Role of ultrasound in the perioperative evaluation of percutaneous transhepatic biliary drainage

Chuan Fu*, Si-Ze Wu, Guang-Qing Liu, Tian-Lun Fan, You-Ke Chen
The Affiliated Hospital of Hainan Medical College, Hainan Province, Haikou 570102, China

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ABSTRACT

Objective: To explore the evaluation and application of the color doppler ultrasound imaging for percutaneous transhepatic biliary drainage (PTBD) in the treatment of obstructive jaundice of preoperative, intraoperative and postoperative. Methods: The related information of 133 patients prepared with PTBD in our hospital from January 2009 to January 2015 was analyzed retrospectively. Including the clinical manifestation of PTBD preoperative, intraoperative and postoperative, laboratory examination, color Doppler ultrasound imaging, CT and/or MR imaging, X-ray and ultrasound guided interventional therapy, surgical treatment, histopathologic analysis record, the evaluation analysis of the role of ultrasound in the perioperative PTBD. Result: In 133 patients prepare with PTBD, preoperative evaluation for ultrasound guided PTBD 105 cases (78.94%, 105/133), finally complete the ultrasound guided PTBD 56 cases, with smoothly and one-time 100% success rate. Postoperative patients with jaundice and skin itching rate significantly reduced, increase food intake and better mental state. At seventh day of postoperative, liver function index improved significantly, ultrasonic follow-up show bile duct with different degree of inside and outside diameters. Postoperative complications were mild with the rate of 7.14%. No biliary infection, liver abscess, bile leakage complications, biliary tumor or liver function damage. Conclusion: The ultrasound evaluation of preoperative PTBD can be helpful with certain patients. Also to formulate operation program, correct positioning and guided with ultrasound is the key to the successful PTBD. Beside to avoid or reduce the complications, ultrasound follow-up provide important information in the detection of postoperative complications.

1. Introduction

Obstructive jaundice is common in clinical practice. Many reasons can cause this condition, including biliary stones, cholangiocarcinoma, pancreatic cancer, periampullary, extrahepatic bile duct inflammation, ascariasis, and postoperative stenosis. Treatment of obstructive jaundice focuses on the cause and symptomatic treatment. Although not being implemented to cause treatment, percutaneous transhepatic biliary drainage (percutaneous transhepatic cholangiography and drainage, PTCD) is ideal for the treatment[1-7]. Traditional X-ray contrast PTCD guide can use ultrasound imaging instead of X-rays, but the X-ray-guided therapy needs more expertise. Ultrasound imaging PTCD also plays a role in the evaluation of patients before surgery and postoperative complications. This study retrospectively analyzed PTCD for ultrasound imaging before surgery, postoperative effects were analyzed and summarized, in order to raise awareness of ultrasound imaging in PTCD perioperative and to improve its clinical applications.

2. Materials and methods

2.1. Clinical information

A retrospective analysis of hospitalized PTBD patients from January 2009 to January 2015 was made. A total of 133 patients intended for PTBD and completed in 56 patients (42 males, 24...
females), with age 48 to 73 years (60.41±7.26) years. 133 cases were confirmed by color Doppler ultrasound, CT and/or MRI, laboratory tests, with clear reasons of obstruction, intrahepatic bile duct dilatation and body biochemical indicators. 56 patients with completed PTBD include 29 cases of cholangiocarcinoma, 10 cases of liver cancer, 8 cases of pancreatic cancer, 5 cases of ampullary carcinoma, and 4 cases of metastases.

2.2. Treatment method

2.2.1. Instruments

ALOKA-PROSOUND 10 using color Doppler ultrasound; phased array probe UST-52105, frequency 1.0-5.0 MHz; convex array probe UST-9130, the frequency of 3-6 MHz; needles in use produced by Guangzhou Ling Jie Medical Devices Co., Ltd. Production disposable sterile indwelling catheter drainage and auxiliary equipment, model specifications for the paperback 1 type 8.5 Fr × 20 cm.

