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**Liver biopsy: analysis of two specialistic teams results**

Anania G *et al.* Adequacy of liver biopsy

**Giulia Anania, Elia Gigante, Matteo Piciucchi, Emanuela Pilozzi, Eugenio Pucci, Adriano Maria Pellicelli, Carlo Capotondi, Michele Rossi, Flavia Baccini, Giulio Antonelli, Paola Begini, Gianfranco Delle Fave, Massimo Marignani**

**Giulia Anania, Elia Gigante, Matteo Piciucchi, Flavia Baccini, Giulio Antonelli, Paola Begini, Gianfranco Delle Fave, Massimo Marignani,** Department of Digestive and Liver Disease, School of Medicine and Psychology University “Sapienza”, 00189 Rome, Italy

**Emanuela Pilozzi, Eugenio Pucci,** Department of Pathology, School of Medicine and Psychology University “Sapienza” Azienda Ospedaliera, 00189 Rome, Italy

**Adriano Maria Pellicelli,**Liver Unit, Azienda Ospedaliera San Camillo, 000149 Rome, Italy

**Carlo Capotondi, Michele Rossi,** Department of Radiology, School of Medicine and Psychology University “Sapienza” Azienda Ospedaliera, 00189 Rome, Italy

**Author contributions:** Marignani M, Gigante E, Anania G and Antonelli G performed the research; Marignani M, Begini P, Baccini F, Capotondi C and Rossi M performed the procedures; Pilozzi E and Pucci E performed the histological analysis; Marignani M, Gigante E, Piciucchi M, Anania G and Begini P analyzed the data; Marignani M, Pellicelli AM and Delle Fave G drafted the paper; Marignani M, Anania C, Gigante E and Piciucchi M wrote the paper.

**Correspondence to: Massimo Marignani, MD,** Department of Digestive and Liver Disease, Biliary Tract and Liver Disease Section, School of Medicine and Psychology University “Sapienza”, Azienda Ospedaliera Sant’Andrea, Via Grottarossa, 1035-1039, 00189 Rome, Italy. mmarignani@hotmail.com

**Telephone:** +39-6-33775691 **Fax:** +39-6-33775526

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**Abstract**

**AIM:** To analyze the safety and the adequacy of a sample of liver biopsies (LB) obtained by gastroenterologist (GI) and interventional radiologist (IR) teams.

**METHODS:** Medical records of consecutive patients evaluated at our GI Unit from 01/01/2004 to 31/12/2010 for whom LB was considered necessary to diagnose and/or stage liver disease, both in the setting of day hospital (DH) and regular admission (RA) care, were retrieved and data entered in a database. Patients were divided into two groups: one undergoing ultrasonography (US)-assisted procedure by G team and one undergoing US-guided biopsy by IR team. For the first group an intercostal approach (US-assisted), and a Menghini modified type needle 16G (length 90 mm) were used. The IR team used a subcostal approach (US-guided) and a semiautomatic modified Menghini type needle 18 G (length 150 mm). All the biopsies were evaluated for appropriateness according with current guidelines. The number of portal tracts present in each biopsy was assessed by a revision performed by a single pathologist unaware of the previous pathology report. Clinical, laboratory and demographic patients characteristics, adverse events rate, and diagnostic adequacy of LB were analyzed.

**RESULTS:** During the study period 226 patients,126 males (56%) and 100 females (44%) underwent LB: 167 (74%) were carried out by the G team, whereas 59 (26%) by the IR team. LB were mostly performed in a day hospital setting by the G team, while IR completed more procedures on inpatients (*P* < 0.0001). Groups did not differ in median age, body mass index (BMI), presence of comorbidities and coagulation parameters. Complications occurred in 26 patients (16 G team *vs* 10 IR team, *P* = 0.15). Most gross samples obtained were considered suitable for basal histological evaluation, with no difference among the two teams (96.4% G team *vs* 91.5% IR, *P* = 0.16). However, the samples obtained by the G team had a higher mean number of portal tracts (G team 9.5 ± 4.8; range 1-29 *vs* IR team 7.8 ± 4.1; range 1-20) (*P* = 0.0192) and a longer mean length (G team22 mm ±8.8 *vs* IR team 15 ±6.5 mm ) (*P* = 0.0001).

