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EUS guided Left lobe Liver biopsy: Safer modality with similar diagnostic yield as right lobe: A Pilot study


Affiliations below.

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Abstract:

Background and Study Aims: Percutaneous liver biopsy is traditionally done from right-lobe of liver. Endoscopic-ultrasound guided liver biopsy (EUS-LB) can be performed from either left- or the right-lobe or combined bi-lobar biopsy. Earlier studies did not compare benefit of bi-lobar biopsies to single lobe biopsy for reaching a tissue diagnosis. The current study compares the degree of agreement of pathological diagnosis between left-lobe of liver compared to right- and with bi-lobar biopsy.

Patients and Methods: Fifty patients fulfilling the inclusion criteria were enrolled in the study. EUS-LB with 22G core needle was taken separately from both the liver lobes. Three pathologists, who were blinded to the site of biopsy independently reviewed the liver biopsies. Sample adequacy, safety, and concordance of pathological diagnosis between left- and right lobe biopsy of liver were analyzed.

Results: The pathological diagnosis was made in 96% patients. Specimen length from the left-lobe and the right-lobe were 2.31 ± 0.57cms and 2.28 ± 0.69cms respectively (p-value = 0.476). The respective number of portal tracts were 11.84 ± 6.71 versus 9.58 ± 7.14; p-value= 0.106. Diagnosis between the two lobes showed substantial (Kappa value ± 0.830) concordance. Left-lobe (± value 0.878) or the right-lobe (± value 0.903) biopsies showed no difference when compared with bi-lobar biopsies. Adverse events were observed in 2 patients, both in biopsy from right-lobe.

Conclusions: EUS guided left lobe liver biopsy is more safer to right lobe biopsies with similar diagnostic yield.

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Introduction

Liver biopsy is the gold standard investigation for etiological diagnosis and prognostication of several liver diseases.[1, 2] Percutaneous liver biopsy (PLB) is the most common method, with or without image guidance and is mostly performed from the right-lobe. Prolonged local pain, though usually mild is reported in about 25% of patients.[3] PLB related bleed is a serious adverse event which requires hospitalization in about 1-3% patients.[4] Such unpredictable and serious complications make the clinicians hesitant for considering PLB in clinical practice.

The alternate methods of obtaining liver biopsy are surgical and trans-jugular liver biopsy (TJLB). Surgery, either conventional or mini laparoscopy, for liver biopsy is scantly described in literature, and appears an aggressive approach to obtain tissue just for diagnosis. Randomised controlled trial of laparoscopic liver biopsy versus PLB found that laparoscopic liver biopsy was more sensitive for the diagnosis of cirrhosis with similar safety profile.[5] It is more useful when performed alongside curative surgery.[6]

TJLB is safe, even in presence of ascites and/or coagulopathy. However, it is not routinely available at all centers and requires expertise. The technical success of TJLB is reported between 95-96.8%.[7] Failure of TJLB, is mainly due to inability to cannulate the hepatic vein in 43% of all unsuccessful cases [7] However, tissue adequacy with TJLB is suboptimal. McAfee et al. reported overall tissue adequacy for diagnosis in 69%, marginally
adequate in 23% and inadequate in 8% of cases. [8] The overall TJLB related adverse events rate varies between 1.3 to 20.2%, with major complications being observed in <0.6%. [9, 10]

EUS guided liver biopsy (EUS-LB) is a relatively new method with high tissue acquisition and histological accuracy of 93.8%. The reported overall complications rate is 2.3% including bleeding in 1.2% cases. [11] The first report of EUS-LB obtained adequate tissue length along with high diagnostic accuracy in 91% using a regular 19G FNA needle.[12] Subsequent larger studies on EUS-LB also report high tissue acquisition with impressive diagnosis rate in up to 98% along with minimal complications.[13] The major advantage with EUS-LB is that both the left- and the right-lobe of liver can be accessed, through the stomach and duodenum, respectively thus providing the option of bi-lobar biopsy in the same session. [14] Although, acquiring tissue EUS-LB from the right-lobe of the liver may be slightly technically challenging compared to the left-lobe due to long position of the echo-endoscope and interposing vital structures. EUS in hepatology provides simultaneous assessment of peri-GI wall collaterals, portal vein or splenic vein thrombosis, novel direct measurement of portal-pressure gradient in select individuals, and intervene by variceal obliteration of gastric or ectopic varices using coil and or glue injection.[15]

