Percutaneous drainage in high risk patients with acute cholecystitis

Poster No.: C-2394
Congress: ECR 2013
Type: Educational Exhibit
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Keywords: Interventional non-vascular, Abdomen, Ultrasound, CT,
Fluoroscopy, Diagnostic procedure, Drainage, Inflammation,
Abscess, Infection

DOI: 10.1594/ecr2013/C-2394

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Learning objectives

To describe indication, technical procedure and results of percutaneous transhepatic gallbladder aspiration (PTGBA) and drainage (PTGBD) in patients with acute cholecystitis.

Background

Acute cholecystitis (AC) is a frequently encountered problem in surgical practice. 50-70% of all cases occur in elderly patients.

Cholecystectomy is the mainstay of therapy for AC, with good clinical outcome in otherwise healthy patients. However, a reported mortality rates after cholecystectomy as high as 14-30% has been reported in elderly patients with significant comorbidities [1].

The appropriate management of acute cholecystitis in critically ill or elderly patients is a controversial issue due to the high postoperative morbidity and mortality rates after emergency cholecystectomy.

Current treatment options for these patients over the last two decades include either early cholecystectomy or conservative treatment, consisting of intravenous antibiotics and an interval cholecystectomy several weeks later (6-8 weeks) [2].

Percutaneous drainage has been proposed as an option for patients in whom conservative therapy failed or as a salvage procedure for high risk patients, with a reported technical success rate ranging from 95 - 100% [3,4].

Success of this procedure (resolution of symptoms and signs in symptomatic patients, reduction in temperature to less than 37.5 °C, and reduction in white blood cell count by at least 25% or to less than 10000/mm$^3$ within 72 hours) was reported in 86%, with some authors reporting a higher success rate in calculous cholecystitis [5].

PTGBD has been reported as a procedure with a low peri-procedure mortality (0.36%). However, overall mortality at 30 days has been reported to range between 18% and 69%, but has been mainly attributed to the presence of co-morbid conditions in these selected patients.

Complications associated with PTGBD usually occur immediately or within days and include hemorrhage, vagal reactions, sepsis, bile peritonitis, pneumothorax, perforation of the intestinal loop, secondary infection or colonization of the gallbladder and catheter dislodgment. Late complications have been reported as catheter dislodgment and recurrent cholecystitis [Table 1].
To our knowledge, only one study has compared the efficacy of PTGBA with that of PTGBD. Both procedures were technically successful in 97% and clinical improvement was achieved in 77% and 90%, respectively. Complications occurred in 0% and 14% [6-8].

These less invasive approaches have been described as an effective mini-invasive option to surgery in critical cases and may be particularly useful when dealing with patients at high surgical risk, being less invasive, safe, and not requiring general anesthesia.

There have been no randomized controlled trials on surgical management in patients with AC after PTGBD; however PTGBD is known to be an effective option in critically ill and elderly patients [4]. A recent study reported that gallbladder aspiration was significantly safer than percutaneous cholecystostomy and should represent the procedure of choice in high-risk patients with AC. Anyway, percutaneous cholecystostomy was more effective than gallbladder aspiration in terms of clinical effectiveness [7].

Images for this section:

<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>INCIDENCE (%)</th>
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</thead>
<tbody>
<tr>
<td>Sepsis or cholangitis</td>
<td>Not uncommon (not necessary related to the procedure)</td>
</tr>
<tr>
<td>Hemorrhage (both requiring transfusion or embolization)</td>
<td>1.6- 2.2</td>
</tr>
<tr>
<td>Biliary leaks and/or peritonitis</td>
<td>2.4-4.4</td>
</tr>
<tr>
<td>Hemotorax and/or Pneumotorax</td>
<td>Rare</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>0-25 (the wide range depends on the underlying morbidity of the patients population)</td>
</tr>
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</table>
Table 1: More frequent complications related to PTGBD procedure, according with "Cholecystostomy and Transcholecystic Biliary Access" Ginat et al.
INDICATION

Indications for this procedure include calculous and acalculous cholecystitis, gallbladder perforation, malignant obstruction, percutaneous biliary stone removal, biliary duct drainage, and diagnostic imaging of the gallbladder and biliary ductal system as shown in Table 2.

Since the indications for PTGBD are not clearly defined and guidelines are lacking, surgeons feel uncomfortable on whether to apply PTGBD or not [9].

Tokio consensus meeting suggests that the management of acute cholecystitis should be established on the basis of the severity grade and proposed new guidelines for the treatment of patients with AC. [Table 3]

Mild acute cholecystitis (grade I) does not meet the criteria for a more severe grade; in these cases the preferred procedure is early laparoscopic cholecystectomy, that can be performed in most of these patients. Elective cholecystectomy may be selected (if early cholecystectomy is not performed) in order to improve other medical problems.

