Transjugular liver biopsy: Indications, technique and results

A. Dohan, Y. Guerrache, M. Boudiaf, J.-P. Gavini, R. Kaci, P. Soyer

Department of abdominal imaging, hôpital Lariboisière, AP–HP, 2, rue Ambroise-Paré, 75010 Paris, France
Université Paris-Diderot, Sorbonne Paris-Cité, 10, avenue de Verdun, 75010 Paris, France
UMR Inserm 965-Paris 7, angiogenesis and translational research, 2, rue Amboise-Paré, 75010 Paris, France
Department of pathology, hôpital Lariboisière, AP–HP, 2, rue Ambroise-Paré, 75010 Paris, France

Abstract Transjugular liver biopsy is a safe, effective and well-tolerated technique to obtain liver tissue specimens in patients with diffuse liver disease associated with severe coagulopathies or massive ascites. Transjugular liver biopsy is almost always feasible. The use of ultrasonographic guidance for percutaneous puncture of the right internal jugular vein is recommended to decrease the incidence of local cervical minor complications. Semiautomated biopsy devices are very effective in obtaining optimal tissue samples for a precise and definite histological diagnosis with a very low rate of complication. The relative limitations of transjugular liver biopsy are the cost, the radiation dose given to the patient, the increased procedure time by comparison with the more common percutaneous liver biopsy, and the need of a well-trained interventional radiologist.

Transjugular liver biopsy is a well-established technique for obtaining histological samples from patients with acute or chronic liver disease who have severe coagulation abnormalities or ascites [1,2]. Although it requires a longer procedure time, an experienced interventional radiologist, and costs more than percutaneous biopsy, transjugular liver biopsy is necessary in many circumstances to permit histological analysis of the liver parenchyma, which is the key examination for diagnosis and management of many hepatic diseases [3]. For patients with severe coagulation abnormalities or ascites, standard percutaneous liver biopsy is associated with a high risk of hemoperitoneum, which can be life threatening [1,4]. To avoid these risks, transjugular biopsy is a satisfactory alternate option, and is better tolerated by patients [3,5]. The sample collection technique using a semiautomated system has been adopted by almost all interventional radiologists.

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Corresponding author.
E-mail address: philippe.soyer@lrb.aphp.fr (P. Soyer).

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The aim of this minireview is to recall the indications and contraindications for transjugular liver biopsy, to propose a rigorous technique for performing it and to analyze the results reported in the literature according to the biopsy system used.

**Indications and contraindications**

**Indications**

Transjugular liver biopsy is used to obtain samples of liver tissue in diffuse liver disease associated with a severe coagulation disorder, ascites or a combination of the two conditions [1]. Liver biopsies are necessary for diagnosing cirrhosis, acute liver failure, or viral hepatitis, and for assessing its activity, for determining whether there is non-alcoholic steatohepatitis (NASH), or, in fulminant hepatitis, for determining the prognosis and providing the indication for an emergency liver transplant [4,6]. At present, the main indication for transjugular liver biopsy is diagnosis of acute alcoholic hepatitis, due to the need for specific corticosteroid treatment and the frequency of hemostatic disorders in this condition [7]. Similarly, just after a liver transplant, hemostatic disorders are common, so that a histological examination is often necessary [8].

Biopsy via the venous system reduces the risks of bleeding, because the capsule of Glisson is not perforated [9,10]. In addition, if bleeding does occur, it returns directly into the venous system rather than into the peritoneum. Indications for transjugular liver biopsy in general result from contraindications to percutaneous biopsy and include a prothrombin level lower than 50 or 60% of normal values depending on local policies, a platelet count of less than 60,000/mL, abundant ascites, the need to measure the pressures in the hepatic vein, right atria and inferior vena cava as well as the intraportal wedge or precapillary pressure, or an anticoagulant or antiplatelet aggregation treatment that cannot be interrupted [4]. Some authors include other indications even if there is no coagulation abnormality or ascites, such as previously failed percutaneous biopsy, morbid obesity, an atrophic liver, suspected amyloidosis, a cardiac liver, hemodilution and chronic renal insufficiency, peliosis hepatis, and hereditary hemorrhagic telangiectasia, which all increase the risk of hemorrhage [4,11].