**CONCLUSION:** LB can be performed with similar outcomes both by G and IR. Use of larger dimension needles allows to obtain better samples, despite a similar rate of adverse events.

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**Key words:** Liver biopsy; Ultrasound-guided biopsy; Ultrasound-assisted biopsy; Menghini needle; Sample adequacy; Portal tracts.

**Core tip:** Gastroenterologists and Interventional Radiologists are equally proficient in performing liver biopsy both in day hospital and regular admission setting, even with different techniques are used (ultrasound-guided and ultrasound-assisted). However, biopsy performed with larger needles provides better samples for histopatological evaluation, with no increase of morbidity or mortality rates as compared to those obtained using needles of smaller size.

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**INTRODUCTION**

Liver biopsy is an invasive procedure aimed to obtain a sample of liver tissue for the evaluation of acute and chronic liver disease[1]. Sampling can be performed either during surgery, or by percutaneous needle biopsy using different techniques[2]. Currently, this procedure is supported by imaging techniques such as ultrasonography (US) or computed tomography, with significant reduction of complications[3-5].

Our study was aimed to analyze the results of the same medical-surgical procedure, percutaneous LB, performed by two different medical teams: Gastroenterologists (G), and Interventional Radiologists (IR). G team performs the procedure with US-assisted method (the area in which to insert the needle is identified with US before LB) via intercostal approach, while the IR team performs the procedure with an US-guided technique (LB is performed by the Operator during US, sometimes with a needle supported and directed by a dedicated US probe) with a subcostal approach[6,7] .

There are presently no comparative data available on these two different modalities of LB performance. The two approaches were compared, analyzing the characteristics of patients undergoing LB, safety of the procedure, and capability to provide suitable material for histopathological evaluation.

**MATERIALS AND METHODS**

Medical records of consecutive patients evaluated at our GI Unit, from 01/01/2004 to 31/12/2010, and for whom LB was considered necessary to diagnose and/or stage liver disease, both in the setting of day hospital (DH) and regular admission (RA) care, were retrieved and data entered in a database. Indications to undergo LB were those provided by the main international guidelines[2]. Patients were divided into 2 groups: one undergoing US-assisted procedure by the G team, and one undergoing US-guided biopsy by the IR team. For the first group, an intercostal approach (US-assisted) and a Menghini modified type needle 16 G (length 90 mm) were used. For the second group, the RI team used a subcostal approach, (US-guided), and a semiautomatic modified Menghini type needle 18G (length 150 mm)[6,7] (Table 1). Conditions of the patients were monitored with subsequent blood pressure and complete blood count testing at two and four hours post-procedure[8,9]. A telephone follow up call was made after a week from the procedure, in order to detect possible late adverse events/complications.

All the biopsies were evaluated for appropriateness according with current guidelines by a team of pathologists experienced in the evaluation of liver parenchyma at our hospital. All specimens were fixed in formaline, embedded in paraffine, and sectioned by microtome. Specimens were routinely stained with ematoxyline and eosine. The adequate specimen for the diagnosis was considered having a length between 1-4 cm[2]. The number of portal tracts present in each biopsy was assessed by a revision performed by a single pathologist unaware of the previous pathology report. The portal tracts were identified by the presence of foci of connective tissue and at least two luminal structures embedded in the connective tissueand their number counted and entered in a database. Presence of at least 6 portal tracts was used to define an optimal sample.

Clinical, laboratory, and demographic characteristics of study patients, adverse events rate, and diagnostic adequacy of LB were analysed by the Student's t test for continuous variables, and by Fisher exact test in case of binary variables (Table 2). Data are expressed as percentage (number/total), median (range) for demographic and laboratory data, and as mean ± SD for number of portal tract per bioptic sample and length of samples.

All patients gave informed consent for the use of clinical data at the time of admission.