Moderate acute cholecystitis (grade II) includes the presence of one or more of the following conditions: elevated white-cell count (>18,000 cells/mm$^3$), palpable or tender mass in the right upper quadrant, duration larger than 72 hours and marked local inflammation including biliary peritonitis or pericholecystic abscess or gangrenous/emphysematous cholecystitis. It is treated in the same way as mild but, if there are severe signs of local inflammation, early PTGBD is indicated.

Severe cholecystitis (grade III) is accompanied by organ dysfunction (cardiovascular/neurologic/respiratory/renal/hematologic and hepatic dysfunction) and/or severe local inflammation. Appropriate organ support in addition to medical treatment is necessary for patients with organ dysfunction. Management of severe local inflammation by percutaneous gallbladder drainage and/or cholecystectomy is needed. Delayed elective cholecystectomy should be performed later when indicated. [3,10].

Procedure Details

1. Procedure

Once informed consent for the procedure is obtained, this procedure is usually performed, under aseptic conditions, intravenous sedation and local anesthesia, using a 21G needle with 10-20 ml of lidocaine or carbocaine 2% without adrenaline to achieve a good pain control, either at the radiology department or bedside.
Prophylactic antibiotics (aminoglycosides or cephalosporins) are administered 12 to 24 hours before the procedure. In case of patients who have not received antibiotics before the procedure piperacillin and tazobactam can be administered intravenously at the preliminary procedures starts.

Coagulopathy, if present, should be corrected with transfusions of fresh frozen plasma or platelets or both. Pre-procedural laboratory testing and management of blood alteration are reported in Table 4 following the Consensus guidelines for periprocedural management of coagulation status and hemostasis risk in percutaneous image-guided interventions [11].

Often ultrasound guidance is chosen to obtain the puncture of the gallbladder thanks to its advantages such as continuous visualization, mobility, low-cost, availability, and lack of ionizing radiation. Once needle placement is achieved, catheter insertion is commonly performed under fluoroscopy/ultrasound/CT.

-PTGBA

PTGBA is a method to aspirate bile through the gallbladder with a small-gauge needle (21G or 18G in case of highly viscous bile). It is an easy low-cost bedside-applicable procedure. Gallbladder is punctured by a needle with a spindle, generally under ultrasound guidance. The correct placement is achieved with a real-time ultrasound image: the needle tip is confirmed as a high-echoic spot in the gallbladder, revealing successful puncture [4]. Then the spindle is finally removed, and bile is aspirated, with ultrasound real-time revealing the shrinkage of the gallbladder. When a sufficient bile aspiration is achieved the needle is withdrawn. It is also possible to inject antibiotics into gallbladder before the needle withdrawn [5]. Bile sample should be obtained for cultures.

-PTGBD

PTGBD consists of percutaneous catheter placement in the gallbladder lumen under imaging guidance.

The procedure is carried out using an anterior or right anterolateral approach. There are two basic gallbladder access routes that can be employed for PTGBD: transhepatic and transperitoneal. Moreover, either modified Seldinger technique or trocar technique may be used.

Transhepatic approach

Transhepatic approach consists of traversing the liver parenchyma (ideally via the bare area) of the gallbladder on the superior third portion of the gallbladder. Transhepatic approach is theoretically associated to a lower incidence of bile leak compared with the transperitoneal approach, although this assumption remains controversial and is not evidence based. Nevertheless, the transhepatic technique has the advantage of providing greater catheter stability and more rapid track maturation to the direct
transperitoneal approach. In addition, the transhepatic approach is the safest method in the setting of massive ascites and bowel interposition between the liver and gallbladder. The main disadvantage is that coagulopathy is a contraindication.

Transperitoneal route

In this case, the access to the gallbladder is achieved through the bare area of the gallbladder, which is formed by the reflections of the peritoneal linings off the gallbladder and liver where there is no peritoneal coverage of the gallbladder. This means entering through free peritoneal surface of the gallbladder wall. It can be considered a more suitable option to minimize potential hemorrhage and infectious complications in patients with liver disease and uncorrected coagulopathy even if there is a greater possibility of bile leaking.

Modified Seldinger technique

Several introducer system are available. They normally consist in a 21 gauge diagnostic needle used to achieve gallbladder puncture, a coaxial dilator/sheath (generally a 6F dilator) that can be passed over a 038” heavy-duty guidewire with a choice of ‘J’ or straight tip shapes, and an 8 Fr self retaining pigtail drainage catheter to be placed in the gallbladder. Access into the gallbladder is ascertained by the aspiration of bile.

Trocar technique (One step)

The catheter is loaded on the trocar with sharpened stylet and the components are introduced into the gallbladder as one single unit. Proper placement is confirmed by removing the stylet and sampling fluid. If bile is aspirated, the catheter is further advanced through the trocar and fixed in the gallbladder, otherwise the system is retracted while continuously exerting suction and a second attempt is made.

PTGBD is considered technically successful when the pigtail catheter loop is visualized either sonographically or fluoroscopically in the gallbladder lumen. As for PTGBA, bile sample should be obtained for cultures.

Both procedures needs that the catheter is finally sutured to the skin with a Molnar disk, and placed on gravity drainage.

