The Egyptian Journal of Radiology and Nuclear Medicine xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

The Egyptian Journal of Radiology and Nuclear Medicine

journal homepage: www.sciencedirect.com/locate/ejrnm

Original Article

Surgical and non-surgical treatment of non-traumatic gallbladder perforation

Mohammad Alaa Abusedera, MD *, Magdy Khaliel, MD, Assem Elsani M.A. Hassan, MD

Department of Diagnostic Radiology, Sohag University, Egypt
Department of General Surgery, Sohag University, Egypt
Department of General Surgery, Sohag University, Egypt

ARTICLE INFO

Article history:
Received 10 August 2016
Accepted 9 October 2016
Available online xxxx

Keywords:
Gallbladder perforation
Surgery
Percutaneous catheter
Drainage

ABSTRACT

Objective: Our aim was to present a single-center experience in the management of gallbladder perforation (GBP).
Patients and methods: Adult patients who had GBP were managed surgically and percutaneously. Patients who were high risk surgical candidates or who refused surgery were managed by image guided percutaneous drainage.
Results: Thirty-seven patients (21 males, 16 females) with an average age of 64 ± 14 years had GBP. The number of patients with GBP type I, II, and III were 13, 21, and 3, respectively. All GBP types I and III patients were treated surgically. Eleven of GBP type II patients were treated surgically, and 10 were treated by percutaneous catheter drainage. The overall mortality rate was 27% (10/37). No procedure-related mortality rate among those patients who were treated percutaneously; however, 30 days post procedure, the mortality rate was 30%. All of these deaths were related to the patients' comorbidities; none of them was due to septicemia but conversely in surgically treated patients, 5 died due to septicemia (3 in GBP type I and 2 in GBP type II) in the postoperative period and one patient died because of severe internal hemorrhage complicating acute pancreatitis and one patient died few months later because of myocardial infarction.
Conclusion: Surgery is the cornerstone of treatment for all types of GBP. Percutaneous catheter drainage is a safe and effective option for treating patients with localized disease with favorable outcome.

1. Introduction

Gallbladder perforation (GBP) is a rare but serious complication of cholecystitis which needs to be managed promptly. GBP incidence ranges from 2% to 11% [1,2]. Gallbladder stones are the most common cause of acute cholecystitis, and a calculus cholecystitis is seen in only 5–10% of cases [3]. The fundus is the most common site of GBP followed by the body, and this may be due to poor blood supply in the fundus [1,4].

Historically, GBP has been associated with high mortality rate, which ranges from 11% to 26% [5]. Niemeier, in 1934, classified GBPs into three types: type I (acute) that was associated with generalized biliary peritonitis; type II (subacute) that consisted of the localized collection of fluid at the site of perforation, and it also featured pericholecystic abscess and localized peritonitis; and type III (chronic) that represented the formation of internal or external fistulae [6]. Preoperative diagnosis is challenging and many cases may be diagnosed during surgery [7,8].

The ultrasonographic picture of GBP is diverse and non-specific. Findings include wall thickening (>3 mm), distension (largest diameter: >3.5–4.0 cm), gallstones, coarse intracholecystic echogenic debris, and bile duct dilatation. Distension of the gallbladder and edema of its wall may be the earliest detectable signs of impending perforation. The "hole sign" (a defect in the gallbladder wall) is the most specific finding. In study by Stood et al, ultrasound (US) detected perforation in 61% (11/18) of cases and computed tomography (CT) detected it in 78% (14/18) [9]. Early diagnosis of GBP and immediate surgical intervention is of crucial importance [10].

Peer review under responsibility of The Egyptian Society of Radiology and Nuclear Medicine.

* Corresponding author at: Prince Hammod st, Saad specialist Hospital, P.O: 30353, Alkhobar 31952, Saudi Arabia.
E-mail address: Malaa2@yahoo.com (M.A. Abusedera).

http://dx.doi.org/10.1016/j.ejrnm.2016.10.005
0378-603X/

The aim of this study was to present single-center experience in the management of GBP by using surgical or percutaneous non-surgical techniques. The later technique was applied in selected patients.

2. Patients and methods

This is a retrospective study of adult patients from the University Hospital who had GBP from August 2003 until June 2014. Cases of traumatic, iatrogenic GBP or perforation that occurred in children were excluded. Institutional review board approved this study. The patients' informed consent for the research was waived due to the investigation's retrospective design. Patients' informed consent for the procedure – either for surgical or percutaneous intervention – was obtained from each patient. Clinical presentations and investigations were reviewed from the patients' medical records.

Patients who presented with acute abdominal pain, fever, tenderness, rebound tenderness, and those who were positive for Murphy's signs were subjected to US and CT examinations, as well as for a laboratory workup for acute abdomen. Surgical treatment was the first line of treatment for cases of perforated viscous complicated by acute peritonitis. The CT and US diagnostic criteria for GBP were as follows: a thick edematous, distended gallbladder wall with or without stones; pericholecystic collection or localized perihepatic collection; and free intraperitoneal fluid collection.

