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Image Guided Percutaneous Cholecystostomy–A Single Center Experience

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Abstract

Purpose To assess the technical feasibility of percutaneous cholecystostomy (PCC) for acute cholecystitis and formulate an algorithm for PCC.

Materials and methods This is a retrospective study of 35 patients (28 male and 7 female; mean age 60 years) who underwent image-guided PCC from 2008 to 2018 at a tertiary care hospital in South India. Descriptive summary statistics and frequencies were used to assess the technical success and complications.

Results The patients (35/35) presented with fever, abdominal pain, and a few of them had severe sepsis. All these patients were high risk for surgery considering the comorbidities (17/35) and hemodynamic instability (18/35). PCC was performed under ultrasoundguidance, through transhepatic approach, and using single puncture and modified single puncture techniques. The procedure was technically successful in all 35 patients (100%). Two patients (2/35) did not improve clinically after PCC; hence, they were taken up for emergency cholecystectomy with high-risk consent. One patient required a repeat procedure after 3 days due to tube dislodgement. There were no major procedure-related complications.

Conclusion Image-guided PCC can be performed safely and is effective for treating high-risk patients with acute cholecystitis.

Keywords
- percutaneous cholecystostomy
- ultrasound guidance
- single puncture technique

Introduction

Acute cholecystitis is a common surgical emergency in clinical practice. The gold standard of treatment has been laparoscopic cholecystectomy.[1] However, in patients who are acutely ill and afflicted with sepsis, surgery carries a high rate of mortality and morbidity.[2-4] Percutaneous cholecystostomy (PCC) is a nonsurgical therapeutic procedure for treating acute cholecystitis and it involves the placement of an external drainage catheter into the gallbladder.[5] It is usually performed under local anesthesia and ultrasound (US) guidance. The purpose of this study is to assess the safety and efficacy of PCC in terms of technique and immediate procedural and clinical outcomes. We also provided an algorithmic approach for performing PCC.

Materials and Methods

Approval for the study was obtained from the Institutional Review Board. This is a 10-year retrospective study of patients who received PCC at a tertiary care academic hospital from 2008 to 2018. The clinical and procedural details were collected from the electronic medical records. The following data were collected: patients' age, gender, clinical presentation and diagnosis, and imaging modality used for confirming the clinical diagnosis, comorbid conditions

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(systemic hypertension, diabetes mellitus, chronic obstructive pulmonary disease, heart disease, and malignancies), laboratory values including serum bilirubin and bile culture, time interval between diagnosis and intervention by the radiologist, clinical outcome of the patients during hospital stay, and procedure- or disease-related morbidity and mortality.

Patients and Clinical Presentation

All patients who underwent PCC under ultrasound (USG) or computed tomography (CT) guidance were included in the study. During the study period from 2008 till 2018, a total of 35 patients underwent image-guided PCC. The mean age of the study population was 60 years and the male to female ratio was 4:1 (29 males and 7 females). In 33 out of 35patients (94%), the indication for PCC was complicated cholecystitis. In one patient, PCC was performed for biliary drainage when an existing external biliary drainage catheter was dislodged and a repeat biliary drainage catheter placement was not feasible. In another patient, PCC was performed for biliary drainage as a bedside procedure in a patient with choledocholithiasis and cholangitis but with very minimal biliary dilation. The demographic information and comorbidities of patients are listed in ►**Tables 1** and **2**.

The patients presented with high fever and abdominal pain (few of them had nonlocalizing, diffuse abdominal pain). Eighteen patients (51%) had severe sepsis in addition to the comorbidities, making them unfit for surgery.

Imaging

Ultrasound was performed in all the patients. The following information was collected from picture archiving and communication system (PACS): gall bladder (GB) distension and wall thickness, presence or absence of calculus, presence or absence of sludge, integrity of GB wall, presence of air in gall bladder/pericholecystic collection, and presence of contained liver abscess.