PLB acquire specimen from the right lobe of liver. There are some reports of discordance due to uneven distribution of steatosis and fibrosis in non-alcoholic-fatty liver disease (NAFLD) [16] However, surgical liver biopsies during bariatric surgery showed reasonable concordance for steatosis and fibrosis between the two lobes of 79% and 82% respectively. [17] Similar variations in interpretation of fibrosis has been noted in patients of chronic hepatitis.[18] A recent report also suggests bi-lobar biopsies is likely to improve overall
assessment of disease severity and fibrosis in NAFLD. We therefore aimed to analyze the accuracy of EUS-LB in diagnosis of liver disease and its safety.

Objectives:

The primary objective of the study was to evaluate the degree of agreement of histological diagnosis between the right and left-lobe liver biopsy with each other and individually with combined bi-lobar biopsy (BLB).

Secondary objectives of the study were:

1. Safety of performing EUS-LB between left- and right-lobe of liver.
2. Assessment of technical difficulty in doing EUD-LB from left- and right-lobes.

Materials and methods:

This was a prospectively done observational pilot study conducted between 22\textsuperscript{nd} January 2020, and 4\textsuperscript{th} January, 2022, at a tertiary care center. The study was approved by the local Institutional Ethics Committee and registered in Clinicaltrials.gov (NCT04235855). All consecutive patients requiring liver biopsy at Hepatology Clinic were screened for the study. The study was conducted in concordance with the declaration of Helsinki and informed written consent was obtained from every patient.

Patients were counselled about the available procedures for doing a liver biopsy and all these patients underwent an Esophagogastroduodenoscopy prior to getting the EUS guided liver biopsy. This was done during the same session at which the liver biopsy was done.

The inclusion criteria for EUS-LB were as follows: age $\geq 18$ years; patients with abnormal liver function test of unknown etiology $>3$ months; patients with NAFLD for diagnosis of
non-alcoholic steatohepatitis (NASH) and fibrosis; patients with suspected autoimmune hepatitis (AIH), drug induced liver injury (DILI), small duct primary biliary cholangitis (PBC) and primary sclerosing cholangitis (PSC); and, in cases where staging of fibrosis for hepatitis B was required.

The exclusion criteria were: platelet count <50,000/μL; international normalized ratio (INR) >1.5, concurrent use of anti-coagulants or anti-platelet drugs within the last 5 days from scheduled procedure, pregnancy, patients with decompensated chronic liver disease, biliary obstruction, or patients deemed unfit for procedure due to either severe cardiac or pulmonary disease. [20]

**Procedure details:**

All patients underwent pre-anesthetic evaluation prior to EUS-LB. The patients were sedated using 1% propofol at a dose of 0.5–1mg/kg intravenously as loading dose and repeated as required dose of 0.5 mg/kg increments every 3 to 5 minutes under anesthetist supervision. [21] EUS-LB was performed by one of the operators (SL, JB, RK) using linear echoendoscope (GF-UT-180, Olympus, Tokyo, Japan) and 22 Gauze EUS FNB needle (Acquire, Boston Scientific Corp.). Interposing vessels, either in gastro-intestinal wall, or within the liver parenchyma were avoided using color Doppler. The left-lobe of liver was accessed from the proximal stomach (trans-gastric approach) with the echoendoscope generally in straight position. The right-lobe of the liver was accessed from the first part of the duodenum (trans-duodenal approach) with the echoendoscope in long-position.

The 22G core needle with the stylet was passed into peripheral liver parenchyma through the capsule. In each pass, 3-4 actuations of up to 4 to 6cms depth were made in the slightly different direction (fanning) of the liver parenchyma avoiding major vessels while
withdrawing the needle (stylet slow-pull technique). Before the final removal of the needle from liver, if any persistent flow signal was observed in the needle track on Doppler (‘post Fine needle biopsy needle pathway color flow signal’) suggesting active bleed, the needle tip was kept in-situ within the liver capsule for approximately 20-30 seconds till spontaneous hemostasis was achieved.