**Contraindications**

Transjugular liver biopsy is generally contraindicated or not feasible if there is thrombosis of the right internal jugular vein [4]. But in this case, there are alternative approaches, suggested by certain authors such as via the right external jugular vein, the left internal jugular vein or the femoral vein. However, these approaches are more risky than the conventional route and should be performed by very experienced interventional radiologists and used only as a last resort.

The other contraindications for transjugular liver biopsy are thrombosis of the hepatic veins, hydatid cyst, cholangitis, and the absence of cooperation from the patient [4].

**Material and technique**

**Preparation**

The patient receives a premedication of 100 mg hydroxyzine (Atarax®, UCB Pharma SA) orally and, depending on the team, 1 g of paracetamol codeine (Dafalgan codeine®, Bristol-Myers Squibb) two hours before the procedure. An EmlaPatch® 5% (AstraZeneca) is routinely applied to the puncture site on the neck one hour before the procedure. During the biopsy, which is performed in an interventional radiology room, under strictly aseptic conditions, the patient’s vital signs are checked by repeatedly recording arterial pressure and continuous heart monitoring to detect arrhythmia as the catheter passes through the right atria [12]. The patient is infused into an antecubital vein into the right arm. The classic recommendation is that the patient should have strictly fasted so that general anesthesia can be administered in the unlikely event of the need for surgical management of a severe complication of the biopsy.

**Puncture procedure**

Transjugular liver biopsy is performed by an experienced interventional radiologist assisted by a radiology technician. The French Health Authority’s (HAS) generic interventional radiology checklist should be used. It is accessible from the following link (in French, accessed 15 April 2013): http://sfcv-com.micrologiciel.com/images/files/Check_list_Rx_derniere_version_relu_DF.pdf.

Ultrasoundographic localization of the right internal jugular vein and real-time guidance of the puncture process is highly recommended to increase safety [13]. Ultrasoundographic guidance avoids accidental puncture of the ipsilateral carotid artery and pneumothorax, and allows the most suitable puncture point to be chosen, depending on the individual anatomy, with negligible increase in the procedure time [14]. It is essential in patients with a short neck. Ultrasonography also ensures that the right internal jugular vein is patent [13,14]. When the jugular vein is of small diameter or is collapsed, it is possible to distend it by carefully tilting the angiography table to lift the patient’s feet and increase the cardiac preload or, more rarely, to increase the blood volume by intravenous administration of saline depending on the hemodynamic and cardiac status. The skin of the neck over the selected entry site is steriley cleansed using a local antiseptic and a preperforated sterile drape is used to cover the patient. A local anesthetic agent (2% lidocaine) is used to numb the skin. A small skin incision is made with a disposable scalp knife, then the right internal jugular vein is punctured using an 18-Gauge needle-catheter under ultrasonographic guidance using a superficial high-frequency linear probe draped in a dedicated sterile covering and sterile ultrasonographic gel. After introducing a 0.035-inch J-tipped guide wire, a 9-French 10 cm long introducer sheath is inserted according to Seldinger’s technique. The right hepatic vein is catheterized with a 5-French end-hole catheter and
a J-tipped 0.035 inch flexible hydrophilic guide. Fluoroscopic angiography is used to ensure that the catheter is correctly in place in the right hepatic vein, using 10 mL of iodinated contrast agent injected by hand. A 145 cm long 0.035 inch stiff guide (Amplatz extra-stiff, Cook or other) is then introduced into the 5-French catheter allowing an exchange and the introduction of the 7-French curved-end sheathing catheter [13]. To assist with this introduction, the patient is asked to breathe in deeply and to hold his or her breath. This step is important because it opens the angle between the inferior vena cava and the right hepatic vein, making the procedure easier (Fig. 1). After withdrawing the stiff guide wire, the sampling system is introduced coaxially to carry out the biopsy [13].

The procedure is checked regularly by moderate use of fluoroscopy. It is important to ensure that the distal end of the biopsy needle is not too close to the liver capsule, because during the biopsy the semiautomatic sampling system moves forward by at least 24 mm [15,16]. For this reason, to better control the distance between the liver capsule and the distal tip of the biopsy needle, it is preferable to use the right hepatic vein. In the case of ascites, the exact situation of the liver capsule is estimated by prior abdominal ultrasonography or CT examination. Following each pass, some authors recommend opacification of the hepatic vein to detect any break in the capsule and leakage of contrast agent. It is recommended to take three biopsy samples, but two passes seem to be sufficient [12,15,17,18]. The choice between two or three passes must be left to the interventional radiologist’s judgment, depending on the total size of the first two samples and their degrees of fragmentation.

Figure 1. Transjugular liver biopsy. The sheathing catheter (arrow) is in the right hepatic vein. The angle between the inferior vena cava and the right hepatic vein is superior to 90°, which makes the procedure easier.

Once a tissue sample is obtained, it is examined visually by the radiologist to decide whether to obtain another one. A sample which is at least 10 mm long is essential [15,16]. The samples are then usually fixed in 10% formal for later analysis. They are subsequently set in paraffin and sliced with a microtome at three levels. Several staining methods are systematically used including hematoxylin-eosin safran, Masson’s trichrome or Sirius red, and Perls’ Prussian blue stain to estimate iron overload [15]. Other special preparations, such as Gordon and Sweet’s stain for reticulin, are performed on request depending on the condition being suspected. A minimum of 6 portal triads is necessary for a diagnosis and to grade the severity of the acute or chronic liver condition [8,12].

The use of a Colapinto needle (aspiration system) has been replaced by a semiautomatic system. The Colapinto needle is now almost entirely reserved for creating an intrahepatic portosystemic shunt [19]. The aspiration system is associated with inadequate tissue sampling in 12.5% to 29% of the cases and multiple samples must be taken [20]. On the other hand, a semiautomatic system enables larger, less fragmented, more reproducible samples to be obtained [15]. In addition, a single biopsy produces a quality sample in 72% of cases, thus reducing the number of passes and consequently the dose of radiation delivered to the patient [10,12]. Finally, using the semiautomatic system significantly reduces the mean procedure time by about 30% (15.5 min as against 22.6 min) [20].

Two semiautomatic systems are currently commercially available. At present only the Quick-Core® Biopsy Needle has been studied by a large number of studies (Fig. 2) [21]. The other system (FlexCore® Biopsy Needle) has been the subject of only a few comparative studies, but the comparison was in favor of the FlexCore® system in terms of fragmentation and number of portal triads in the specimens [20,21].

The hepatic pressure gradient is obtained by measuring the wedge pressure and the free hepatic venous pressure [22]. Its normal value is less than 5 mmHg. This measurement necessitates very carefully setting up the pressure measuring system and increases the length of the procedure. It is thus not systematically undertaken but is reserved for particular indications, especially as there are noninvasive means available of indirectly assessing intraportal pressure. Contrast-enhanced ultrasound with CO₂ microbubbles has recently appeared as a promising noninvasive technique but direct blood measurement is still the reference method [23]. Direct measurement of the pressure gradient allows the evolution of intraportal pressure to be assessed after drug treatment, or the risk of bleeding by rupture of esophageal varices, survival or the risk of hepatic encephalopathy to be predicted [24,25]. This measurement is useful for monitoring the response to antiviral treatment in patients with chronic hepatitis C virus infection [15].

