

Original Research Article

Current experience with emphysematous cholecystitis

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ABSTRACT

Background: Emphysematous cholecystitis (EC) is a rare variant of acute cholecystitis with a reported 15-25% mortality rate. Conventionally, EC is managed with an early open cholecystectomy. However, recent advancement in percutaneous intervention and laparoscopic techniques have influenced our management of this biliary pathology. This study reviews the management and outcomes of EC in a regional centre.

Methods: Retrospective analysis of a clinical database constituting all patients diagnosed with EC at a regional Australian hospital in NSW from Jan 2010 to July 2019. Inclusion criteria: sepsis, abdominal pain and radiological evidence of gas in the gallbladder wall, lumen, and pericholecystic tissue in the absence of an abnormal connection between the gallbladder and gastrointestinal tract. We investigated patient risk factors, management and outcomes.

Results: 16 patients with EC were identified. The mean age of the cohort was 73 years old. The majority of patients had co-morbidity including type 2 diabetes and ischemic heart disease (56 and 62% respectively). Laparoscopic cholecystectomies were performed in 9 patients during their index admissions and 7 patients were managed with PTC. 5 patients required ICU admission for septic shock, and all were managed with PTC drain placement. The overall mortality rate was 6%.

Conclusions: Laparoscopic cholecystectomy on index admission is the treatment of choice for EC. Although more technically challenging, adverse clinical event including major complication and open conversion was avoided in our cohort while percutaneous cholecystostomy was reserved for unstable and poor surgical candidate.

Keywords: Emphysematous cholecystitis, Percutaneous cholecystostomy, Laparoscopic cholecystectomy

INTRODUCTION

Emphysematous cholecystitis (EC) is a rare life threatening variant of acute cholecystitis, constituting only 1% of all acute cholecystitis presentations.¹ It is characterised by gas within the wall, lumen, or pericholecystic tissue of the gallbladder as a result of necrosis and superimposed gas forming bacterial infection. It is considered a surgical emergency and early intervention is required due to the high reported mortality rate of 15 to 25%.^{1,2} Traditionally considered an indication of immediate open cholecystectomy, advances in laparoscopic surgery and increasing evidence of

percutaneous cholecystostomies have changed the landscape of modern treatment.^{3,4}

Micro-organisms associated with EC are *Clostridia* species, *Escherichia coli*, *Klebsiella* species, and anaerobic streptococci.⁵ Several theories have been proposed to explain the aetiology of EC. Although not fully understood, it is believed that the sentinel event preceding the development of EC is one of an ischemic nature. Gallbladder wall necrosis was subsequently followed with secondary translocation of gas-forming bacteria. Another hypothesis postulates that gallbladder distension from obstructive cholelithiasis results in mal-

perfusion, progressive necrosis and infection. Additionally, several studies have suggested several risk factors for EC including male sex, advanced age, diabetes or immunosuppression.⁵

Despite its rarity, complications from EC can be detrimental, gallbladder perforation may result in bile peritonitis, sepsis and multi-organs failure.³ Risk of perforation is also significantly higher in emphysematous cholecystitis than in uncomplicated cholecystitis, resulting in a higher comparative morbidity and mortality rate.

Clinical diagnosis of EC is often non-specific and initial presentation is identical to uncomplicated cholecystitis. However, patients with EC can deteriorate more quickly as gangrene can progress rapidly resulting in gallbladder perforation.⁶ Radiologically, EC is classified as grade 1 when intra-luminal gas is present within the gallbladder, grade 2 when gas is detected within the gallbladder wall and grade 3 when gas tracking into the pericholecystic tissue is detected.⁷ The aforementioned radiological features are best identified with computed tomography (CT) scan due to its high (99-100%) sensitivity.⁷ CT scan also has the added benefit of detecting pericholecystic changes indicating complicated disease including the presence of collection or perforation.⁸ Despite this, ultrasound (US) is still the first-line modality to investigate gallbladder pathology. This is because, US more readily detects gallstones and allows gallbladder wall thickness measurement. However, in the case of EC, US is of limited utility as it may not detect gas bubbles in small volumes while atypical gallbladder appearances (e.g., porcelain vs contracted gallbladder) may not be easily distinguished on US. Nonetheless, several USS findings to suggest EC include the presence of echogenic foci with posterior acoustic shadowing (ring-down artifact) and more specifically, the presence of rising bubbles in the gall-bladder (“effervescent gallbladder” or “champagne sign”).⁸