The sequence of EUS guided liver biopsy was left-lobe first, followed by right-lobe under direct visualization (Fig 1). The total duration of the procedure was noted by study coordinator. The start-time was oral insertion of echoendoscope, and end-time was its final withdrawal from mouth, after completing EUS-LB.

The specimen obtained within the hollow of needle was delicately expelled by the stylet into Petri-dish partially filled with saline. A scale kept adjacent to the Petri-dish measured the length of the obtained sample (Fig:2). Multiple passes were made by the endoscopist to achieve a cumulative sample length of at least 2 centimeters at bedside. The tissue samples were processed as per standard protocol of the institute. Separate formalin bottles were labelled and coded ‘A’ or ‘B’ for either lobe, that was recorded by the dedicated research coordinator. The liver biopsies were evaluated by two experienced pathologists (JK, SS) who were blinded about the lobe of origin. A senior pathologist (AS) gave the final bi-lobar biopsy report and was not aware of the individual lobe reports.

The technical ease of performing EUS-LB from the right- and left-lobe of the liver was graded as 5-point Likert scale (1 easiest to 5 hardest) based on the position of the echoendoscope and the operator.
After EUS-LB procedure, the patients were monitored in the day-care ward, for the next four hours. The ‘pain score’ was recorded using the visual-analog scale of 0 to 10 after recovery from effect of sedation. Any pain score of >4 was treated with intravenous paracetamol infusion. The surgical and the interventional radiology team were informed for any procedure related bleed for timely intervention.

**Definitions:**

The criteria described by Neuberger.J et al was used for assessing the *adequacy of tissue* acquired. A sample of at least 20-millimeter (mm) length or with at least 11 portal tracts was considered as ‘adequate’ while a sample of less than 10 mm or with less than 6 portal tracts was considered ‘inadequate’. Any specimen sample falling between the above two (at least 10 mm length and 6 portal tracts but less than 20 mm length and 11 portal tracts) were considered as ‘compromised’.[20] In this study, from each lobe the combined length of tissue and their total portal tracts obtained after multiple- or single-pass was taken for analysis. *Technical success* was defined as completion of liver biopsy from both lobes with the endoscopist confirming adequacy of specimen.

**Statistical Analysis:**

The data was collected using case record forms which was designed to capture all the required information. Sample size calculation was not considered as this was the first study to address the degree of agreement of histological diagnosis with EUS-guided liver biopsies. Continuous variables were expressed as mean and standard deviation (SD) if uniformly distributed or median and interquartile range (IQR) if it was not uniformly distributed.
Categorical variables were expressed as n (%). The means of specimen length, number of portal tracts and percentage of steatosis between two lobes were compared using independent t-test. The degree of concordance between right and left lobe liver biopsy by two pathologists was assessed using Cohen’s kappa. Also, concordance between individual lobe biopsy and combined biopsy was analyzed using Cohen’s kappa (κ). Concordance was defined using the following scale:

<table>
<thead>
<tr>
<th>κ</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.0</td>
<td>Poor</td>
</tr>
<tr>
<td>0.0 – 0.2</td>
<td>Slight</td>
</tr>
<tr>
<td>0.21 -0.4</td>
<td>Fair</td>
</tr>
<tr>
<td>0.41-0.60</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.61-0.80</td>
<td>Substantial</td>
</tr>
<tr>
<td>&gt;0.81</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

The proportion of adequate biopsy specimen were compared using Chi-Square test. The grade of ease of doing EUS-LB from right- and left-lobe of liver was compared using Mann-Whitney test. A p-value of <0.05 was considered as statistically significant. The SPSS version 25 (IBM Corp., Armonk, New York, USA) was used for statistical analysis.

Results:

A total of 64 patients fulfilled the inclusion criteria and were eligible for liver biopsy. Fourteen cases were excluded due to reasons explained in figure 3 and finally 50 patients (31 females, 19 males) underwent EUS-LB from both the lobes of liver.

Baseline characteristics:
The baseline characteristics of the patients are shown in Table 1. The common indication of EUS-LB was - unexplained transaminitis 28 (56%), cholestatic jaundice 20 (40%), and jaundice with haemolysis in 2 (4%).