Liver and renal function tests, complete blood count (CBC), total leukocytic count and the differential count, C reactive protein (CRP), as well as a surgical fitness examination (including echocardiography and chest radiography) were performed. Patients surgical risk was evaluated by using American Society of Anesthesiology (ASA) physical status classification system [11]. Surgically-fit patients were subjected to laparoscopic cholecystectomy as soon as possible following good hydration and the correction of electrolyte imbalances in addition to empiric broad spectrum antibiotics. When laparoscopic cholecystectomy was not technically feasible, the procedure was converted to an open cholecystectomy, where peritoneal lavage was carried out and a tubal drain was inserted.

High risk surgical candidates, who were class IV or V, were subjected to Ultrasound guided percutaneous drainage by using 8.5 and 10 Fr multipurpose drainage catheter to decompress the gallbladder by a *trans*-hepatic approach in all cases with local infiltration anesthesia. One of two techniques was used to insert catheter: the single step trocar or modified Seldinger technique. The single step trocar is simple (Fig. 1a) in which multipurpose drainage catheter assembled over its metal stiffener and trocar. The set was inserted through the liver targeting the gallbladder and the sub-hepatic collection then the trocar is removed and catheter advanced over the metal stiffener to the collection and loop is formed while the metal stiffener was removed (Fig. 1b). Catheter position was confirmed by contrast injection through the catheter (Fig. 2c).

The other technique is modified Seldinger technique in which the catheter is introduced over guide wire in two steps. After injection of infiltration anesthesia, 18 gauge vascular access or Chiba needle was introduced to the gallbladder through the liver guided by Ultrasound and confirmation of needle position by injection of contrast (Fig. 2a) then stiff 035 guide wire was inserted in the gallbladder (Fig. 2b). The needle was removed leaving the guide wire, in place, over which catheter with its plastic stiffener was advanced over the guide wire under Fluoroscopy guidance. The guide wire and stiffener were removed, catheter loop was formed and position was confirmed by contrast injection (Fig. 2c).

Another catheter was used to drain the localized collection, and to drain the liver abscess. The detailed standard technique of percutaneous image guided catheter insertion was described in many previous articles [12]. Each catheter was connected to bag for gravity-assisted drainage and flushed with 10 ml of normal saline every 8 h to prevent catheter obstruction. Antibiotics were continued based on culture and sensitivity. Catheters were kept in place until the catheter output declined to about 10 ml/24 h, and clinical improvements were indicated by normalization of the leukocytic count and the disappearance of fever and tenderness. Those patients were followed up by Ultrasound examination every three days and CT scan was carried out when catheter removal was contemplated. Data were tabulated and Student's *t*-test was applied to compare quantitative data; *P*-values $\leqslant 0.05$ were considered statistically significant.

3. Results

Thirty-seven patients (21 males and 16 females) comprised the study population. The patients' mean age was 64 ± 14 years.

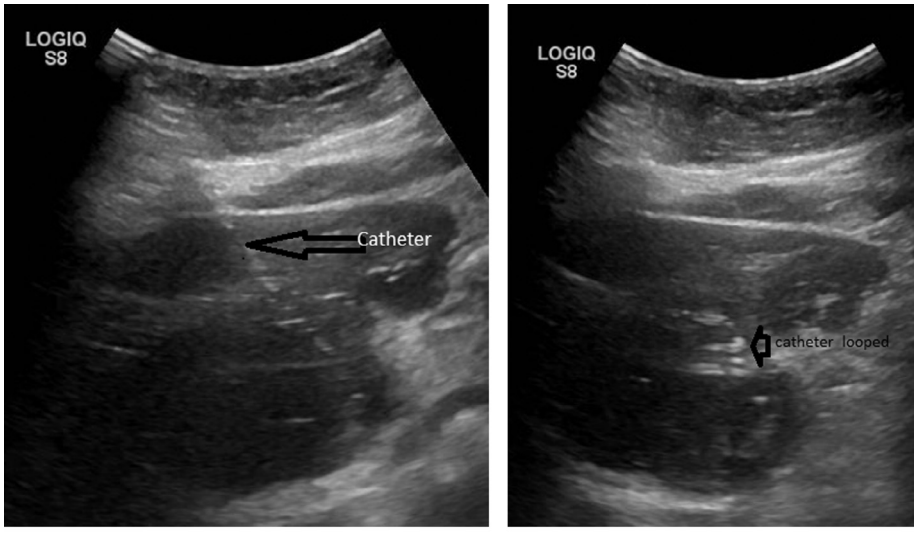

Fig. 1. 73 years old male patient was diagnosed gallbladder perforation type II and he refused surgical intervention. Percutaneous drainage was carried out by insertion of 8.5 Fr multipurpose drainage catheter inserted through the liver to the gallbladder (a). The stiffener was removed and catheter was looped in the collection (b).