METHODS

A retrospective review of all patients diagnosed and managed with EC in a regional centre in NSW, Australia between January 2010 to July 2019. The local electronic medical record system was accessed, search term “emphysematous cholecystitis” was used, and a total 71 patient records were extracted. Inclusion criteria for the diagnosed EC includes radiological evidence of gas in the wall, lumen or pericholecystic tissue of gallbladder on either USS or CT imaging. Patients with biliary enteric communication or incidental findings with no clinical evidence of cholecystitis or sepsis were excluded. Of the 71 patient records, 16 patients met criteria for inclusion into study. Patient demographics were noted and primary outcomes including treatment modalities as well as the rate of CVS (critical view of safety) achieved in operative cases as well as mortality rate were analysed. Relevant secondary measures such as patient age, comorbidities,

ICU admission and complication rate were compared amongst the studied population. Descriptive statistics were reported as percentages including the mean and median where appropriate.

This retrospective study was approved by the local institutions review board as a negligible risk research activity and ethics review was not required.

RESULTS

Over a 9-year period, a total of 16 patients were diagnosed with EC in a regional Australian centre. All diagnoses were radiologically confirmed with the presence of changes typical of emphysematous biliary disease on either US or CT scans (see Figure 2). The average patient age was 73 years old (range 35-89, median 65). 5 patients were admitted to ICU on admission, presenting in septic shock requiring inotropic support, these 5 patients all underwent percutaneous transhepatic cholecystostomy (PTC). Mean length of stay in ICU for these patients was 4.4 days. 56% (n=9) of patients underwent laparoscopic cholecystectomy on index admission, 44% (n=7) underwent PTC intervention. The overall 30-day mortality rate was 6% however those requiring ICU admission had a mortality rate of 20%.

Conversion to subtotal cholecystectomy was observed in 1 out of the 9 patients managed operatively. This was due to severely indurated tissue planes, creating a hostile and potentially unsafe environment for a conventional cholecystectomy to be performed. Histopathology of all gallbladder specimens confirmed acute gangrenous cholecystitis. Conversion to open procedure was not required in any patients and no bile duct injury or post-operative biliary leak was reported. However, only 44% (n=4) of operation reports were able to confirm that CVS was achieved during the dissection. 2 patients required an interval endoscopic retrograde cholangiopancreatogram (ERCP) for concomitant choledocholithiasis. Unfortunately, 2 patients developed acute coronary event in the peri-operative period requiring medical management only. Both patients were known to have underlying ischaemic heart disease (IHD).

On the other hand, a total of 7 patients underwent PTC with no procedural complications. Excluding the single mortality, all cholecystostomy drains were left in situ for 4 weeks till review in outpatients. The mean length of stay (LOS) in hospital was 8.2 days in the PTC cohort versus 3.4 in the operative cohort.

Lastly, we noted that, in our cohort, male sex was more common with a male to female ratio of 5:3. The distribution of co-morbidities (Figure 1) was the following: 56% of patients were diabetic, 25% had chronic obstructive pulmonary disease (COPD), 62% of patients had a history of IHD, 75% had hypertension and 62% had underlying chronic kidney disease (CKD).

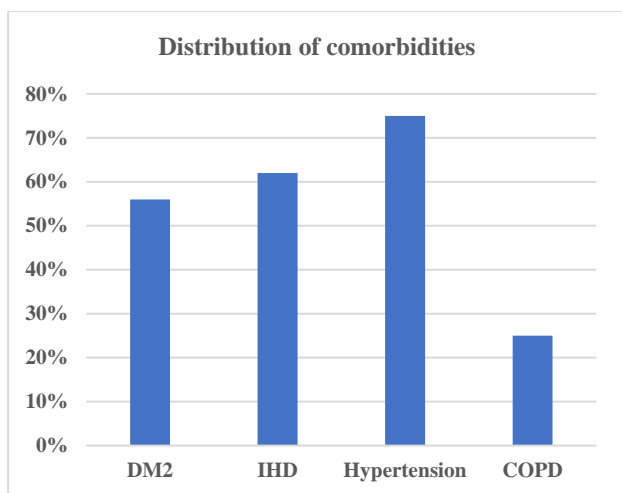


Figure 1: Comorbidities of patients treated for emphysematous cholecystitis.