**Procedure details:**

The median number of passes EUS-LB for the left-lobe was 2 (range 1-4) and for the right-lobe was 2.06 (range 1-4). Three patients had 4 passes per lobe (2 patient for right-lobe, and one-patient for left-lobe). The mean duration of the procedure was 18.54 ± 4.54 minutes (range 14-23.08 mins).

**Adequacy of sample and pathological diagnosis:**

There was no significant difference between overall specimen length from the left-and the right-lobe (2.31 ± 0.57 versus 2.28 ± 0.69; p-value = 0.476) as calculated after processing in the pathology laboratory. The length of the longest tissue obtained in a single pass was 3.1 cms in right lobe and 3.6 in the left lobe. The number of portal tracts from the left- and the right-lobe were similar (11.84 ± 6.71 versus 9.58 ± 7.14; p-value= 0.106). The tissue adequacy as determined by the tissue length and portal tracts assessed by the pathologist was 42(84%) from the left-lobe compared to 38(76%) from the right-lobe of liver (p=0.3197). The degree of steatosis expressed in percentage was 12.76 ± 16.53 in the left-lobe versus 11.96 ± 16.0 in the right-lobe (p=0.816). The biopsy was deemed as inadequate in 4(8%) from right lobe and 1(2%) from left lobe biopsy. The remaining 8(16%) in right lobe- and 7(14%) in left lobe biopsies were deemed as compromised.

The pathological diagnosis concurred between the right – and left lobe was in 45/50 (90%)
cases. There was excellent agreement on histological diagnosis between two blinded pathologists reporting right- or left-lobe biopsy (kappa value $\kappa 0.830$). Similarly, excellent agreement was observed between left-lobe biopsy compared with BLB (kappa value $\kappa 0.878$) as well as between right lobe and BLB (kappa value $\kappa 0.903$). The overall pathological diagnosis was possible in 48 (96%) cases when both lobes biopsies were analysed together. The final pathological diagnosis based on both lobes are shown in Table 2.

The disagreement between left- and the right-lobe biopsy was observed in 5 cases. In two cases, despite adequate tissue, a definitive diagnosis on histology was not possible. In another two cases, right-lobe and BLB confirmed autoimmune hepatitis. In the remaining case, both right and left- lobe biopsy individually could not identify overlap syndrome of AIH-PSC which was established on BLB.

There was significantly higher technical difficulty for performing EUS-LB from right-lobe [22] compared to left-lobe [22]; $p$ value 0.001.

**Adverse events:**

There was no anesthesia related adverse events (AE). There was one (2%) serious adverse event of intra-peritoneal bleed from right lobe biopsy site requiring blood transfusion and controlled at laparoscopy. This case underwent 3 passes during the acquisition of biopsy from the right lobe. There was one minor intra-procedural bleed which spontaneously stopped.

**Discussion:**

EUS-LB is a recent and evolving method of hepatic tissue acquisition. Most EUS-LB are reported from the left-lobe of liver, with the literature focusing either at the biopsy-length or
tissue-adequacy as the primary end point.[23-25] A recent meta-analysis reported a histological diagnosis rate of 93.9%. [26]

The standard of care is PLB which targets the right-lobe. From a clinical standpoint, it becomes important to establish whether a EUS guided left-lobe liver biopsy, that is technically simpler, would match liver biopsy from right-lobe in the pathological diagnosis. Our study, that was designed to explore the concordance of left-lobe biopsy for histological diagnosis establishes that the left-lobe liver biopsy is equal to the right-lobe biopsy.

When a comparison is made between EUS guided liver biopsy from left lobe with the standard of care percutaneous liver biopsy, a previous study by Bhogal et al found no difference between specimens of liver biopsy obtained by either method as regards then length of longest piece and the number of portal tracts, though the tissue length was longer in percutaneous liver biopsy.[27] Similar studies have found that similar diagnostic accuracy between EUS liver guided liver biopsy (88.8%) and percutaneous liver biopsy sample (100%) (p = 0.82).[28] Therefore, it has been found that EUS guided liver biopsy specimens are at least comparable to percutaneous liver biopsy specimen with a benefit to sample widely separated liver segments.[14].