Table 1 Demographic profile in the study population (total number of patients [*n* = 35])

	Variables	No. of patients
Age	30–50	8
	51–60	7
	61–70	10
	71–90	10
Sex	Male	28
	Female	7

Table 2 Comorbidity profile in the study population (total number of patients [*n* = 35])

S. No	Comorbidity	No. of patients
1	Hypertension	16
2	Diabetes mellitus	19
3	COPD	5
4	Heart disease	5

Preprocedure Workup

PCC was performed as an inpatient procedure in all patients. As per the department protocol, preprocedure blood investigations such as prothrombin time, activated partial thromboplastin time (aPTT), and platelet count were performed. Coagulopathy, if present, was corrected with appropriate products when platelet count was below 50000, international normalized ratio (INR) > 1.5, and deranged aPTT.

Procedure Technique

The procedure was performed under local anesthesia with the patient in supine or semirecumbent position. Conventional single puncture technique, which involves direct insertion of the drainage catheter mounted over a stylet, as well as modified single puncture technique, without serial dilation of the tract, was used. In the modified single puncture technique, the distended GB is initially punctured with an 18G 15 cm Trocar needle (Cook Medical) under US guidance. Bile is aspirated and sent for culture. Then, a 0.035" short Amplatz guide wire (Cook Medical) is inserted through the needle and the needle is removed. An 8F single puncture pigtail catheter is inserted over the guide wire after removing the stylet. Percutaneous drainage catheters (Devon Innovations Private Limited) of different sizes were used.

The biliary drainages were passive. There was no protocol for flushing the drainage catheters. The patients were on empirical antibiotics and changed to appropriate antibiotics based on bile culture. Empirical antibiotics were continued in few patients, in whom bile culture did not grow any organism.

Outcomes

Primary success is defined as the placement of the pig tail catheter tube into the GB lumen. Clinical success is defined as the improvement in fever and abdominal pain and decrease in bilirubin. Primary failure is defined as inability to place the pig tail catheter into the GB lumen, and secondary failure is defined as dislocation/dislodgement of drainage catheter outside the GB lumen after initial successful placement.

Results

The interval between diagnosis (clinical and imaging) and PCC ranged from 5 hours to 14 days, with a median time gap of 48 hours. The explanations for this wide range of time interval included optimization of patients, and often delay due to failure of conservative treatment or acutely ill patients who were unfit for surgery. The imaging guidance used for

PCC was US in all cases, with CT being used as an adjunct in one case. PCC was performed as a bedside procedure in five cases in the study, as the patients were too unwell to be shifted to the procedure room. No patient required ascites drainage prior to the procedure.

Imaging: Complicated cholecystitis such as gallbladder perforation with pericholecystic collection on imaging was noted in 18 patients (51%) These patients were acutely ill with other comorbidities; hence, surgery was deferred for PCC. One patient had distal common bile duct (CBD) stricture due to recurrent pancreatitis, and another patient had cholangitis secondary to choledocholithiasis. In the remaining 15 patients (42%), there were no features of complicated cholecystitis on imaging. They were not taken up for cholecystectomy considering the high risk associated with the surgery.

In 28 patients (80%), there was GB calculus and sludge. Four patients (11%) had acalculous cholecystitis. Empyema and emphysematous GB was present in one case each. One patient had choledocholithiasis and cholangitic abscess in liver with very minimal intrahepatic biliary dilation. Mild ascites was documented in four patients (11%), but none of these patients required drainage before the procedure.

Procedure Outcomes

GB aspirate culture resulted in the growth of different organism listed in ►**Table 3**. Technically, the procedure was successful in all 35 patients (100%). One patient had a small parietal wall hematoma and continued to have fever and mild abdominal pain. He was treated with antibiotics and underwent cholecystectomy after a week. The other patient underwent repeat PCC, since the CT scan showed the drainage tube to be outside the lumen of GB after initial successful placement inside the lumen.