Please cite this article in press as: Abusedera MA et al. . Egypt J Radiol Nucl Med (2016), http://dx.doi.org/10.1016/j.ejrnm.2016.10.005

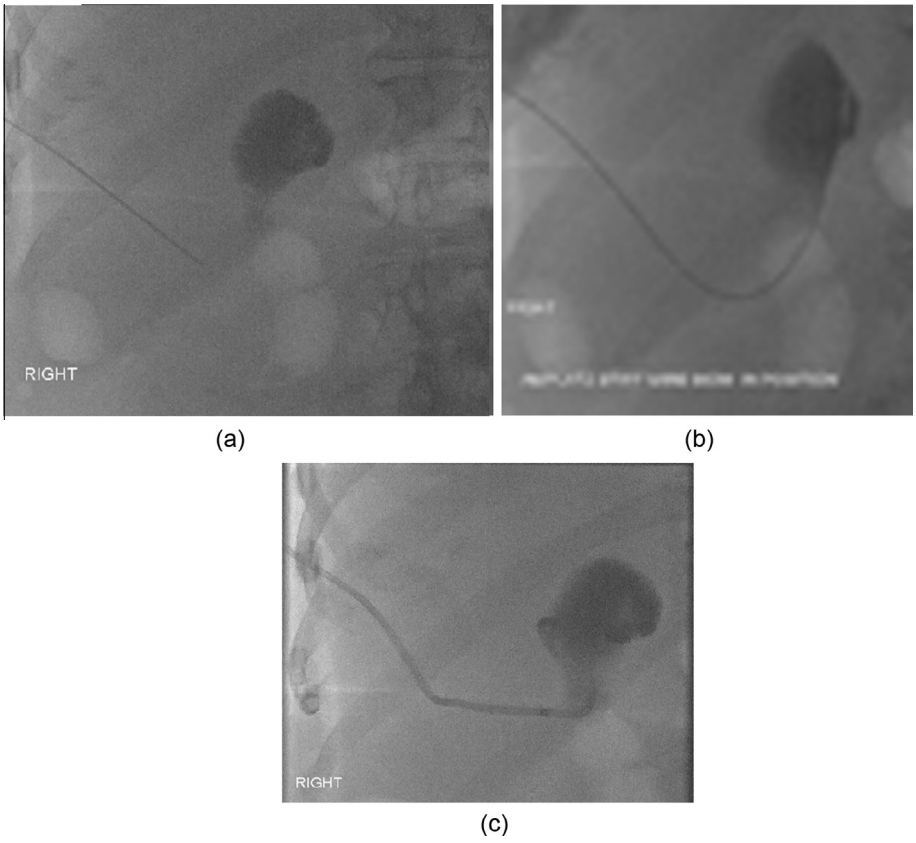

Fig. 2. 65 years old female patient with GBP type II with sub-hepatic collection. Needle was inserted through the liver parenchyma to the collection guided by Ultrasound. Needle position was confirmed by contrast injection under fluoroscopy (a) and then 0.35 super stiff Amplatz guide wire was inserted in the collection (b). The needle was removed and catheter was inserted over the guide wire supported by its plastic stiffener. The catheter was advanced to the collection and then stiffener and guide wire were removed and self-retaining loop of the catheter was formed confirmed by contrast injection(c).

According to Neimer's GBP classification system, 13 patients (6 males and 7 females) were classified as GBP type I and were treated by laparotomy and surgical exploration.

Twenty-one patients (12 males and 9 females) were classified as GBP type II. Three patients had GBP type III; all were males. A preoperative diagnosis was made in all patients with GBP type II and in 12 patients with GBP type I. None of the GBP type III patients were diagnosed preoperatively.

Distended gallbladder (>5 cm in maximum diameter) and wall thickening (>3 mm) thick and edema were the most common findings seen in 81% of patients *(n = 30)*. Pericholecystic fluid collection was seen in 78% *(n = 29)*, localized sub-hepatic and at gastrohepatic recess fluid collection in 65% (n = 24), and free intra peritoneal fluid collection in 35 % *(n = 13)*. Gallbladder mass was seen in 2% *(n = 1)*, and Liver abscess in 2% *(n = 1)* that was seen as hypodense area adjacent to distended gallbladder. The abscess wall and that of gallbladder enhanced after IV contrast. Distended gallbladder with impacted stone at cystic duct with peri cholecystic collection is seen by Ultrasound in 62% *(n = 23)*, distended edematous gallbladder without stones in 27% *(n = 10)*, non distended thick walled gallbladder with stones in 5% *(n = 2)* and turbid internal echoes were seen in 27% *(n = 10)*.

Ten of the 21 patients with GBP type II were so high-risk surgical candidates who were managed by percutaneous drainage, while 11 patients were treated surgically. Laparoscopic cholecystectomy was carried out in 7 patients and open surgical cholecystostomy and peritoneal lavage were performed in 4 patients, followed by elective laparoscopic cholecystectomy after the quiescence of inflammation.