Mok et al for EUS-LB reported higher tissue adequacy with 19G FNA (88%) when compared with 22G FNB (68%) [29]. Further studies reported that core-biopsy needle gave better tissue length along with more portal tracts [29, 30]. Likewise, in the current study we used 22G FNB needle with good histological outcome. Gor et al obtained good mean tissue length of 3.6 cm and median of 9 portal tracts using 19G FNA needle with median of 2 pass. [31] The sample adequacy of 91% matches our sample adequacy of 86% which was sufficient to give
a diagnosis. Histological diagnosis is possible in compromised samples, however the assessment of fibrosis and biliary pathology may be underestimated. [20]

Systemic diseases, like AIH and NASH, should equally involve both lobes of the liver, yet in this study, the biopsy from right-lobe of liver picked up additional PBC cases. This could be a chance observation since there is no evidence that more often involves the right-lobe of liver. [32]

Unlike PLB, at present, there is no standardized criteria to assess sample adequacy for the specimen obtained by EUS-LB. The criteria for ‘liver-biopsy adequacy’ was originally described for PLB where the operator usually make a single pass. [33] In contrast, at EUS-LB, the tissue is acquired in two to three passes; hence we propose that the cumulative length of the tissue measured at bedside should be considered for tissue adequacy in EUS-LB. This may be re-confirmed by the total number of portal tracts seen at pathology. If the standard criteria of percutaneous liver biopsy were considered to estimate the sample adequacy, a significant proportion of samples in this study would have been sub-optimal and would fall within the grey zone.

The overall adverse events rate with EUS-LB was low (2/50) with two bleeding events (one severe), both occurring with the right-lobe liver biopsy. This may be attributed to the occasional technical challenges due to awkward position of either the echoendoscope or the endoscopist or both during the procedure. (Figure 4). In addition, presence of several interposing vital structures (portal vein or its tributaries, hepatic artery, gastro-duodenal artery, hepatic veins, gallbladder, and bile ducts) on the right-lobe approach, may increase the chance of complications. However, the sample size of this study was modest to provide a
conclusive opinion on the adverse outcome from right-lobe biopsy and requires future head-to-head trials.

To avoid any bias in our study, the independent pathologists were blinded regarding the origin of liver lobe from which biopsy was obtained. The biopsy of each lobe was analyzed separately by the two pathologists. The final diagnosis was made by the third pathologist who assessed both-lobe tissues and was unaware of the diagnosis made by earlier pathologist. With such stringent criteria of pathological assessment, this study shows left-lobe biopsy may alone suffice to establish the pathological diagnosis. Right-lobe liver biopsy did not statistically add to the overall histological diagnosis. Technical ease and feasibility of acquiring tissue from left-lobe of liver with equal efficacy would pave the way for only left-lobe EUS guided liver biopsy.

EUS-LB from right-lobe is technically more difficult than the left-lobe as perceived by endosonologist. We used a 5-point Likert scale to quantify level of difficulty during the procedure by endosonologists. However, it is largely subjective and operator dependent.

The study demonstrates that EUS-LB is safe due to direct visualization while acquiring the liver tissue thus avoiding interposing blood vessels and other vital structures.

This study had some limitations. This was a single-center study with a modest sample size. The decision to perform a liver biopsy was on the discretion of the treating physician and lacked uniform indication. Patients with cirrhosis of liver with small lobes were excluded and this may require pre-biopsy proper imaging before advising EUS-LB.
Another limitation of this study is the use of a 22Gz needle which was selected based on the data that was available at the time of designing of the study which showed that 22Gz needle was a safer alternative for liver biopsy with equal diagnostic yield as larger needles.[22] Using of a larger 19Gz needle could have provided longer core tissue and more portal tracts. Recent studies with 19Gz needle for EUS guided liver biopsy has shown longer core length (2.5 cms vs 1.2 cms, p <0.00001) with more portal tracts (8.8 vs. 3, p<0.0001), and longer, intact, fragment length (0.75 cm vs. 0.32 cm, p<0.0006).[28]

The major strength of the study was that the pathologists were blinded about the tissue sample and three separate pathologists were independently involved in the diagnosis. In addition, the EUS-LB was done by 3 operators that avoided bias.

**Conclusion:**

EUS guided liver biopsy may be safer in the left lobe of liver when compared to the right lobe. The sample obtained from the left-lobe of the liver is technically easier, and is sufficient in reaching a final diagnosis, when compared to biopsy of right-lobe of liver or combined right- and left-lobe.