Table 3 Organism growth in the study population (total number of patients [*n* = 35])

S. No	Organism in bile culture	No. of patients
1	*Escheria coli*	15
2	*E. coli*, Klebsiella & *E. coli*, Enterococcus & *E. coli*, Pseudomonas	1 1 1
3	Enterobacter and Klebsiella, Enterobacter and Klebsiella, *Staphylococcus aureus*	3 2 1
4	Klebsiella, Bacteroides *S. aureus* Nonfermenting gram negative bacilli Enterococcus	3 1 1 1 1
5	No growth No results available	2 2

In 31 out of 35 patients (88%), PCC resulted in a clinical improvement of the patient in terms of relief of fever and abdominal pain. Two patients had to undergo emergency cholecystectomy due to clinical deterioration documented by increase in bilirubin, hypotension, and shock, and these patients recovered clinically after the surgery. Two additional patients did not improve clinically after PCC and developed nonprocedure-related complications such as renal failure and respiratory distress syndrome and were discharged against medical advice. PCC was technically successful in all 35 patients (100%) and clinical success was seen in 31 patients (88%). No major procedure-related complications or deaths were encountered (0%). Mortality was seen in 3 out of 35 patients (8%) secondary to nonprocedure-related complications. One patient died during the hospital stay due to sepsis. One patient died due to acute coronary syndrome and multiorgan dysfunction. Another patient, who was subsequently found to have hilar cholangiocarcinoma, passed away.

Discussion

The Revised Tokyo Guidelines classify acute cholecystitis into three grades, ranging from Grade I (mild) to Grade III (severe). Healthy patients who develop acute cholecystitis with mild inflammatory changes in the gall bladder and without any organ dysfunction, making cholecystectomy a low-risk operative procedure, are categorized as Grade I. Patients with elevated white blood cell counts, duration of symptoms for more than 3 days, palpable tender mass in right hypochondrium, and marked inflammation in gallbladder, such as gangrenous cholecystitis or perforation, are categorized as Grade II. Finally, patients with cholecystitis and organ dysfunction, who are critically ill, are categorized as Grade III. The guidelines suggest that surgically unfit grade II and III patients must be offered percutaneous intervention.[6,7]

The success rate for PCC is as high as 95 to 100%.[8] PCC can be used as a temporizing procedure to tide over the initial crisis, especially in high-risk candidates for surgery and in patients with severe sepsis. Following this, patients can undergo interval cholecystectomy. The advantage of PCC is that it can be performed under local anesthesia and as a bedside procedure.

We followed the conventional single puncture technique as well as a modified version of single puncture and Seldinger technique, wherein the catheter is introduced into the GB through the Seldinger technique but without any tract dilation. This modification reduces the risk of bleeding in patients with coagulopathy by avoiding serial dilation, risk of damage to pleura or other vasculature by using a smaller bore needle for puncturing the gall bladder, and risk of guide wire dislodgement during serial dilatations.

The transhepatic route has the advantages of reduced bile leak, quicker tract maturation, and greater catheter stability.[9] The intercostal or subcostal approach can be performed, but

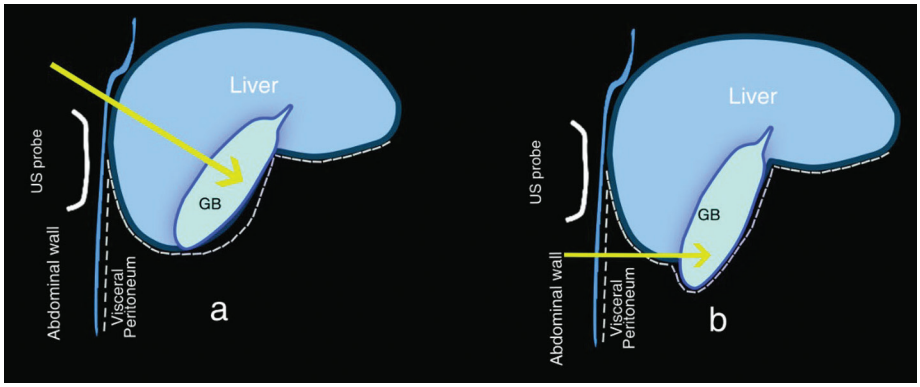

Fig. 1 Techniques to perform percutaneous cholecystostomy : transhepatic (**a**) and transperitoneal (**b**).