All patients who had GBP types I and III were classified as ASA class II and III and were managed surgically; all GBP type I patients *(n = 13)* underwent exploratory laparotomy, while all GBP type III patients *(n = 3)* underwent laparoscopic cholecystectomy, which was converted to open cholecystectomy due to the presence of adhesions and given the difficulties faced when exposing the gallbladder. An intraoperative diagnosis of GBP with cholecystoenteric fistulae was obtained and treated by cholecystectomy and fistulectomy.

Patients who were managed percutaneously were older than those managed surgically; the patients' median ages were 73 and 54 years, respectively. The percutaneously treated group had more comorbidities than the surgically treated patients, and the difference was statistically significant (Table 1). Patients who were treated percutaneously were ASA class V in 60% *(n = 6)* patients and class IV in 4 patients. Surgically treated patients were ASA class II in 100% of GBP type I patients *(n = 13)* and in 27% patients of GBP type II *(n = 3)*; Class III in 64% of GBP type II *(n = 7)* and in 100% of GBP type III *(n = 3)*; and Class IV in 9% of GBP type II *(n = 1)*.

The comorbidities were as follows: peripheral arterial disease in 90% in the percutaneously-treated group compared to 19% in the surgically-treated group; DM and ischemic heart disease; chronic obstructive pulmonary disease (COPD); cardiomyopathy; ESRD with regular dialysis renal and respiratory failure; cerebrovascular stroke; and septic shock. DM was the most frequent comorbidity among the surgical patients, followed by ischemic heart disease. Acute calcular cholecystitis was seen in 26 patients and acalcular cholecystitis in 11 patients.

Perforation was diagnosed at the fundus in 38% of GBP type II patients (n = 8) and in 69% of GBP type I patients (n = 9). Neck perforation was seen in 14% of GBP type II (n = 3) and in 31% of GBP type I (n = 4) patients, while body perforation was seen in all patients with GBP type III (n = 3) and in a single patient with

Table 1
Comparing the data of patients treated either by percutaneous catheter or surgically.

		Percutaneous (n = 10)	Surgical (n = 27)	*P*-value	Total
Age		69–82	52–71	3.12	
Sex	M	8	13		21
	F	4	12		16
Duration from onset to diagnosis		12 (7–19)*,a,°	5 (2–7) type I[a] 11 (8–20) type II* 52 (25–70) type III°	*0.4 [a]0.001 °0.0003	
WBC		17,000 (12,000–20,000)	18,000 (9,000–19,000)	0.26	
Fever		39.5 (38–40)	38 (37–40)	0.28	
Comorbidities					
DM		8 (80)	11 (41)	0.0017	18/37 (49)
IHD		7 (70)	12 (44)		19/37 (51)
Cardiomyopathy		3 (30)	0		3/37 (8)
COPD		4 (40)	1(4)		5/37 (15)
Renal failure		3 (30)	2 (11)		5/37 (15)
Respiratory failure		3 (30)	0		3/37 (8)
Septic shock		1 (10)	2 (7)		3/37 (8)
Ischemic stroke		1 (10)	0 (0)		1/37 (3)
Peripheral arterial disease		9 (90)	5 (19)		14/37 (38)
Outcomes					
30-day mortality		3 (30)	6(22)	0.018	
Long-term mortality		0 (0)	1 (4)		
Complications: bleeding		1 (10)	1 (4)		
Pancreatitis		0	3 (11)		
Septicemia		0 (0)	8 (30)		
Immediate post-procedure mortality		0 (0)	4 (15)		
Hospital stay in days		15 (15–28)*,a,°	Type I 10 (9–17)[a] Type II 16 (14–32)* Type III 14 (8–17–19)°	*0.2 [a]0.0002 °0.07	

The numbers in parentheses represent percentages.
WBC: White blood cell count.
DM: Diabetes mellitus.
IHD: Ischemic heart disease.
COPD: Chronic obstructive pulmonary disease.

GBP type II; it was complicated by a liver abscess. GBP type III patients with cholecystoenteric fistulae were diagnosed during laparoscopic cholecystectomy, which was subsequently converted to open surgical cholecystectomy.

The site of perforation was not identified in 42% of GBP type II patients (n = 9) who were treated by percutaneous drainage. Fever and leukocytosis were seen in all patients with GBP type I and type II, and in 33% of patients with GBP type III. There were no differences in the level of leukocytosis among the surgically-treated and percutaneously-treated patients.

GBP type III patients showed mild symptoms and a long duration between the onset of symptoms and presentation (mean: 52 days), but this duration was shortest for GBP type I (mean: 5 days) ($P = 0.0003$), and that for GBP type II was significantly different from that for GBP type I ($P = 0.001$) (Table 1).

