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Brief Report

Complication Rate after Percutaneous Liver Biopsy Using a Real-time Ultrasound Approach and Introducing a Uniform Methodology: A Brief Report

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Abstract

Following the initial liver biopsy attempts, several techniques using a wide range of methodologies and materials were developed. Many studies on the evaluation of post-liver biopsy complications were conducted. However, their fundamental limitation was significant variance in patient demographics and methodology, which might account for the inconsistent outcomes. Therefore, a uniform methodology to perform percutaneous liver biopsies that result in comparable outcomes around the world is required. This study aimed to determine the precise complication rate following percutaneous liver biopsy using a consistent method in all individuals. It also aimed to establish a consistent operating procedure for a percutaneous liver biopsy that yielded comparable outcomes. Between July 2018 and July 2019, 116 patients were enrolled in this retrospective study for percutaneous liver biopsy. All individuals underwent a biopsy using the same procedure. There was an attempt to exclude elements that could have an impact on the complication rate. For this purpose, the same type and size of needle were utilized. Moreover, a single needle pass, a subcostal approach, deep inspiration breath holding, identical pre- and post-biopsy preparation, real-time ultrasonography guidance, the use of a single operator, and the absence of sedation or general anesthesia were the other approaches that were used to minimize the impact of variables that could raise complication rates. The overall complication rate was 19.8%, of which 18.9% of patients experienced pain and mild bleeding, and one patient (0.9%) experienced hematoma necessitating precautionary hospitalization. The overall percentage of patients who experienced pain was 13.8%. No further complications were observed. The findings of this study could provide an accurate estimate of the post-liver biopsy complication rate. Furthermore, due to a lower complication rate than other practiced procedures, this uniform methodology could be an attractive alternative in clinical practice. However, more research is required to confirm these results.

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Keywords ● Biopsy ● Ultrasonography ● Liver ● Bleeding ● Postoperative complications

What's Known

- The procedure of percutaneous liver biopsy is minimally invasive.
- Despite the use of ultrasound guidance, complications occur; and patient morbidity and mortality are still a possibility.

What's New

- We use a uniform method to perform a biopsy that may lead to comparable outcomes.
- The present study reveals a lower incidence of complications.

Introduction

Nowadays, liver biopsy is an important method for evaluating liver histology in the diagnosis, treatment, and staging of liver diseases. A wide range of methodologies and materials have been used to develop a number of techniques for liver biopsy. Although percutaneous liver biopsy is generally a safe and effective technique that is minimally invasive,[1-4] it has several potential complications,[5, 6] which are classified as major and minor complications. The evaluation of post-liver biopsy complications was the subject of numerous studies. However, their main limitation was significant variance in patient demographics and methodology, which might account for the inconsistent findings. Therefore, published complication rates may not be precise estimations. Moreover, a uniform method for doing percutaneous liver biopsies with comparable outcomes globally is required.

According to the findings of a study, the most common consequences following a biopsy without ultrasound guidance in patients with liver disease were pain (30.9%), vasovagal reaction with transient hypotension (2.0%), and intrahepatic hemorrhage (1.6%).[7] Another study that used ultrasound to determine the site of the biopsy found that approximately 20% of the individuals experienced minor complications, while 1.15% of the subjects had major complications such as pneumothorax, hemobilia, and hematoma.[8] A previous research evaluated the safety of real-time ultrasonographic guided percutaneous liver biopsy in a mixed patient population of transplant and nontransplant patients. The findings indicated that about 50% of the latter group underwent liver mass biopsy in addition to random liver biopsy. This study found a 2% complication rate, with pain (0.9%), symptomatic hemorrhage (0.6%) that required no transfusion, and infection (0.4%).[3] The mortality rate varied in different studies with no clear conclusions being drawn,[7, 9] which were attributed to limited case numbers, or to distinct patient demographics and methods.[9] According to a recent systematic review and meta-analysis, the mortality incidence was 0.01%.[10]

Patient's cooperation, coagulation status, associated disease such as liver malignancy, multiple operators with different levels of experience, using ultrasonography guidance, type and size of the needle, number of needle passes, route of approach including a subcostal or intercostal, phase of respiration and breath holding, and patient's confidence and information about the procedure are all factors that may influence the frequency of complications after percutaneous liver biopsy. The purpose of this study was to determine the precise complication rate after percutaneous liver biopsy utilizing a uniform method in all individuals without the above-mentioned conditions that have led to inhomogeneous complication rates reported in the literature. Another aim of this research was to provide a standardized methodology for liver biopsy in clinical practice that yields comparable results.

