p<0.001) even when performed by "junior" operators. When only one passage was performed, the quality of the fragment was similar in "junior" vs. "senior" operators with Menghini needles (Table 2: B4-C4 p>0.05), or slightly better in "senior" operators when TruCut needles were used (Table 2: B2-D2 p<0.001, C2-D2 p<0.01). Thus, when only one intrahepatic passage was performed, the TruCut needle seems to obtain better tissue samples.

The statistical analysis suggests that the best liver samples are obtained when Menghini needles are used and 2 passages are performed into the liver.

When we analyze the differences regarding the fragment length and the number of PT obtained using different types of needle, we must consider their technical construction details. With the Menghini modified needle, due to its construction and the biopsy technique (two passes in the liver within a very short time – as described by Menghini in 1958), two fragments of 2 cm each can be obtained (so that the final liver specimen can be 40 mm long). TruCut needles for automatic devices are "user-friendly". After passing through the abdominal wall and reaching the liver surface, only a push of a button is needed in order to obtain a liver fragment, usually 20 mm long. This is why, in the study of de Man [9], better results were obtained with automatic needles, more consistent with respect to tissue yield, and also why automatic TruCut needles offer an advantage for physicians with no or limited experience in LB.

For performing the Menghini technique some experience is needed, since the time the needle passes through the liver must be very short and since usually two passes are performed.

Concerning the safety of different types of needle (the risk of complications) there are few published papers. In a retrospective study published in 1986 by Piccinino et al. [10], the complication rate was correlated to the type of needle used for biopsy: 3.5% for the TruCut needle and 1% for the Menghini needle [10]. But it must be mentioned that in this study old types of TruCut needles were used, without the "gun" device. Thus presently there are no arguments for a higher safety profile of one or another needle type.

In a study performed by Lindor [11], the impact of using manual TruCut needles vs. automatic biopsy needles, and "blind" vs. echoguided LB were evaluated. The mean specimen length was slightly larger when echoguided LBs were performed (1.7 mm vs. 1.6 mm, p<0.05) and when automatic needles were used as compared to manual TruCut needles (1.7 mm vs. 1.5 mm, p<0.05), but these differences do not appear clinically significant. Concerning the use of ultrasound guidance of LB (in our study all the biopsies were performed echoguided or echoassisted), Younossi [12] showed that complications occurred in 4% of blind biopsies and in 2% of echoguided" biopsies (thus proving the cost-effectiveness of echoguidance). Pasha et al. [13] found severe complications in 0.5% of ultrasound-guided LB and in 2.2% of blind biopsies (p<0.05). The same author showed that pain appeared more often (50%) in the blind biopsy group as compared to the ultrasound-guided biopsy group (37%, p=0.003).

We must specify that in our study we did not assess separately the LBs performed in patients with liver cirrhosis, in which a single percutaneous LB can miss the stage of disease in 10-30% of cases [14-16]. By using a computer generated model, Bedossa et al. [17] showed that a 25 mm LB has a 25% error rate and that a 40 mm biopsy is optimal for the diagnosis of cirrhosis.

Considering all these data, we think it would be better to perform LB with Menghini modified needles, which can theoretically obtain, in a two-pass LB, two fragments of 2 cm, thus a sample 4 cm long.

Concerning the operator's experience, as in every domain, experience is mandatory for doing a "good job". But in medicine experience is difficult to achieve (especially with invasive procedures). We think that the fellows of gastroenterology should perform LBs under the strict supervision of a senior gastroenterologist (to correct possible mistakes in technique at an early stage) and if the visual inspection of the liver sample reveals a fragment smaller than 20 or 25 mm, a new biopsy should be performed immediately by the senior. In addition, we must be aware that performing more than one biopsy can increase the diagnostic value, but may also have an effect on morbidity [18]. In a study performed by Riley on 165 patients, in daily practice only 1.8% of cases required multiple passes [19].

Also, Jensen [20] showed that the operator's experience and expertise is important in limiting the patient's anxiety and in minimizing the complications, and that the use of biopsy "guns" can result in obtaining inadequate samples.

5. Conclusion

Our study demonstrates that optimal biopsy samples are obtained by two intrahepatic passages with Menghini needles, regarding both the fragment length and the number of portal tracts. Also, LBs performed by "senior" operators may obtain better tissue samples than those performed by "junior" ones.

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