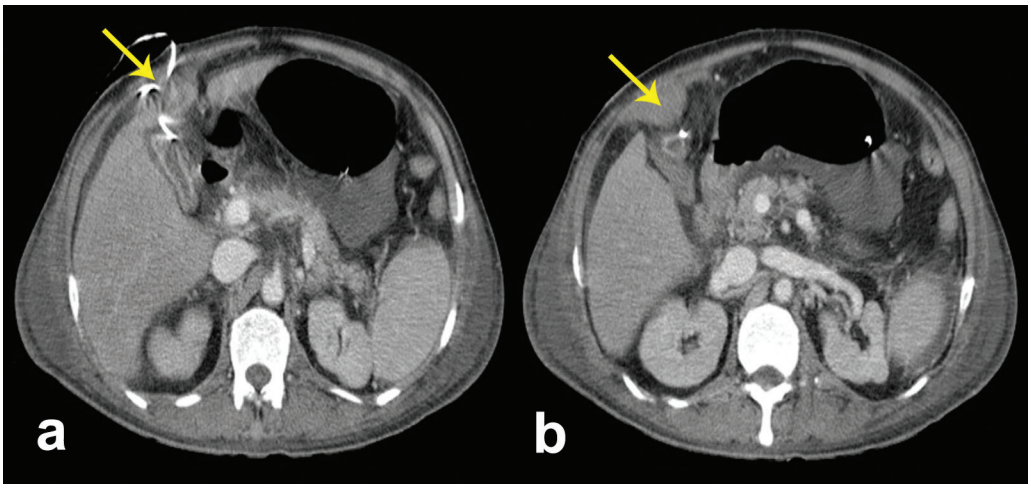

Fig. 2 CT performed on day 3 in a patient who underwent percutaneous cholecystostomy. Arrows showing drainage tube outside the lumen of gall bladder (**a**) and a small parietal wall hematoma (**b**).

care must be exercised to avoid pleural space (►**Fig. 1**). The transperitoneal route is used only when the transhepatic route is not accessible or in case of liver disease and coagulation disorders.[9]

In our series, there were no major procedure-related complications. One patient had a small parietal wall hematoma which resulted in mild abdominal pain and fever (►**Fig. 2**). In another patient, the tube had dislodged and had to be reinserted. There were no major complications or procedure-related mortality. Immediate complication rate in our study is significantly low when compared with literature which states a 5 to15% chance of pain, bleeding, pneumothorax, and biliary peritonitis. The Society of Intervention Radiology Guidelines 2010 states that over 95% cases of PCC are performed for gall stones and acute cholecystitis. Other less common indications are malignant biliary where endoscopic retrograde cholangio-pancreatography (ERCP) has failed and percutaneous transhepatic biliary drainage (PTBD) is not feasible due to nondilated biliary ducts.[5] In our study, except for one case all other patients underwent PCC for management of acute cholecystitis. One patient underwent the procedure as an alternative to PTBD in view of decompressed biliary system.

The steps involved in successfully performing US-guided PCC and the materials required for performing the procedure are illustrated in ►**Figs. 3** to **5**. A flowchart is given to serve as an algorithm for management of acute cholecystitis (►**Fig. 6**). Important points to remember at the time of procedure are mentioned in ►**Table. 4**.

The major limitation of this study was its retrospective nature. Information regarding the maintenance of catheters, duration of catheter placement, and change of dressing were not available. We would not have been able to collect minor complications in case they were not properly documented. Nine patients in our study underwent elective cholecystectomy and seven patients are planned for surgery. Ten patients did not attend follow-up.