3. Follow-up

After the procedure, vital signs should be monitored for 2 to 4 hours and antibiotics are continued for at least 48 hours. The catheter should be flushed with 5 to 10 mL of normal sodium chloride solution once or twice a day to prevent catheter obstruction. After 3 days, a cholecystogram with or without cholangiography can be performed to evaluate catheter position, the presence of stones, and cystic and common bile duct patency.
If contrast material does not leak into the peritoneal cavity or through subhepatic, subcapsular and subdiaphragmatic spaces, the tract is deemed mature. Otherwise, a catheter is reinserted over the guidewire and imaging is repeated one week later.

Drainage is left in place until fistula is formed and collection is resolved: a period of two weeks is sufficient for the majority of patients to develop a mature tract when the transhepatic access route is used; when using the transperitoneal route at least three weeks are required. Transhepatic route is preferable since it allows earlier removal of the catheter and reduces the incidence of complications and discomfort for the patients [12].

The main reasons of the technical failure for these techniques may be porcelain gallbladder or thickened gallbladder wall which can make the gallbladder puncture impossible, small gallbladder lumen either filled with stones or not which does not accommodate pigtail catheter, lack of experience and suboptimal patient cooperation.

Transperitoneal and transhepatic percutaneous cholecystostomy are similar in short-term safety, with no significant difference in complication rate [14]. It should be stressed that no difference had been found in the complication rates between the patients drained either transhepatically and transperitoneally [15].

Images for this section:
### Table 1: Indications for Percutaneous Cholecystostomy

<table>
<thead>
<tr>
<th>Gall Bladder Indications (More-Common Indications)</th>
<th>Common Bile Duct Indications (Less-Common Indications)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Drainage of the gall bladder.</td>
<td>A. Drainage of the biliary ducts through a patent cystic duct and through the cholecystostomy drain.</td>
</tr>
<tr>
<td>a. Calculus cholecystitis</td>
<td>B. Providing a portal (percutaneous access) for minimal invasive interventions for the common bile duct. An internal/external transcholecystic biliary drain can be placed to drain the gall bladder and the common bile duct.</td>
</tr>
<tr>
<td>b. Acalculous cholecystitis</td>
<td>C. Diagnostic opacification of the biliary tract including decompressed intrahepatic bile ducts after failed PTC to opacify the ducts. This makes it possible for a more precise and more selective percutaneous transhepatic biliary drain placement.</td>
</tr>
<tr>
<td>c. Iatrogenic/traumatic gall bladder perforation (bile leak)</td>
<td></td>
</tr>
<tr>
<td>A. Providing percutaneous access for minimal invasive interventions, such as percutaneous removal of biliary stones.</td>
<td></td>
</tr>
<tr>
<td>- Fluoroscopic-guided stone removal</td>
<td></td>
</tr>
<tr>
<td>- Percutaneous endoscopic and fluoroscopic stone removal and/or lithotripsy</td>
<td></td>
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</tbody>
</table>

**Table 2: Indication for PTGBD**
**Table 3:** Flowchart for the management of acute cholecystitis according to grade and with response, from Consensus Meeting for acute cholangitis and acute cholecystitis in Tokio -TG13
Fig. 1: A 92 years old women, came to our ER with abdominal pain, fever, elevated WBC counts and severe associated comorbidities. US confirm the AC diagnosis. An iperechoic line passed through liver is observed at US examination confirming the right placement of catheter.
Conclusion

Cholecystectomy has been widely accepted as an effective treatment for AC. However, it may be burdened by a high morbidity and mortality in critically ill patients.

Percutaneous cholecystostomy appears to be a fast, easy, effective and safe treatment for critically ill, elderly patients with AC and for patients in whom conservative treatment has failed [16].

Recently a randomized controlled trial reported that the drainage effect of single PTGBA is lower than that of PTGBD. However, repetitive PTGBA can improve its effectiveness (from 71% to 96 %) and this methodology has not been compared with PTGBD [10].

PTGBD and PTGBA are fundamentally different from each other. PTGBA has various advantages if compared with PTGBD, such as the lower complication rate, the use of a smaller needle and no tube displacement, as it requires no drainage tube management. Moreover it requires less restriction of the patient’s daily activity but it provides only one-time gallbladder decompression and drainage of the contents. The usefulness and safety of aspiration have not been yet fully definite [7].

Given data at the hand for severe AC, PTGBD has ben proven superior in terms of efficacy to gallbladder aspiration.

At the best of our knowledge immediate PTGBD in high-risk patients with AC has not been proven to decrease mortality in comparison with conservative treatment. Thus, it might be suggested for patients not presenting clinical improvement following three days of conservative treatment or for the ICU’s patients.

PTGBD has been reported as a feasible, safe and efficacy alternative to laparoscopic cholecystectomy or open surgery. This technique may avoid the morbidity and mortality of surgery in high-risk patients.

Further studies are needed to better clarify the issue in order to determine the best treatment for acute cholecystitis in high risk patients.

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Reference:


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