All patients with GBP type I presented with the typical criteria for surgically acute abdomen and peritoneal irritation; they suffered from fever, pain, tenderness and rebound tenderness, rigidity, and guarding (n = 13). All GBP type II patients presented with pain, tenderness in 90% (n = 19), and a right upper abdominal mass (n = 2); jaundice was evident in a single patient who had a liver abscess. A subhepatic abscess was seen in 21 patients (Fig. 3).

All critically ill, poor surgical candidates of GBP type II (n = 10) were managed by percutaneous drainage (Fig. 4) by transhepatic cholecystostomy; an additional catheter was placed in patients with a subhepatic abscess (n = 9; 90%). Two patients required 3 pigtail catheters each: one to decompress the gallbladder, one to drain the subhepatic abscess, and another to drain the liver abscess. 23 catheters were inserted in 10 patients at a rate of 2.3 catheters per patient. The most common used catheter was 10 Fr *(n = 17)* and the rest of catheter (n = 6) were of 8.5 Fr caliber.

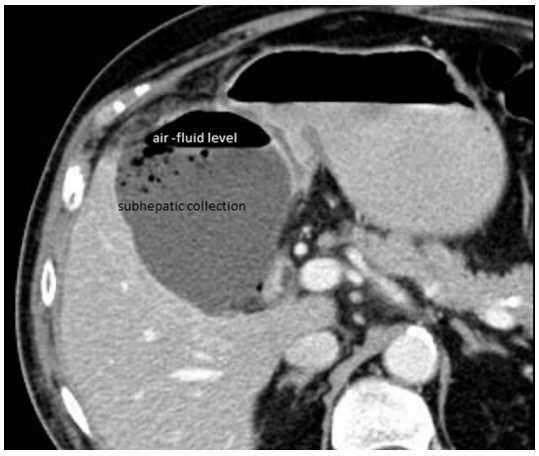

Fig. 3. 66 years old woman presented with frequent attacks of upper abdominal pain, recently pain worsen associated with fever and rigor and leukocytosis CT scan showed large sized cavity at the sub-hepatic region with air fluid level and was not separated from the thick walled gallbladder. Patient managed by cholecystectomy and abscess drainage and peritoneal lavage and recovered after 12 days.

Catheter drainage duration ranged from 15 to 28 days. The daily catheter output ranged from 150 to 400 ml. Progressive decline was noticed gradually. Catheter obstruction was noticed in one patient when recurrence of fever was noticed and elevation of CRP and WBC after improvement. The rise in inflammatory markers was associated with catheter output reduction from approximately 120 ml to 10 ml and US examination showed increased