2.2.2. Preoperative preparation

Preoperative examination included clotting time, liver function; prolongation for prothrombin time, 2 d coagulation check prior to hemostatic surgery; discussed with patients before surgery and signed informed consent. Preoperative ultrasound assessment[8]: 1. Within close distance from the surface, select the target bile duct; 2. If there is no obstruction of the common hepatic duct, find the left hepatic lobe and intrahepatic bile duct; 3. Insert a needle 20 mm-40 mm, to reach the target biliary liver tissue; 4. Select the bile duct targeted with diameter greater than 6 mm; 5. At vertical surface of the liver, puncture a path of diameter line; 6. The angle between the needle and the target duct is less than 60-70 degrees; 7. Select color Doppler imaging to scan larger vessels for puncture path; 8. Check puncture path; 9. Measure the distance between the puncture site and the target; 10. Tell patients to breathe calmly when measuring the placement between the puncture site and the target duct.

2.2.3. Operation

The patient was supine, ultrasound and marked, with routine disinfection and covered properly, painted with the probe coupling agent, film wrapped with sterile probe, ultrasound equipment adjustment to make clear image; with 2% lidocaine local anesthesia at the puncture site, and blade puncture point to out 3-5 mm skin incisions, according to a predetermined puncture path in paperback 1 type PTBD drainage tube to puncture the muscle. The patient was asked to breathe deeply; the depth of the needle was measured into the liver parenchyma goal by the preoperative bile duct area. Immediately after enabling ultrasound imaging, the position and the angle of the drainage tube, which under special circumstances can re-catheter drainage. If necessary, with ultrasonography and biliary drainage tube, adjust the position and the angle of the drainage tube, which under special circumstances can re-catheter drainage.

2.3. Observation indicators

Incidence of postoperative complications was observed, and also daily bile drainage and traits; jaundice situation; eating pattern, itching and other skin conditions, and liver functions after seven days was checked. Consider saline drainage tube if not smooth; and if necessary, with ultrasonography and biliary drainage tube, adjust the position and the angle of the drainage tube, which under special circumstances can re-catheter drainage.

2.4. PTBD index

Success catheterization criteria indicate smooth bile drainage of 500 mL or more per 24 h. Complications involve[2,6-8]: puncture area bleeding, biliary tract infections, liver abscess, bile leakage, bile duct -portal vein leakage, bile tumor, liver dysfunction.

2.5. Statistic

Quantitative data with normal distribution to Mean±sd, between the two groups, were compared using two independent samples t test. Non-normally distributed data represented by the median (interquartile range) between the two groups were compared using non-parametric test (Mann-Whitney test). P<0.05 was indicated that the difference was statistically significant. Research data were analyzed using statistical software SPSS 16.0

3. Results

133 cases PTBD intended for patients after surgery before ultrasound assessment, suitable for ultrasound-guided PTBD were 105 cases (78.94%, 105/133). The reasons of 28 patients not suitable for ultrasound-guided biliary PTBD are tortuous targets, tumor diameter less than 6 mm puncture path, large blood vessel in puncture path, difficulty to breath or shortness of breath. 105 cases suitable for ultrasound-guided PTBD with 18 cases which did change the X-ray (DSA) guided PTBD and stent implantation. 12 cases gave up treatment, and 9 cases were because of other contraindications to give up surgery PTBD. 56 cases completed ultrasound guide PTBD. 56 patients with intrahepatic bile duct routine PTBD inner diameter 6-16 mm (10.93±2.30) mm; clotting time and platelet count normal range; no contraindications PTBD. 56 cases of patients were with PTBD biopsy and left bile duct and its branches in 36 cases, the puncture of the right hepatic duct and its branches in 19 cases, respectively puncture left and right hepatic duct and its branches in 2 cases. Total catheter 58 cases are one-time catheterization success; the success rate is 100%. After the catheter drainage of bile daily volume was 467-975 mL (741.27±108.58) mL, 7 d after surgery in patients with jaundice, pruritus was significantly reduced, significantly improved liver function, increased food intake, mental state improved, ultrasound examination showed intrahepatic bile duct in varying degrees to reduce the inside diameter. Complication rate was 7.14%(4/56), including two cases of postoperative biliary bleeding occurred, the line hemostatic bleeding was stopped after treatment; 2 patients drainage tube was blocked, the drainage tube
angle adjustment was performed and physiology saline to allow the passage through. There were no biliary tract infections, liver abscesses, bile leakage, bile tumor, and liver dysfunction complications. No drainage tube shedding occurred. After the first seven days, liver function tests for comparison was checked as shown in Table 1. Figure 1 shows the successful PTBD catheter sonogram.