**RESULTS**

During the study period, 365 patients underwent liver biopsy at our centre. From this group those who had performed LB to investigate liver mass lesions were excluded (n = 139, 38%). The remaining 226 patients (62%) underwent LB to evaluate liver parenchyma. Of these, 226 patients [126 males (56%), 100 females (44%)], 167 (74%) underwent LB performed by G team (intercostal approach, US-assisted), and 59 (26%) by the IR team (subcostal approach, US-guided). Hospital setting in which LB was performed was significantly different between the two groups: RA= 29% (48/167) and DH = 71% (119/167) for the G team, *vs* RA = 64% (38/59) and DH = 36% (21/59) for the IR team (*P* < 0.0001). Approach was intercostal in all 167 patients by the G team, and subcostal in all 59 managed by the RI team. The G team performed LB in a slightly but significantly higher number of male patients, while no differences in median age of patients in the two groups was observed (Table 2). Median value of BMI was also similar in both groups (Table 2). Fifty-two patients (23%) were affected by significant comorbidities without no significant differences between the two groups. Similarly, median international normalized ratio, and platelet concentration were not significantly different in the two groups (Table 2). The most frequent indication for LB was staging and grading liver disease caused by viral hepatitis B and C. In fact, out of a total of 226 patients, 141 (62%) had chronic viral infection, 23% of whom were affected by hepatitis B (32/141), and 77% (109/141) by hepatitis C. There were 26 complications in as many patients (11.5%, 26/226). No difference in terms of incidence of complications was observed among the two teams (G team: 9.5%, 16/167; IR team: 17%, 10/59, *P* = 0.15), despite the different needles and approaches used. In none of the cases of adverse events occurring in patients undergoing LB in the DH setting it was necessary to convert to RA. We also performed a subgroup analysis of the rate of adverse events observed in the RA setting, and no difference in the G (6/48) *vs* RI (7/38) team were shown (*P* = 0.548). Subgroup analysis performed on the rate of adverse events observed in the DH setting also did not show any significant difference between the two groups, G (10/119) *vs* RI (3/21) (*P* = 0.413). The adverse events occurred were summarized in Table 3. Telephonic surveillance at one week after the procedure was negative in all cases discharged without complications after LB.

The overall number of LB samples not suitable for histological evaluation was low (11/226, 4.9%), and there was no statistical difference in the number of suitable and unsuitable samples obtained by the two teams (Table 4). Data on number of portal tracts per bioptic sample were evaluable for 205 biopsies, 151 performed by the G team and 54 by the IR team respectively. At the time of retrospective re-evaluation of bioptic samples for portal tract count, 10 samples, all from the G team, were not anymore available. Interestingly, samples provided by the G team had a significant higher number of portal tracts as compared to those obtained by the IR team (Table 3; *P* = 0.0192). Overall 30.7% (63/205) of bioptic samples had ≥ 11 complete portal tracts, 34% (52/151) and 20% (11/54) G *vs* RI respectively. Bioptic samples with ≥ 6 complete portal tracts were overall 76.6 % (157/205), 78.1% (118/151) and 72.2% (39/54) G *vs* RI respectively. Moreover the samples obtained by the G team were longer compared with those of the R team (Table 4; *P* = 0.0001).

**DISCUSSION**

There are few studies comparing the outcomes of LB on parenchyma adopting different approaches (subcostal versus intercostal), and different imaging modalities to aid its performance (US-guided *vs* US-assisted)[7,10]. Thus, the results of our study add information to the available literature. From our data it emerges that both LB performance modalities, supported and implemented by the use of US, allow to achieve optimal results in terms of patients safety. These data are not present in the literature, which has been mainly focused on the comparison of US- *vs* non-US-guided procedures[2,11-13].

In addition, even with the limitations inherent to the retrospective nature of our analysis, since the patients had similar coagulative profiles, BMI, and prevalence of comorbidities, there were no elements suggesting a preferential choice of one team over the other. The main reason that guided the choice of one team over the other was the availability of either team at the time the procedure was ordered.