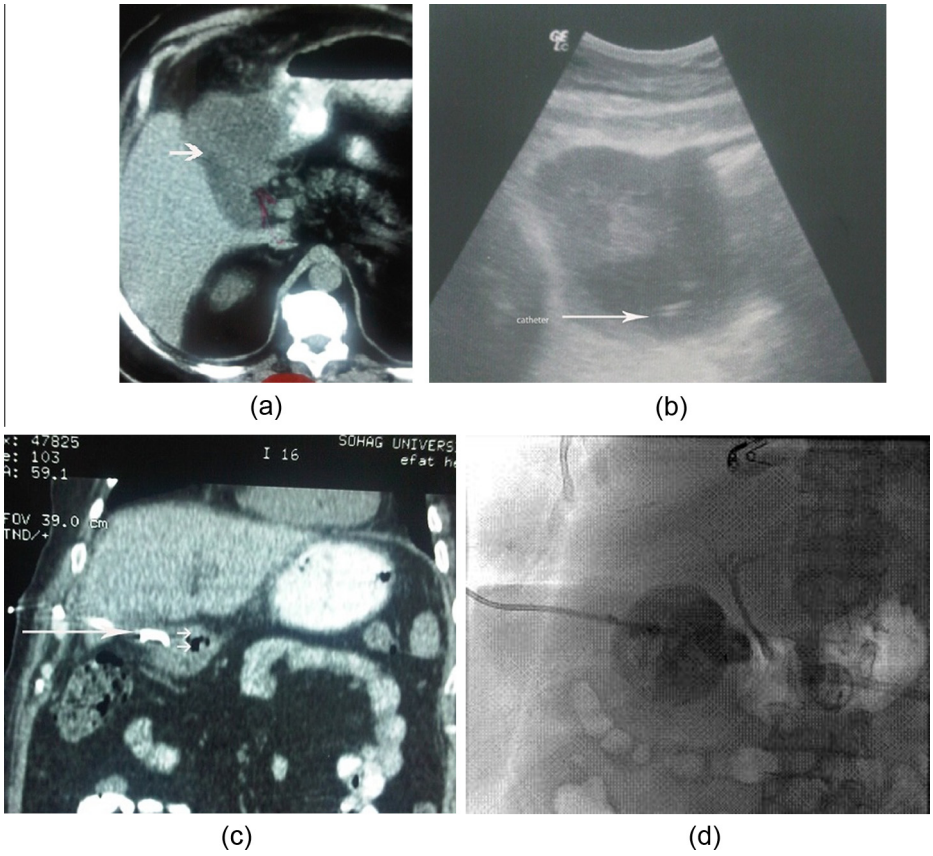

Fig. 4. 76-year-old man presented with upper abdominal pain and tenderness, as well as with fluctuating fever and progressive leukocytosis. The patient's WBC was 16,000 over the course of 10 days. CT scan (a) showed a perforated gallbladder with pericholecystic fluid collection (arrow). The patient had coronary artery disease with ischemic cardiomyopathy and an ejection fraction (EF) of 23%; the patient refused surgery. (b) Ultrasound-guided insertion of an 8.5 French pigtail catheter (arrow) was carried out following diagnostic aspiration of the sub hepatic fluid collection, and another catheter was placed in the gallbladder (not shown). Then, 10 days later, the catheter output from the sub hepatic fluid collection declined to about 5 mL/24 h and the patient's WBC declined to normal. Coronal CT scan (c) showed resolution of the fluid collection and the presence of few air bubbles (small arrows); the catheter (long arrow) was later removed. (d) Cholecystogram in a different patient following the quiescence of inflammation showed a patent cystic duct. Finally, a cholecystostomy catheter was removed and no further management was carried out for this patient.

size of sub-hepatic collection compared to the previous examination. The obstruction was managed by upgrading the catheter from 8.5 Fr to 10 Fr with regular flushing of the catheter with 10 ml of normal saline every 8 h. One patient experienced shivering and rigor during catheter insertion that was difficult and associated with bacteremia that was managed by IV injection of non-steroidal anti-inflammatory medication.

Overall mortality of GBP was 27% (n = 10/37). Nine patients died within 30 days. Three patients out of 13 *(23%)* of GBP type I died with septicemia. Six patients of GBP type II died within 30 days. Three of GBP type II who were surgically treated patients *(27%)* died, 2 because of septicemia and one due to internal hemorrhage complicating acute pancreatitis. Three of GBP type II who were treated by percutaneous catheter insertion *(30%)* died because of medical causes not because of septicemia; one died due to aspiration pneumonia and respiratory failure that was complicated by multiorgan failure; 1 patient suffered from a massive myocardial infarction, and 1 succumbed to a recurrent cerebrovascular stroke. One patient of surgically treated GBP type II died 6 months later because of myocardial infarction. All patients of GBP type III survived during the follow-up of the study.

Complications were pancreatitis in 3 surgically-treated patients and one of them was complicated by internal bleeding. Stress duodenal ulcer with massive upper gastrointestinal bleeding that was controlled by endoscopy was seen in one patient of GBP type II treated percutaneously.

Septicemia was seen in 8 Patients of surgically treated GBP type II, and only two of them survived.

Final CT examination before catheter removal showed collapsed gallbladder over the catheter with resolution of perihepatic fluid collection, and follow-up CT after few month showed average capacity of gallbladder with normal wall thickness without recurrence of inflammation during the follow-up of 18 months.

Seventy percent of percutaneously treated patients (n = 7) were followed for up to 18 months evaluated by ultrasound examination every month for three months and then every three months. Examinations showed no recurrence of acute cholecystitis; they did not require further intervention. Elective laparoscopic cholecystectomy was carried out in three patients and two patients refused surgical intervention, rest succumbed to their morbidities

The length of hospital stay was shortest in GBP type I patients compared to that for GBP type II and III patients; this difference was significant. The length of hospital stay did not differ between the surgically and percutaneously treated GBP type II patients.

After resolution of inflammation, cholecystogram was carried out in 6 patients. All of them showed patent cystic duct without fistulous. Small stone at the distal common bile duct is seen in one patient.

4. Discussion

GBP is a rare but serious complication of acute cholecystitis. In some cases, differentiation between GBP and uncomplicated acute cholecystitis may be difficult; that is the reason why there is associated high morbidities and mortalities [7,9,13].

Treatment options are an urgent laparotomy (or laparoscopy) or percutaneous gallbladder drainage by image guided catheter insertion.

Emergency laparotomy with cholecystectomy, drainage of abscess (if present) and peritoneal lavage have been performed in many reported cases [14] or recently by laparoscopy in selected cases [15].

Advanced age, male gender, fever >38 °C, a high white blood cell count, and the presence of cardiovascular comorbidities are significant risk factors for GBP. Early diagnosis and prompt surgical intervention are cornerstones for the management of GBP [16]. Acute calcular, or less common non-calcular, cholecystitis may be complicated by ischemia resulting in necrosis and perforation [17–19].The fundus is the most common site of perforation because it is the most distal part for the blood supply [20]. In our study majority of GBP type I patients was at the fundus (69%) and fundus is not covered with omentum allowing free bile leakage and development of acute abdomen and biliary peritonitis; in 42% of GBP type II patient the site of perforation could not be identified.