Table 1
Comparing laboratory tests results before and seven days after PTBD.

<table>
<thead>
<tr>
<th>Index</th>
<th>Admission</th>
<th>After 7 days</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB (μmol/L)</td>
<td>427(396,462)</td>
<td>146(132,173)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>AST (μ/L)</td>
<td>147(163,175)</td>
<td>68(62,74)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ALT (μ/L)</td>
<td>178.20±18.01</td>
<td>63.89±8.42</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

4. Discussion

Color Doppler ultrasound imaging guided PTBD is an important method of obstructive jaundice biliary decompression and drainage of bile, and its indications are strictly controlled. Skilled operators are keys to successful operation and to reduce and avoid complications[2,3,6]. In this study, although a preliminary assessment of 133 patients were able to line PTBD, but preoperative ultrasound assessment suitable for ultrasound guided PTBD were 105 cases (78.94%). The reason the author believes is that ultrasonography, CT and/or MRI to assess the focus and priorities and for the direction of ultrasound-guided puncture treatment is inconsistent, before puncture ultrasound assessment is more accurate and relevant. The reasons this group is not suitable for ultrasound-guided PTBD are because of no suitable target for bile duct tumor puncture path, but there is a large blood vessel puncture path for patients with shortness of breath and difficulty to puncture. When the common bile duct obstruction, extrahepatic bile duct dilatation and intrahepatic bile duct were widened, these make it difficult to reach the target. Hastily puncture may lead to failure[3]. Intraoperative ultrasound puncture success increases efficiency precise positioning, and can also reduce the number of puncture. Postoperative complications of ultrasound can be used to help understand the situation, and to guide the development of treatment programs. Specific terms of the efficacy of this group of 56 patients with a one-time catheterization success, higher than Wang Chang-chun et al[3] reported 92.3% (192/208), and Ding Jian-min et al[3] reported in 99.8% (473/474) almost unanimously. The group of 56 patients after PTBD, report about jaundice and pruritus incidence was significantly reduced, food intake increased, and mental state improved. After the first seven days, serum ALT, AST, TB were significantly decreased (P<0.05), showed PTBD efficacy, and as literature reported unanimously[1-4,6]. The group PTBD complication rate was 7.14%, though a slight illness, which was quickly corrected, the literature[2,3,6,7] reported no severe complications, showed PTBD invasive ultrasound-guided is safe.

Figure 1. A woman of 76 years old had ultrasound-guided PTBD, figures showed bile duct (arrow) biliary drainage tube, within the echo. (Ultrasound and CT examination revealed ampulla mass, common bile duct obstruction, common bile duct diameter 26 mm, inner diameter of the intrahepatic bile duct 15 mm.)

In summary, this group of 56 patients who underwent surgery PTBD achieved success rate, fewer complications due to the strict preoperative ultrasound assessment and indicated the correct intraoperative ultrasound-guided puncture and operation skills cooperation and understanding with the physician.

In short, the PTBD preoperative ultrasound assessment can be applied with appropriate patient, helping in surgical planning. Intraoperative ultrasound correct positioning and orientation process and guided puncture is the key to success and reduce PTBD complications. Postoperative follow-up ultrasound detection and treatment of disease provide important information. PTBD ultrasound-guided shows it is minimally invasive, safe, simple, with fewer complications. Biliary drainage that can effectively improve liver function, rapidly relieve symptoms and improve the quality of life of patients should be widely applied.

References