Our results also show that the two groups are homogeneous regarding the occurrence of complications, (9.5% *vs* 17%, *P* = 0.15), and that in all occurrences there was no increased morbidity, such as requirement for surgery, blood transfusions, IR treatments, nor death (mortality). Also, in none of the patients managed in DH, the complications occurred led to the conversion to RA, further supporting the current data regarding the safety of LB[2,14].

Unfortunately, the smaller number of procedures performed by IR might have lead to underestimate the difference between the two groups, an intrinsic bias of the retrospective nature of this study which in turn limited the power of data analysis. It has to be pointed out that in our study, also localized pain at site of needle insertion was defined as a complication, and that this contributed in more than 73% of all complications, a figure well within those reported in the literature (up to 84%)[2,11,14-17].This event is so common, that some authors do not even include it among the complications. Thus, we performed a sub-analysis separating the adverse event pain from the other signs and symptoms developing after the performance of LB. Again, no differences were observed between the results obtained by the G and the RI team (*P* = 1).

Apart from pain, the most common adverse events were biochemical abnormalities such as a mild increased white blood cell count and a mild haemoglobin decrease (< 2 gm/dL) from baseline, observed in a marginal number of patients (Table 3). This absence of difference is interesting, since higher percentages of complication have been reported when larger needles are used, as is for the G team. Thus, performance of LB in a DH setting confirms its safety, with the post procedure monitoring protocol allowing to safely discharge patients after a brief observation (4 h), and with the negative telephonic surveillance performed one week after the procedure integrating these safety data. This approach contributes to contain hospital costs, by reducing the need for admission to perform this procedure. In addition, considering a health service system based on a disease related group reimbursement such ours, ordering LB to a service or department not belonging to the one which has posed the indication for it has many potential positive aspects. Firstly, it is obviously less expensive, since it uses resources already available to the unit ordering the procedure, and secondly, it does reduce the burden of this relatively simple procedure to the already busy schedule of the IR team, without encumbering their high technology and expensive wards. Thus, being equally safe, and possibly less expensive, LB should be preferably performed in-house in the Gastroenterology department[18,19].

Our results also show that even if the adequacy of samples obtained by the two teams are comparable in terms of overall dimension, the bigger needle used by the G team provided a larger number of evaluable portal tracts and sample length, a necessary requirement for better histopatological evaluation as it was previously demonstrated[20-22].

A further possible limitation of our data is represented by the percentage of samples with a number ≥ 11 of complete portal tracts (30.7%). As suggested by the 2009 AASLD guidelines, the presence of < 11 complete portal tracts should be noted in the pathology report, with recognition that diagnosis, grading and staging may be incorrect due to an insufficient sample size. Nevertheless, presence of 6 portal tracts have been previously considered to be acceptable for diagnosis[23], and overall 76.6% (157/205) of samples obtained in our study were above this limit. Thus, since we have chosen the latter numeric parameter, we acknowledge that reduced number of portal tracts obtained might have affected the accuracy of diagnosis. However, the significantly higher mean number of portal tracts obtained by the biopsy samples performed by G team suggests a higher opportunity for better diagnostic findings.

Interestingly, even if intuitively a bigger needle should obtain a bigger sample and consequently a higher number of portal tracts, available evidences are at times contrasting. In fact, a systematic review by Cholongitias[24] et al described that LB performed with bigger needles did obtain a slightly higher number of portal tracts and samples of longer length, but that these differences did not reach statistical significance. On the other hand, data from other authors obtained in a single centre study, also suggested that the use of a bigger needle (16G as in our case for the G team) can obtain samples with a significantly higher number of portal tracts[25,26]. Considering that the use of a 16 G needle is also suggested by AASLD guidelines to obtain LB 3 cm long, and to avoid sampling errors, especially for diffuse parenchymal diseases such as cirrhosis, we concluded that our data provide further support to the use of biopsy needle of larger gauge to perform LB in terms of sample adequacy, and with comparable incidence of complications[2].

Thus, our retrospective, single centre study suggests that LB can be performed with equal safety with different techniques performed by specialists from different Units. At the same time, the better performance in terms of sample adequacy obtained by needles of larger gauge also suggests their use. Cost effectiveness analyses are needed to better define the economic burden inherent to the different approaches.