Patients and Methods

This retrospective study was carried out to assess the complication rate of percutaneous liver parenchymal biopsies performed between July 2018 and July 2019 at Shahid Faghihi Hospital, Shiraz, Iran. This study was approved by the Ethics Committee of Shiraz University of Medical Sciences, Shiraz, Iran (IR.SUMS.MED.REC.1399.341). Written informed consent was obtained from all the patients. A total of 116 participants were recruited for this study. All of the participants were referred to a single radiology department in an outpatient setting by gastroenterologists with different indications such as chronic viral hepatitis, autoimmune hepatitis, persistent abnormal liver tests, and primary sclerosing cholangitis. Uncooperative patients, as well as those with impaired hemostasis, ascites, or liver malignancy, were excluded from the study. All 116 liver biopsies were carried out by a radiologist (first author) utilizing real-time ultrasonography with a Philips iU22, convex probe C5-1, and a semi-automated 18 G Tru-Cut biopsy needle (TSK, Japan). Liver biopsies were performed on each patient for the first time. In each patient, the specimen was taken with a single needle pass, and no sedation or general anesthesia was used.

All patients underwent the same procedure, including the technical aspects of the biopsy.

All subjects were required to undergo preprocedural coagulation tests, with acceptable values were platelet count >70×10^9/L, an international normalized ratio (INR)<1.5, and an activated partial thromboplastin time (PTT)<40 sec. Patients were instructed to stop taking antiplatelet medications such as aspirin seven days before the biopsy and to resume them 72 hours later.

Prior to the procedure, the participants were instructed to fast for at least four hours. Before performing the biopsy, the technique and any potential complications were explained to them. In addition, they were instructed to hold their breath, and the operator reassured them to alleviate their anxiety.

Patients were placed in a supine position with

the upper limbs resting over the chest wall, and an ultrasonographic examination of the liver was performed to rule out any focal hepatic lesion. Then, they were asked to inhale air and hold their breath until the end of inspiration (deep inspiration) to identify a suitable subcostal route. After determining the best access route, the appropriate entry point on the skin was marked, and the skin was subsequently sterilized as usual using a 10% povidone-iodine solution. Subsequently, during the indicated respiration cycle, local anesthesia was injected (5-10 cc lidocaine 2%) into the deeper tissue close around the liver capsule as well as the subcutaneous tissue using real-time ultrasound in the selected course of needle path.

Thereafter, using surgical scalpel blade no. 11, a 2 mm incision was made in the selected point in the subcostal skin. Using real-time ultrasonographic visualization of the needle, after the needle was situated inside the incision, its tip progressed right adjacent to the liver capsule and then moved back a few millimeters away from the liver capsule. To ensure that the liver capsule was punctured at the same point as the administrated local anesthesia, the patient was asked to hold his/her breath in deep inspiration (the same as for local anesthesia). At this point, the needle was advanced into the right lobe of the liver, and the specimen was taken. Once the needle was removed, the liver, its surroundings, and the site of the biopsy were all scanned for hemorrhage. Finally, the biopsy site was dressed with a sterile gauze pad. It should be noted that only one sample was taken, and no co-axial was employed.

After the procedure, the patients were placed in a comfortable supine or right lateral decubitus position, and their vital signs were monitored by the nursing staff for 3-4 hours. The patients' post-biopsy pain was classified on a scale of 1-10, with 1-3 as mild, >6 as severe, and in between as moderate. Before being discharged, they were thoroughly examined by ultrasonography for abdominal free fluid and hematoma of the liver or biopsy site. Those who had no complications were discharged. Due to the potential late complications, they were recommended to stay close to the center for 24 hours.

Results

In total, 116 patients underwent percutaneous liver biopsies. The mean age of the patients was 41.5±12.0 years, ranging from 20 to 71 years old (55% men, 45% women). The overall complication rate was 19.8%, of which 18.9% were pain and mild bleeding, and only one patient (0.9%) required hospitalization due to a hematoma (table 1).

Table 1: Complications after percutaneous liver biopsy

Complications	N (%) N=23
Pain	16 (69.6)
Minimal bleeding	6 (26.1)
Hematoma	1 (4.3)
Hemorrhage with hemodynamic alteration	0 (0.0)
Vasovagal hypotension	0 (0.0)
Other organs injury	0 (0.0)
Death	0 (0.0)
Total	23 (100)

The most frequent complication was mild pain in the right upper quadrant or right shoulder, which was observed in 15 patients (13%). During the routine post-biopsy period of observation, this pain subsided spontaneously without the need for analgesics. One patient (0.9%) required oral analgesia due to severe pain at the biopsy site. The overall number of patients who experienced pain was 13.8%.

Six patients (5.2%) with minimal free fluid near the liver were monitored for eight hours while having their vital signs monitored before being discharged with unremarkable ultrasonographic examinations. They were recommended to stay close to the center for at least 24 hours.