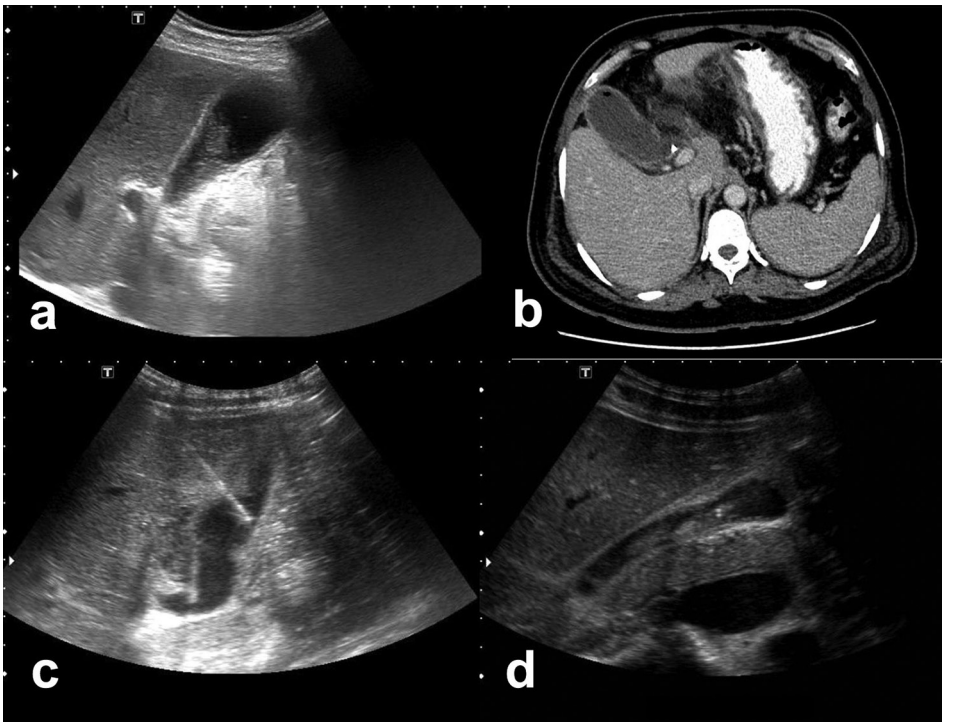

Fig. 3 Ultrasound and CT scan (**a** and **b**) in a case of acute cholecystitis. (**c**) Puncture of distended GB lumen with 18G Trocar needle through transhepatic route. (**d**) Collapsed GB lumen with pig tail catheter in situ.