In our study, GBP was seen more frequently in males than in females (21 males versus 16 females); their average age was >64 years. These results were in agreement with those of other authors who found that although cholecystitis was more common in females, perforation was more common in males and in the elderly [2].

GBP type I is an acute condition, and so the time lag between symptom onset and diagnosis was short when compared to GBP type III and type II. This time lag was 5, 12, and 50 days, on average, for GBP types I, II, and III, respectively. This can be explained by the natural history of GBP and free peritonitis in GBP type I patients in contrary to chronic inflammatory picture of GBP type and the subacute state where the omentum reacts to conceal the perforation in GBP type II. This hypothesis is supported by the presence of fever and leukocytosis in all type I patients and in the majority of type II patients, but fever or leukocytosis was lacking in type III patients. This finding agreed with that by Derci et al. [16]. Furthermore, it was found that the time to diagnosis of GBP was about 5–20 days in study of Huang et al who treated GBP in emergency department when gallbladder perforation was diagnosed as GBP type I or type II [21].

In our study, duration from onset to diagnosis was shortest for GBP type I (around 5 days) and relatively long for type III (52 days) but was around 11 days in GBP type II. The most frequent diagnostic criteria were distension of gallbladder, wall thickening and pericholecystic and peri hepatic collection with or without impacted stone at cystic duct or liver abscess and these imaging criteria agreed with that of other investigators [21–23].

In our study, GBP type I and type III patients were treated surgically; however, in GBP type II patients, 10 patients were not surgical candidates, and they were thus subjected to percutaneous drainage. Type II patients had more comorbidities than the surgical group; this difference was significant.

Huang et al. [21] have found that percutaneous drainage had favorable outcome than open surgery, for treatment of gallbladder perforation (type I) 100% survival compared to 50% survival in surgically treated patients. In our study immediate post catheter drainage motility was zero but it was 22% (n = 6) for surgically treated patients and 4 of them were of type I and 2 of them were of type II. None of the catheter treated patients develop septicemia but on the other hand, it was seen in 30% (n = 8) of surgically treated patients. Percutaneous image guided drainage was carried out in patients who were critically ill with multiple comorbidities and were surgically unfit compared to surgically treated patient. Nevertheless none of the conservatively treated patient by catheter drainage suffered from septicemia, they have improved clinically till resolution of the abscess and eventually catheters were removed. Few cases were reported where catheter drainage was attempted with favorable outcome. Percutaneous catheter drainage has multiple advantages as it can be performed with local anesthesia and few tools were used and easy to perform with favorable outcome.

In our study, the demographic, clinical, and laboratory data did not differ between the surgically treated and percutaneously treated GBP type II patients.

GBP, which is complicated by liver abscess formation, is an even rarer complication of acute cholecystitis, particularly since its clinical presentation is challenging and usually seen in elderly patients presenting with pain and episodes of fever, malaise, anorexia, and weight loss. Image findings may not be able to differentiate gallbladder malignancy from liver infiltration or primary liver malignancy, and diagnosis is usually achieved intraoperatively. GBP is treated via open surgical intervention with good outcomes [24–26].

In our study, a single patient had a perforated gallbladder with an intrahepatic abscess and was not a surgical candidate; this patient was treated by successful percutaneous drainage of the gallbladder and liver abscess, and this patient was also advised to undergo elective cholecystectomy, but the patient refused surgery. These results were similar to few cases reported in the literature in which GBP type was treated by percutaneous drainage in elderly critically ill patients without further cholecystectomy [24,27]. Few cases reported of liver abscess complicating GBP who were managed with percutaneous drainage followed by elective laparoscopic cholecystectomy [28], and few reported cases in which GBP in children was reacted by percutaneous drainage and no further cholecystectomy was performed with preservation of the gallbladder function proved by isotope studies [29,1].

Stefanidis et al. [30], reported that the postoperative complications of GBP were about 37%; the mean length of hospital stay was 13 days, and the need for intensive care unit admission was observed for 33% of patients. Similarly, in the present study, the median length of hospital stay was 15 days (range: 4–26 days) for percutaneously treated patients, and the shortest length of stay was for GBP type I patients (range: 9–17 days); this difference was significant. Conversely, the difference in length of hospital stay for GBP type II patients who were surgically treated and those who were treated percutaneously was not significant. This can be explained by the higher rate of comorbidities that required intensive care unit admission in percutaneously treated patients.

Due to the difficulty in making a prompt diagnosis, as well as to the presence of associated comorbidities, GBP is associated with high morbidity and mortality rates. In an early study, Glenn and Moore in 1943 reported that the mortality rate was about 42%; this rate has been declining with recent developments in anesthesiology and intensive care, and it has now reached about 12–16% [2,7,14].