One patient (0.9%) had a hematoma measuring 25 mm in the largest diameter adjacent the inferior aspect of the right hepatic lobe and was admitted to the hospital for 72 hours, during which the vital signs were stable, and no intervention was required. Ultrasound examinations revealed no evidence of hematoma enlargement, and the patient was discharged in good condition, however, was asked to remain close to the center for a few days.

Other complications, such as vasovagal hypotension, internal abdominal hemorrhage with hemodynamic alteration, other organs' injury, pneumothorax, hemothorax, infection, and mortality were not observed.

Discussion

In the present study, the total complication rate including pain and mild bleeding was 19.8%. The most prevalent complication was pain (13.8%). Only one patient (0.9%) experienced a hematoma that required precautionary hospitalization without intervention, and given the nature of the issue, it was regarded as a minor complication. No other complications, including major complications, occurred.

Percutaneous liver biopsy is a minimally invasive method for diagnostic purposes. Although an ultrasound-guided biopsy was performed, complications could still be a cause of morbidity and mortality.[2] Complications of percutaneous liver biopsy are classified as major and minor complications. Minor complications are pain in the biopsy site or right upper quadrant (RUQ), and right shoulder, vasovagal hypotension, and mild bleeding without hemodynamic alteration. Major complications include bleeding with the hemodynamic alteration that requires surgical intervention or blood transfusion, injury to other organs, pneumothorax, hemothorax, hemobilia, bile peritonitis, and mortality.[8, 9] In the literature, variation in the complication rate of percutaneous liver biopsy were reported, however, there was no explicit estimate for incidences of complications.[10]

The advantages of ultrasound-guided liver biopsy over blind biopsy are decreased rate of complications and hospitalization, as well as a more cost-effective procedure.[11] The use of ultrasound and real-time visualization of the needle enables an accurate evaluation of the depth of the liver from the skin while avoiding major vessels and other viscera such as the gall bladder, colon, and right kidney. In addition, the proper site of local anesthesia injection adjacent to the liver capsule and the precise needle path from this site result in a decreased rate of post-biopsy pain. Cutting needle biopsy and a less experienced operator are the two other factors causing an increased use of analgesics for post-biopsy pain.[11] Besides, patient's characteristics and anxiety at the time of the procedure are other factors that can influence the severity of the pain after the biopsy.[11] The current biopsy needle size for diffuse hepatopathies is between 18-14 gauges; if there is a risk for bleeding, an 18-gauge needle is preferred.[11] Compared to the intercostal route, the subcostal approach may reduce the risk of complications such as pneumothorax and hemothorax. The results of this study demonstrated a lower total complication rate than the two previously published reports.[7, 8] According to the previous studies, pain was the most common complication.[7, 8] A previous study reported that 30.9% of patients with liver disease experienced post-biopsy pain.[7] In another study, around 20% of patients experienced a minor complication rate (post-biopsy pain).[8]

The most prevalent serious complication is bleeding. A review of the literature on this subject reported that major complications after a blind liver biopsy were 0.13%-5.4%, with hemorrhage being the most prevalent complication.[11] Moreover, it stated that with the use of ultrasonographic guidance, a more accurate major complication rate was 0.25%-1.8%.[11] Another study demonstrated that using image guidance decreased the rate of complications.[2] Furthermore, another study claimed that image-guided biopsies had fewer complication rates than those procedures without using imaging guidance.[8]

The aforementioned studies demonstrated that complication rates reported in the literature were inconsistent. It's worth noting that the complication rate in this study appeared to be lower than the majority of the reported outcomes in the literature.

Due to the nearly same methods used in prior studies to do a percutaneous liver biopsy, the current study stands out as having a distinctive methodology and a distinct advantage over them. An attempt was made to exclude factors that might influence the post-biopsy complication rate. Therefore, the findings of this study were likely to be a precise estimation of the post-liver biopsy complication rate using real-time ultrasonography guidance. Furthermore, no life-threatening complications occurred with this method, suggesting that it could be a preferred method in clinical practice.

A limitation regarding the methodology of the present study was that various liver diseases resulted in a biopsy, and the effect of this factor on complication rate was not considered for each hepatic disease separately. Therefore, further investigation regarding the impact of hepatic disease on post-biopsy complications in addition to mentioned factors explained in the current study is recommended.

Conclusion

The findings of this investigation may represent an accurate estimation of the post-liver biopsy complication rate, and it is hoped that this research will serve as a foundation for future studies on this subject. Furthermore, the findings from this investigation highlighted the notion that our uniform methodology could be a preferable alternative due to lower complication rates as compared with the majority of the reported data in the literature. Additional advantages included the absence of life-threatening complications and the need for a consistent approach to performing percutaneous liver biopsies that result in comparable outcomes worldwide.

Authors' Contribution

All authors contributed to the study concept and design, analysis and interpretation of data;

drafting and critical revision of the manuscript for important intellectual content; Final approval of the version to be published; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest: None declared.

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