**Abbreviations:**

κ : Kappa value  
AIH : Autoimmune Hepatitis  
BLB : Bilobar biopsy  
DILI : Drug induced liver injury  
EUS-LB : Endoscopic ultrasound guided liver biopsy  
FNA : Fine needle Aspiration
References:

14. Pineda JJ, Diehl DL, Miao CL et al. EUS-guided liver biopsy provides diagnostic samples comparable with those via the percutaneous or transjugular route. Gastrointest Endosc 2016; 83: 360-365. DOI: 10.1016/j.gie.2015.08.025


**Figure Legends:**

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**Figure 1:** EUS Image showing 22 G core needle (white arrow) acquiring biopsy from left-lobe of liver

**Figure 2:** Liver tissue obtained by EUS-LB measured in Petri dish with a scale below. The black arrow indicates liver core tissue, and the blue arrow indicates blood clots acquired during the procedure.

**Figure 3:** Consort diagram showing the recruitment and final analysis of patients
(EUS: Endoscopic ultrasound, EUS-LB: Endoscopic ultrasound guided liver biopsy
n= number of patients)

**Figure 4:** Image showing the position of the endosonologist and the echoendoscope during EUS-LB a from the left-lobe (Panel A) and right-lobe (Panel B) of the liver
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD / Number(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>45.76 ± 12.20</td>
</tr>
<tr>
<td>Basal Metabolic Index (BMI)</td>
<td>24.6 ± 4.8</td>
</tr>
<tr>
<td>Haemoglobin (g/dl)</td>
<td>11.51 ± 2.41</td>
</tr>
<tr>
<td>Platelet count (/ul)</td>
<td>2.10 ± 1.05</td>
</tr>
<tr>
<td>Total Bilirubin (mg/dl)</td>
<td>9.29 ± 10.0</td>
</tr>
<tr>
<td>Direct Bilirubin (mg/dl)</td>
<td>4.54 ± 5.96</td>
</tr>
<tr>
<td>Alanine amino-transferase (IU/L)</td>
<td>151.46 ± 159.83</td>
</tr>
<tr>
<td>Aspartate amino-transferase (IU/L)</td>
<td>181.46 ± 196.3</td>
</tr>
<tr>
<td>Albumin (g/L)</td>
<td>3.42 ± 0.58</td>
</tr>
<tr>
<td>PT</td>
<td>13.78 ± 4.39</td>
</tr>
<tr>
<td>INR</td>
<td>1.24 ± 0.34</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>25 (50%)</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>13 (26%)</td>
</tr>
<tr>
<td>Essential Hypertension</td>
<td>16 (32%)</td>
</tr>
</tbody>
</table>

**Table 1:** Baseline characteristic of patients undergoing EUS-LB

(mg/dl: milligram per decilitre, IU/L: International unit/litre, PT: Prothrombin time, INR: Internationalized normalised ratio; dl: gram per decilitre, SD: standard deviation)
<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Left lobe liver</th>
<th>Right Lobe liver</th>
<th>Combined (Bilobar biopsy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DILI</td>
<td>13</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>AIH</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>NASH</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Dubin-Johnson Syndrome</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BRIC</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bland Cholestasis</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PBC</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PBC- AIH Overlap</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Wilson Disease</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Small Duct PSC</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Inconclusive</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Viral Hepatitis</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Siderosis</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PSC- AIH Overlap</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2:** Pathological diagnosis obtained from liver biopsy

(NASH: Non-alcoholic steatohepatitis, BRIC: Benign recurrent intrahepatic cholestasis, PBC: Primary biliary cholangitis, AIH: Autoimmune hepatitis, PSC: Primary sclerosing cholangitis, DILI: Drug induced liver injury).
N= 64
Screened for eligibility of EUS LB

Excluded: Pre-procedure n=4
  • Anesthesia related: 2
  • Withdrew consent: 2

N = 60
Underwent EUS Procedure

Excluded: Peri-procedure, N= 10
  • Interval ascites: 2
  • Small size lobe: 3
  • Gall bladder in needle biopsy path: 2
  • Interposing large collaterals: 2
  • Failed duodenum entry: 1

N = 50
Underwent EUS-LB - Final Analysis