In our study, the overall mortality rate was 27% (10/37), which is higher than other comparable to the 24% (8/33) mortality rate in the study by Haung et al. [21], where patients with GBP were managed surgically. However, this rate was 12.5% in a study by Derici et al [2], but in our study, the patient population was slightly younger (64 years old in our study versus 68 years old in Derici 's study); the comorbidities in our investigation were more numerous and severe than those in Derici' s study. In the present study, there was a 0% procedure-related mortality rate among those patients who were treated percutaneously; however, 30 days post procedure, the mortality rate was 30%. All of these deaths were related to the patients' comorbidities and none of them was due to septicemia but conversely in surgically treated patients, 5 died due to septicemia (3 in GBP type I and 2 in GBP type II) in the postoperative period, one patient died because of severe internal hemorrhage complicating acute pancreatitis and one patient died few months later because of myocardial infarction.

Please cite this article in press as: Abusedera MA et al. . Egypt J Radiol Nucl Med (2016), http://dx.doi.org/10.1016/j.ejrnm.2016.10.005

In conclusion, the early diagnosis of GBP is crucial and requires a high index of suspicion, especially in the elderly. Ultimately, this investigation has highlighted that percutaneous catheter drainage is a safe and effective option when treating patients with localized disease, such as type II perforation, particularly among those who are not surgical candidates. This method is also highly associated with favorable outcomes. This study has a number of limitations, such as the small number of cases investigated for each group. It is retrospective design and it is not controlled randomized study.

Conflict of interest

The authors have no conflict of interest to be disclosed.

Acknowledgments

English-language editing of this manuscript was provided by Journal Prep.

References

[1] Dikshit V, Gupta R, Kothari P, Gupta A, Kamble R, Kesan K. Conservative management of type 2 gallbladder perforation in a child. World J Clin Cases: WJCC 2015 Jul 16;3(7):671.
[2] Derici H, Kara C, Bozdag AD, Nazli O, Tansug T, Akca E. Diagnosis and treatment of gallbladder perforation. World J Gastroenterol 2006;12:7832–6 [PMC free article] [PubMed].
[3] Alvi AR, Ajmal S, Saleem T. Acute free perforation of gall bladder encountered at initial presentation in a 51 years old man: a case report. Cases J 2009;2:166 [PMC free article] [PubMed].
[4] Teefey SA, Wechter DG. Sonographic evaluation of pericholecystic abscess with intrahepatic extension. J Ultrasound Med 1987;6:659–62 [PubMed].
[5] Wig JD, Chowdhary A, Talwar BL. Gall bladder perforations. Aust N Z J Surg 1984;54:531–4.
[6] Niemeier OW. Acute free perforation of the gall-bladder. Ann Surg 1934;99 (6):922–4.
[7] Roslyn JJ, Thompson JE, Darvin H, DenBesten L. Risk factors for gallbladder perforation. Am J Gastroenterol 1987;82:636–40 [PubMed].
[8] Ong CL, Wong TH, Rauff A. Acute gall bladder perforation–a dilemma in early diagnosis. Gut 1991;32:956–8 [PMC free article] [PubMed].
[9] Sood BP, Kalra N, Gupta S, Sidhu R, Gulati M, Khandelwal N, Suri S. Role of sonography in the diagnosis of gallbladder perforation. J Clin Ultrasound 2002;30(5):270–4.
[10] Gunasekaran G, Naik D, Gupta A, Bhandari V, Kuppusamy M, Kumar G, Chishi NS. Gallbladder perforation: a single center experience of 32 cases. Korean J Hepato-Biliary-Pancreatic Surg 2015;19(1):6–10.
[11] American Society of Anesthesiology (ASA) physical status classification system ASA last approved; 2014 [<https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>].
[12] Abusedera MA, El-Badry AM. Percutaneous treatment of large pyogenic liver abscess. Egypt J Radiol Nucl Med 2014 Mar 31;45(1):109–15.
[13] Lennon F, Green WE. Perforation of the gallbladder. A review of 32 cases. J R Coll Surg Edinb 1983;28:169–73 [PubMed].
[14] Date RS, Thrumurthy SG, Whiteside S, Umer MA, Pursnani KG, Ward JB, Mughal MM. Gallbladder perforation: case series and systematic review. Int J Surg 2012;10(2):63–8.
[15] Lo HC, Wang YC, Su LT, et al. Can early laparoscopic cholecystectomy be the optimal management of cholecystitis with gallbladder perforation? A single institute experience of 74 cases. Surg Endosc 2012;26:3301–6.
[16] Derıcı H, Kamer E, Kara C, Ünalp HR, Tansuğ T, Bozdağ AD, Nazli O. Gallbladder perforation: clinical presentation, predisposing factors, and surgical outcomes of 46 patients. Turk J Gastroenterol: Official J Turk Soc Gastroenterol 2011;22 (5):505–12.
[17] Bedirli A, Sakrak O, Sözüer EM, Kerek M, Güler I. