Received:
3 May 2014

Revised:
9 September 2014

Accepted:
22 September 2014

doi: 10.1259/bjr.20140327

Cite this article as:

Moses V, Keshava SN, Mammen S, Ahmed M, Eapen CE, Ramakrishna B. Trans-caval trans-jugular liver biopsy—a technical modification of trans-jugular liver biopsy. *Br J Radiol* 2014;87:20140327.

SHORT COMMUNICATION

Trans-caval trans-jugular liver biopsy—a technical modification of trans-jugular liver biopsy

¹V MOSES, DNB, MD, ¹S N KESHA, DNB, FRCR, ¹S MAMMEN, MD, ¹M AHMED, MD, ²CE EAPEN, DM and ³B RAMAKRISHNA, MD

¹Department of Radiology, Christian Medical College, Vellore, Tamil Nadu, India

²Department of Gastrointestinal Sciences and Hepatology, Christian Medical College, Vellore, Tamil Nadu, India

³Department of Pathology, Christian Medical College, Vellore, Tamil Nadu, India

Address correspondence to: Dr Vinu Moses

E-mail: vinu@cmcvellore.ac.in

Objective: To (a) describe the technical modification of trans-caval TJLB and (b) review our series of nine cases.

Methods: We performed a retrospective review of all trans-caval TJLBs performed; we assessed indications for the procedure, technical success, complications, adequacy of specimen and histological positivity.

Results: The technical success rate of the procedure was 9/9 (100%); the minor complication rate was 1/9 (11%), adequate specimen was obtained in all cases

and a histological diagnosis was achieved in 8/9 (89%) cases.

Conclusion: This preliminary report suggests that trans-caval modification of TJLB is a relatively safe procedure that may be useful in cases where conventional TJLB is infeasible.

Advances in knowledge: (a) We describe the technique of trans-caval TJLBs and report our findings in the largest series of published cases. (b) Trans-caval TJLB is relatively safe and can be used to increase the success rates of conventional TJLB.

Trans-jugular liver biopsy (TJLB) is an established technique in patients unsuitable for a percutaneous trans-abdominal liver biopsy. TJLB procedure involves biopsy of the liver parenchyma through trans-jugular venous access, with the biopsy needle placed in the right hepatic vein (commonly described) or the middle or left hepatic veins. However, a TJLB may be not technically feasible in a small subset of cases where hepatic venous cannulation is not possible, owing to unsuitable hepatic venous anatomy, occluded hepatic veins [Budd–Chiari syndrome (BCS)] or markedly shrunken liver. In such cases, a technical modification of TJLB, called a direct trans-caval TJLB, can be performed. In this study, we (a) describe the technical modification of the trans-caval TJLB and (b) review the results of a series of nine cases where the trans-caval TJLB was carried out.

METHODS AND MATERIALS

We undertook a retrospective review of all the trans-caval TJLBs performed between 1 January 2000 and 25 April 2014 at Christian Medical College, Vellore, Tamil Nadu, India. This retrospective review was cleared by our institutional review board. Out of a total of 1483 TJLBs, trans-caval TJLBs were attempted in 9 cases. The indication for TJLB and the reason for performing a trans-caval modification in these cases are summarized in Table 1. Complications were classified according to the Society of Interventional

Radiology classification for complications.¹ Adequate specimen was defined as a specimen of a tissue that was at least 10 mm in length, which was half the length of the cutting core of the biopsy needle. These data were obtained by reviewing the specimen details in the pathology report from the hospital information system. Histology was considered positive if the pathologist was able to make a diagnosis from the specimen provided.

Procedure details

Written consent was obtained from all patients. We reviewed previous radiological imaging of the patient. Patients who did not have any abdominal imaging were screened on ultrasound and colour Doppler for feasibility of a TJLB, before an appointment for the procedure was given. As per our hospital guidelines, a patient was considered to have coagulopathy requiring correction if the prothrombin time/international normalized ratio was >1.4 over that of the control; activated partial thromboplastin time was elevated over 6 s compared with the control; or manual platelet count was <50,000 per cubic millimetre.

On the day of the procedure, patients were pre-medicated with 5 mg of morphine sulphate (Morphitroy injection; Troikaa Pharmaceuticals Ltd, Gujarat, India) and 25 mg of promethazine hydrochloride (Phenargan injection; Nicholas

Table 1. Case profiles

Number	Age (years)	Sex	Clinical data	TJLB indication	Trans-caval TJLB indication
1	13	M	BCS with CLD; for aetiological evaluation of cirrhosis	Coagulopathy	Occluded hepatic veins
2	34	M	BCS with CLD; for aetiological evaluation of cirrhosis	Coagulopathy	Occluded hepatic veins
3	46	F	Hodgkins lymphoma with infiltrative liver changes	Ascites	Diffusely attenuated hepatic veins—unable to cannulate
4	39	M	CLD	Coagulopathy	Unfavourable hepatic venous anatomy
5	60	F	Cholangitis in fulminant hepatic failure	Ascites and coagulopathy	Right hepatic vein could not be recannulated after wire slipped out during attempts at insertion of TJLB metal cannula; other hepatic veins had unfavourable anatomy
6	54	M	Decompensating CLD	Ascites	Attenuated hepatic veins with unfavourable anatomy (acute angulation of hepatic veins)
7	14	M	CLD	Ascites and coagulopathy	BCS detected on table; converted to a trans-caval biopsy
8	22	F	BCS with CLD; suspected underlying autoimmune aetiology	Ascites	Occluded hepatic veins
9	2	M	CLD with renal failure; for staging	Chronic renal failure	Unfavourable hepatic venous anatomy

BCS, Budd-Chiari syndrome; CLD, chronic liver disease; F, female; M, male; TJLB, trans-jugular liver biopsy.

Piramal, Mumbai, India) given intramuscularly 30 min before the procedure. The procedure was carried out under local infiltration anaesthesia. General anaesthesia was used only in children. Patients' oxygen saturation, blood pressure and heart rate were monitored during the procedure.

Single wall, ultrasound-guided puncture of the right internal jugular vein (IJV) was the preferred site of venous access. In cases of unsuccessful cannulation or thrombosis of the right IJV, access to the left IJV was obtained. A 0.035-inch J-guide wire was passed into the infrahepatic inferior vena cava (IVC), and the venous access was secured with a 9-French, 11-cm vascular sheath (Brite Tip® Interventional Sheath; Cordis Corporation, Warren, NJ). A pre-curved metallic cannula (LABS-100; Cook Inc., Bloomington, IN) was passed into the intrahepatic IVC over the 0.035-inch J-guidewire. The position of the cannula tip within the intrahepatic IVC was confirmed on real-time trans-abdominal ultrasound (2–7 MHz C344 abdominal convex probe, Sonoscape S8; SonoScape, Shenzhen, China). The real-time ultrasound was performed by an assisting interventional colleague who stood at the right side of the patient and was not scrubbed in for the procedure. For biopsies from the right lobe of the liver, the metal cannula was turned anterolaterally to the right side. Under fluoroscopy, a 18-G, 60-cm Quick Core TJLB biopsy needle (LABS-100; Cook Inc.) with a needle throw of 20 mm was passed through the metal cannula till its tip was just inside the tip of the metal cannula (Figure 1). On real-time ultrasound, it was confirmed that the cannula tip was wedged into the parenchyma of the right lobe of the liver (Figure 2). If the metal cannula was not adequately wedged into the hepatic parenchyma, it was withdrawn, given a more acute angulation and reinserted. The distance from the cannula tip to the liver

capsule was measured and a trans-caval biopsy was attempted if only there was >3 cm of liver parenchyma anterior to the tip of the cannula. The patient was asked to hold breath in quiet respiration (not in deep inspiration, to minimize risk of displacement of the metal cannula from the intrahepatic IVC due to respiratory excursion), and the biopsy was taken under real-time ultrasound visualization (Figure 3). Two to four biopsy

Figure 1. Fluoroscopy image showing the trans-jugular liver biopsy metal cannula in the intrahepatic inferior vena cava, turned towards the right side, with the Quick Core (LABS-100; Cook Inc., Bloomington, IN) biopsy needle (black arrow) positioned just inside the tip of cannula.

Figure 2. Trans-abdominal ultrasound showing the trans-jugular liver biopsy metal cannula (black arrow) wedged into the hepatic parenchyma of the right lobe of the liver across the intrahepatic inferior vena cava (white arrow).

passes were made till adequate specimen was obtained for histopathology. Before each biopsy pass, the position of the tip of the metal cannula was reconfirmed on ultrasound.

After biopsy, the vascular sheath was removed in the semi-recumbent posture to reduce the risk of bleeding. Gentle compression was applied at the puncture site for 5 min. The heart rate, respiratory rate, blood pressure and abdominal girth were monitored every 2 h for 12 h. The neck puncture site was examined every 4 h for haematoma formation. Patients were discharged after 24 h, if the procedure was uneventful.

RESULTS

A total of nine trans-caval TJLBs were attempted. All nine cases had technically successful biopsies. The male:female ratio was 6:3. The patients' age ranged from 2 to 60 years.

All procedures were performed with local anaesthesia, except for two children, in whom they were carried out under general anaesthesia. The right IJV access was obtained in all cases.

4/9 (44%) cases had a planned trans-caval TJLB, as they were already diagnosed to have occluded hepatic veins secondary to BCS. In one of these cases, the TJLB cannula was wedged into the right hepatic venous ostium and the biopsy carried out. In 5/9 (56%) cases, planned TJLB was converted to a trans-caval TJLB. Of these cases, 4/9 (44%) had unfavourable hepatic venous anatomy, and one case 1/9 (11%) was incidentally discovered to have BCS, the diagnosis being made after unsuccessful attempts to cannulate hepatic veins during TJLB. In another case, 1/9 (11%), the right hepatic vein was cannulated and a venogram performed; the J-guide wire, however, slipped out while attempting to insert the metal cannula and subsequent attempts to recannulate the hepatic vein were unsuccessful. The other two hepatic veins in this case showed unfavourable anatomy. We assumed that the right hepatic vein was in spasm and proceeded with a trans-caval TJLB. Colour Doppler of the right hepatic vein the next day revealed a patent right hepatic vein with normal flow.

The number of biopsy passes ranged from two to four, with most cases having three passes. Multiple cores of liver tissue were obtained, and the median (range) number of biopsy cores was two (one to three). The largest core length was 1.4 cm. The median aggregate core length was 1.3 cm (0.9–2.9 cm). Histological diagnosis was obtained in all except one case, in which the biopsy core was 1.2 cm in length but part of the core was fibrotic tissue and the rest of the parenchyma showed evidence of chronic liver disease. The possibility of cirrhosis was considered in this case, but could not be confirmed.

There were no major complications in our series; one case had a small haematoma at the puncture site in the neck, which resolved over 3–4 days without any intervention. Another case with cholangitis and acute fulminant hepatic failure underwent an uneventful trans-caval TJLB, but passed away 3 days later owing to multiorgan failure. This mortality was thought to be unrelated to the biopsy, as there was no drop in haematocrit to suggest a post-biopsy bleed.

DISCUSSION

TJLB was first described by Rösch et al² in 1973. While there has been extensive literature about TJLB, the basic procedure technique described in this first article in literature has not undergone any significant change over time. Our technical modification of trans-caval TJLB has not been described earlier, except in two of our own earlier publications,^{3,4} where we have briefly mentioned this procedure. There are also no published data comparing the efficacy of this technical modification to conventional TJLB.

A trans-caval TJLB is usually unplanned and is considered by us when hepatic venous cannulation is unsuccessful for any reason.

Mammen et al³ in their retrospective analysis of 601 TJLB cases described a technical success rate of 98.8% and an overall complication rate of 2.5%. Smith et al⁵ in their retrospective review of 410 cases mention a technical success rate of 98% and a complication rate of 2.4%. In our series of 9 cases, the overall technical success rate was 9/9 (100%), and the histologic success

Figure 3. Trans-abdominal ultrasound showing the Quick Core (LABS-100; Cook Inc., Bloomington, IN) needle (black arrow) in the parenchyma of the right lobe of the liver, during the trans-caval liver biopsy.

rate was 8/9 (89%). Although our overall complication rate was 1/9 (11%), there were no major complications in our series.

While trans-caval TJLB shows promising results, we recommend that it be reserved only for cases where conventional TJLB is not feasible, as the procedure requires not just ultrasound imaging equipment in addition to fluoroscopy, but also an extra interventional colleague, who would use the ultrasound to guide the position of the cannula and assess adequacy of hepatic parenchyma for biopsy.

Limitations

We had only a small number of cases in our series. Further studies with larger numbers are needed to validate these results.

CONCLUSIONS

Trans-caval TJLB is a novel technical modification of a conventional TJLB with risks, complications and success rates broadly similar to conventional TJLB in our small series. This preliminary report suggests that this procedure may be useful in cases where conventional TJLB is not feasible.

REFERENCES

1. Sacks D, McClenny TE, Cardella JF, Lewis CA. Society of Interventional Radiology clinical practice guidelines. *J Vasc Interv Radiol* 2003; **14**: S199–202.
2. Rösch J, Lakin PC, Antonovic R, Dotter CT. Transjugular approach to liver biopsy and transhepatic cholangiography. *N Engl J Med* 1973; **289**: 227–31.
3. Mammen T, Keshava SN, Eapen CE, Raghuram L, Moses V, Gopi K, et al. Transjugular liver biopsy: a retrospective analysis of 601 cases. *J Vasc Interv Radiol* 2008; **19**: 351–8. doi: [10.1016/j.jvir.2007.09.002](https://doi.org/10.1016/j.jvir.2007.09.002)
4. Keshava SN, Mammen T, Surendrababu N, Moses V. Transjugular liver biopsy: what to do and what not to do. *Indian J Radiol Imaging* 2008; **18**: 245–8. doi: [10.4103/0971-3026.41839](https://doi.org/10.4103/0971-3026.41839)
5. Smith TP, Presson TL, Heneghan MA, Ryan JM. Transjugular biopsy of the liver in pediatric and adult patients using an 18-gauge automated core biopsy needle: a retrospective review of 410 consecutive procedures. *AJR Am J Roentgenol* 2003; **180**: 167–72.