Figure 2: 65-year-old male with a background of COPD presents with abdominal pain and sepsis. Contrast enhanced CT abdomen demonstrates a distended gallbladder with pericholecystic stranding and gas within the lumen. Patient underwent a laparoscopic cholecystectomy.

DISCUSSION

EC is a rare entity. Only 16 cases were confirmed in our institution over a 9-year period. Once believed to be a surgical emergency requiring open cholecystectomy, our data shows that in patients with haemodynamic stability and deemed fit for surgery, laparoscopic cholecystectomy is a safe and preferable approach.^{3,9} 56% of our patients were managed surgically. Laparoscopic approach was used successfully in this group with 0% 30-day mortality and open conversion was not required. This is a stark difference to an earlier study by Eldar et al where open conversion was seen in 49% of gangrenous cholecystitis versus 4.5% in uncomplicated cholecystitis.¹⁰ Since then, case reports and cohort studies have similarly found success in managing EC laparoscopically in select patients.^{3,11}

In patients with confirmed EC, the severity of tissue inflammation along with poor integrity of the gall bladder wall makes such cases technically more challenging. The concept of CVS was developed by Strasberg et al to minimise risk of bile duct injury and since then has been widely accepted as standard of safety in laparoscopic cholecystectomy.¹² Nassar et al found in a prospective study 84.2% of laparoscopic cholecystectomies achieve CVS and rate of achieving CVS negatively correlates to the difficulty grade.¹³ In our institute routinely the CVS is reported and as such, using this as a surrogate for technical difficulty, we report only 44% of our operative cohort had CVC achieved. Despite the technical challenges, no bile duct injury or intraoperative complication was reported. Previous studies have also recommended for subtotal cholecystectomy to be employed in severe cases where anatomy cannot be accurately assessed and especially if operative cholangiogram is not possible.¹⁴ In our cohort, only 1 case could not proceed with completion cholecystectomy due to severe inflammation resulting in distortion of tissue planes. Consequently, decision was made to perform a subtotal cholecystectomy instead.

Nonetheless, for unstable patients or those unfit for anaesthetic, percutaneous cholecystostomy is a viable and safe option. Imanzadeh et al reported in a cohort study of patients with EC undergoing PTC that mortality rate was 10%.⁴ PTC was used as definitive treatment in 40% of patients while 50% of the cohort underwent interval cholecystectomies.⁴ Mortality rates have, since, declined owing to advances in percutaneous techniques and hemodynamic support.^{4,15,16} Our study also exhibited a similar trend with an overall 30-day mortality of 6%. In our cohort, all patients requiring hemodynamic support underwent PTC placement with one death from severe septic shock. 2 patients not requiring ICU still underwent PTC as they were deemed unfit for surgery.

Despite this, PTC is a morbid treatment. Imanzadeh's group reported a median duration for drainage tube removal of 140 days post procedure while, in our cohort, all drains were left in-situ for a minimum of 4 weeks. The relatively prolonged percutaneous drainage placement is a potential source of considerable distress for patients. Moreover, LOS is also significantly longer for patients undergoing PTC than operative treatment although this is likely due to the severity of the pathology and patients' comorbidities.

The distribution of comorbidities demonstrated on Figure 1 finds that majority of our patients were diabetic and had underlying IHD, 56% and 62% respectively. Similar to other studies the male sex was more commonly associated with EC and comorbidities of diabetes.¹⁶ In the surgical group, 2 patients developed post-operative ACS. Therefore, in patients with EC it is common that significant underlying medical conditions exist predisposing these patients to cardiac complications post operatively. A multidisciplinary approach is required to

manage these complex patients by involving anaesthetics and appropriate medical physicians early in the management.

Though the exploratory nature of this study highlights some important features of EC and its evolving management, the study is limited by the small population size as such conclusive statistical evidence cannot reliably be reported. Furthermore, there is heterogeneity in the experience and training of surgeons, while our study demonstrates high level of success with minimally invasive surgery in EC this may not be true for other centres. A prospective registry database of EC cases is required for further study into this rare entity.

CONCLUSION

Emphysematous cholecystitis is a rare variant of acute cholecystitis. It warrants emergent intervention due to its significant risk of rapid clinical deterioration. Laparoscopic cholecystectomy is the preferred approach in select patients. Subtotal or partial cholecystectomy may be performed when dissection is unsafe to proceed conventionally. Although a safe and efficacious intervention, PTC should be reserved for patients who are deemed unfit for surgery or with haemodynamic instability requiring inotropic support.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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