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**COMMENTS**

***Background***

Percutaneous liver biopsy is a pivotal diagnostic procedure in the management of liver diseases. In order to support the diagnosis process an adequate sample of tissue is required. Several different technical approaches and devices have been developed and are available.

***Research frontiers***

Presently, percutaneous liver biopsies are carried out with the assistance of imaging techniques such as ultrasonography, both with ultrasonography (US)-assisted or an US-guided technique. Furthermore, a wide range of needle sizes are available used, the choice of one technique or needle over the other is mainly based on each physician experience. Up to now there are just few comparative studies on this matter.

***Innovations and breakthroughs***

In previous studies the use of bigger needles to perform liver biopsies was not univocally associated with more suitable samples, thus we performed our analysis to confirm that the use of bigger needle could provide more proficient biopsies with a similar safety profile.

***Applications***

The study results suggest that use of bigger needles could supply more useful liver samples in spite of a similar incidence of adverse events.

***Peer review***

Anania et al proposes an interesting study comparing the parameters of two approaches of liver biopsy – US assisted and US guided, performed by two teams – one of gastroenterologists and one of interventional radiologist. The article has a very interesting idea behind it.

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**Table 1 Details of the techniques adopted for liver biopsy by the two teams**

|  |  |  |
| --- | --- | --- |
|  | Gastroenterology team | Interventional radiology team |
| Needle characteristics | Menghini modified type needle 16 G (9 cm) | Menghini type needle semiautomatic, modified 18 G (15 cm) |
| Method | US-assisted | US-guided |
| Approach | Intercostal | Subcostal |

US: Ultrasonography.

**Table 2 Patients’ characteristics in the two groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Group | Team G | Team IR | *P* |
| Male sex  % (number/total) | 60% (101/167) | 42% (25/59) | 0.021 |
| AGE, years  Median (range) | 50,5 (16-70) | 52 (19-73) | 0.41 |
| BMI  Median (range) | 24 (17-36) | 24(18-41) | 0.94 |
| PLATELETS /mm3  Median (range) | 199.000 (77.000-797.000) | 204.000 (65.000-394.000) | 0.65 |
| INR  Median (range) | 1 (0.86-1.44) | 1.02 (0.87-1.94) | 0.24 |
| Complications  % (number/total) | 9.5% (16/167) | 17% (10/59) | 0.15 |

M: Male; BMI: Body mass index; INR: International normalized ratio; IR: Interventional radiology.

**Table 3 Occurrence of adverse events following liver biopsy by setting, and team performing the procedure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Regular admission | Day Hospital | Team G | Team RI |
| Total number of adverse event | 13 | 13 | 16 | 10 |
| Pain moderate to severe  % (number/total) | 77% (10/13) | 70% (9/13) | 68% (11/16) | 80% (8/10) |
| Relevant biochemical abnormalities1  % (number/total) | 15% (2/13) | 31% (4/13) | 25% (4/16) | 20% (2/10) |
| Nausea/vomiting  % (number/total) | 7% (1/13) | (0/13) | 6% (1/16) | (0/10) |

1Mild increase of white blood cells (4 cases); mild hemoglobin decrease < 2 mg/dL from baseline (1 case); thrombocytopenia (1 case).IR: Interventional radiology.

**Table 4 Characteristics of bioptic samples**

|  |  |  |  |
| --- | --- | --- | --- |
| Number of Bioptic samples | G Team  167 | RI Team  59 | *P* = NA |
| Samples adequate for diagnosis  % (number/total) | 96.4% (161/167) | 91.5% (54/59) | 0.16 |
| Sample length1  mean ± SD | 22 mm ± 8.8 | 15 mm ± 6.5 | < 0.0001 |
| Number of portal tract per sample2  mean ± SD | 9.5 ± 4.8 | 7.8 ± 4.1 | 0.0192 |

1Evaluation performed on 215 (161 by G team, 54 by IR), considered to be adequate for diagnosis. 2Evaluation performed on 205 samples (151 by G team, 54 by the IR). NA: not applicable; IR: Interventional radiology.