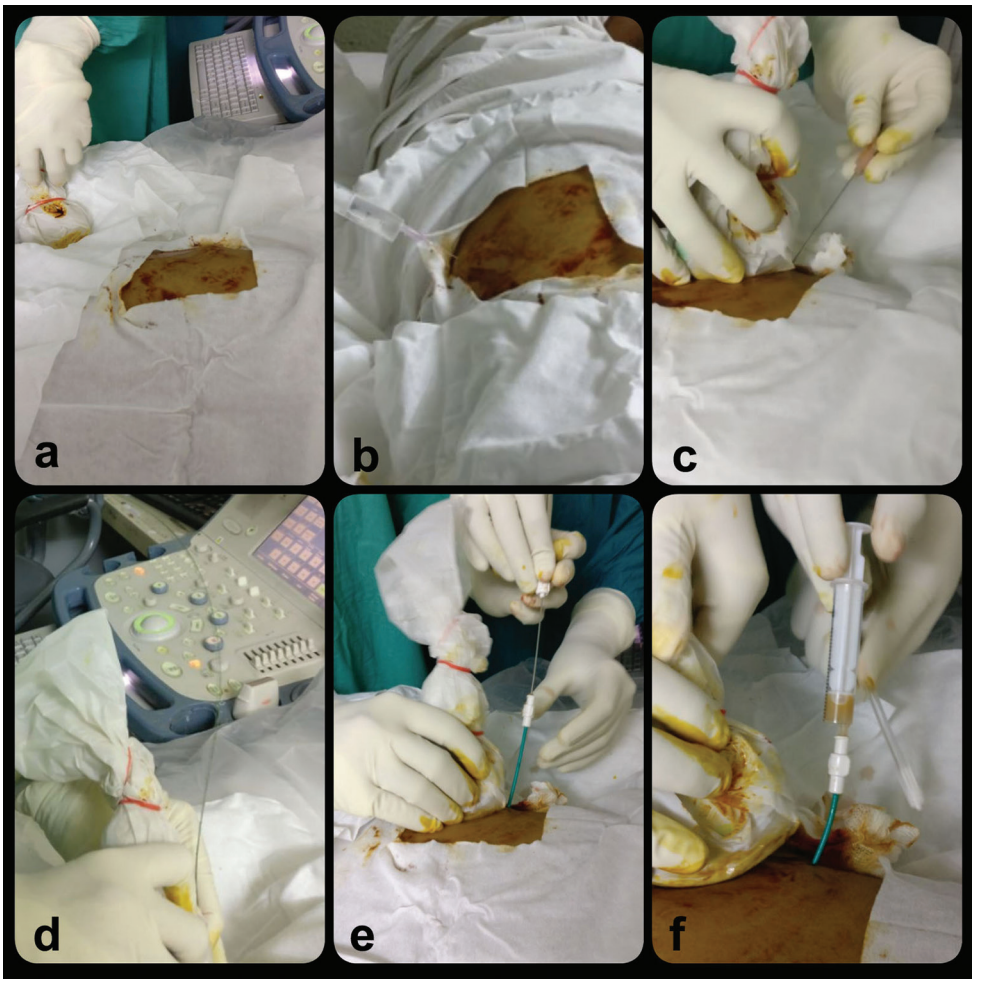

Fig. 4 Steps of image guided percutaneous cholecystostomy. (**a**) Cleaning and sterile draping of the patient; (**b**) Administration of local anesthesia; (**c**) Puncture of gall bladder lumen with an 18G Trocar needle under ultrasound guidance; (**d**) Passage of 0.035" Amplatz guide wire into the GB lumen through the needle; (**e**) Removal of stylet and insertion of pig tail catheter over the guide wire; (**f**) Aspiration of bile for culture for analysis.

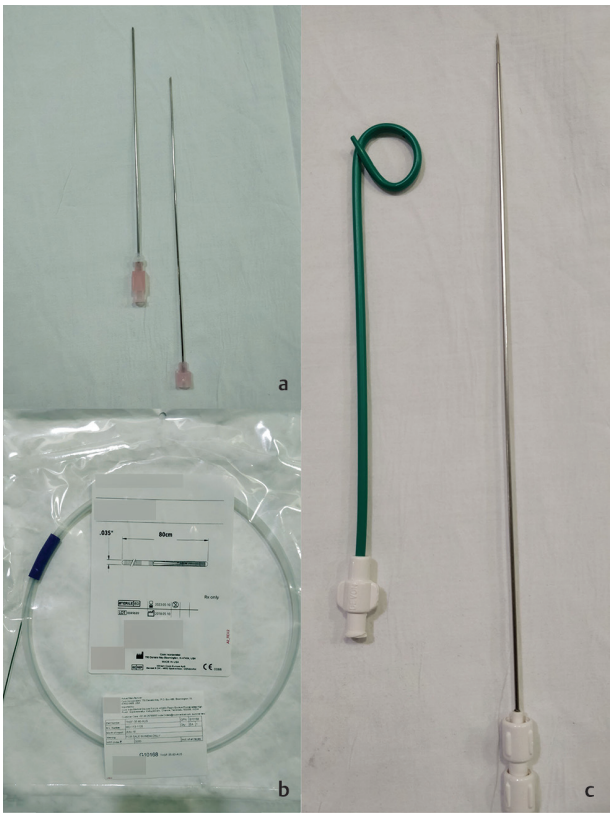

Fig. 5 Materials required for percutaneous cholecystostomy. (**a**) An 18G 15 cm needle; (**b**) 0.035" Amplatz guide wire; (**c**) Single puncture pigtail drainage catheter.