Monitoring

At the end of the procedure, the puncture site should be compressed manually for 10 minutes to avoid a hematoma
in the neck. After the procedure, the patient should remain recumbent and is normally monitored clinically and hemodynamically for at least 4 hours. There is no consensus concerning the length of monitoring; times vary from 4 to 24 hours. If there is abdominal pain after the biopsy or a drop in serum hemoglobin level, serum hemoglobin should be measured repeatedly and an abdominal ultrasonographic examination undertaken. However, an abdominal CT scan is more commonly performed.

Results

Technical results

The mean time for the procedure is 41 min (range: 15–48 min) \[5,12\]. The mean number of passes reported in the literature is 2.7 \[12,26\]. When using a Colapinto needle there was an overall failure rate of between 12% and 29%. \[10,13\]. In contrast, with the semiautomatic system the success rate raised to 96.8% and diagnostic samples were obtained in 96.1% of cases \[20\]. In the case of biopsies from a liver transplant, the technical success was similar but the procedure may be longer or more difficult due to venous anastomosis and anatomical changes.

The mean size of the samples with a semiautomatic system was 12.8 mm ± 4.5 and the mean number of portal triads was 6.8 ± 2.3 \[12,15\]. These values are significantly higher than those obtained with a Colapinto needle, but are still slightly lower than those of samples obtained by percutaneous biopsy. The mean rate of fragmentation of samples was 34.3% \[20\]. Most medical teams consider that the quality of samples obtained via the transjugular route is very close to that of percutaneous biopsies (Fig. 3) \[3\].

Failures

The overall failure rate was 3.2%, mostly due to the impossibility to catheterize the hepatic vein (43%) or the jugular vein (26%) and for multiple other causes \[13\]. An acute angle of less than 90° between the axis of the inferior vena cava and the hepatic vein was the commonest cause of failure and affected approximately 1% of procedures \[12\]. Undesired renal sampling has also been reported due to the biopsy system being placed in the right renal vein rather than the hepatic vein \[22\].

Complications

The overall rate of complications was 7.1%, divided into minor complications (6.5%), major complications (0.6%) and death (0.1%) \[2,10,12\]. This was not correlated with the number of samples taken \[3\]. The complications consisted of hemoperitoneum (0.2% of procedures, generally due to perforation of the capsule of Glisson), arrhythmia (0.02%) capsule perforation without hemodynamic effect (1.4%) transitory abdominal pain (1.6%), limited intrahepatic hematoma (2%) neck hematoma (0.8%) and other very exceptional complications such as a biliary fistula, or hepatic artery aneurysm \[12,27,28\]. Minor complications such as neck pain, hematoma in the neck, accidental puncture of the carotid artery and pneumothorax were much rarer when ultrasonographic guidance was used to monitor the puncture of the internal jugular vein \[8,12\]. Causes of mortality were almost exclusively hemoperitoneum (0.06%) and ventricular arrhythmia (0.04%) \[29,30\].

Figure 2. Semiautomatic transjugular liver biopsy system (Quick-Core® Biopsy Needle). The four different parts from top to bottom are: A — the biopsy needle in the ’armed’ position, B — the white 5-French end-hole catheter used to catheterize the right hepatic vein, C — the blue 7-French curved-ended sheathing catheter equipped with its antireflux valve, and D — the black 5-French end-hole catheter which will be coaxially inserted into the sheathing catheter before descending on a stiff metal guide-wire.

Figure 3. Liver biopsy sample (core) obtained via the transjugular route. The sample measures 20 mm long and is hardly fragmented (HES stain, low magnification).
Conclusion

Transjugular liver biopsy is indicated in diffuse liver disease, for patients with contraindications to a standard percutaneous approach. It is a relatively simple technique, as effective as a transparietal biopsy, well tolerated with very few contraindications at the penalty of a greater procedure time and extra costs. The use of ultrasonographic guidance to puncture the internal jugular vein significantly reduces the incidence of minor complications. The use of semiautomatic sampling systems substantially increases the diagnostic yield of tissue samples. This procedure has a relatively low level of morbidity and mortality when performed by an experienced radiologist.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References