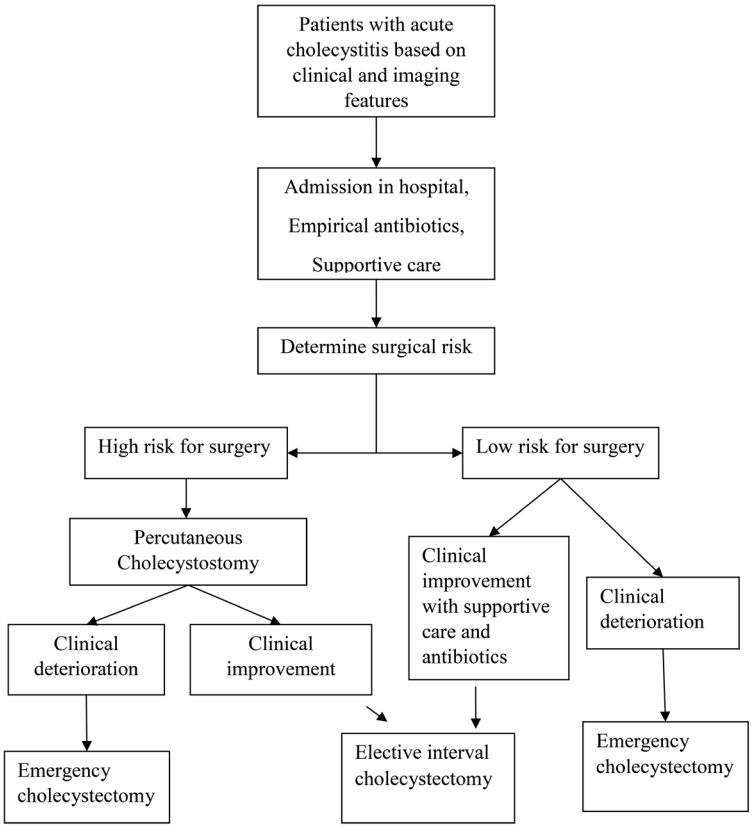

Fig. 6 Algorithm for management of acute cholecystitis.

Table 4 Precaution and care that must be taken during image guided percutaneous cholecystostomy

Steps	What to do?	What not to do?
Case selection	Clinical and imaging features of acute cholecystitis	–
Imaging guidance for PCC	USG (real time imaging) CT as backup	–
Prerequisites	Distended gall bladder and obstruction below the level of cystic duct. Drain ascites if any (to reduce chance of bleeding from the liver capsule).	Collapsed gall bladder (not required to do percutaneous cholecystostomy, technically may not be feasible)
Puncture route	Transhepatic preferred over trans-peritoneal (to reduce chance of biliary peritonitis)	Avoid puncture through vessels (to reduce chance of bleeding).
Attempts	"To traverse only once" (to reduce chance of biliary peritonitis and bleeding).	Avoid multiple punctures.
Puncture needle	18G needle with stylet.	–
Catheter	Single puncture pig tail catheter [8Fr] over 0.035" Amplatz guide wire.	Serial dilation with dilators.

Conclusion

Image-guided PCC is a simple, minimally invasive and effective procedure to treat acute cholecystitis, especially in patients who are high risk for surgery. The main advantage of PCC is that it can be performed at the bedside on an emergency basis. Conventional single puncture or modified single puncture technique through the transhepatic route and the usage of pig tail drainage catheter will lead to successful outcomes in majority of the cases.

Conflict of Interest
None.

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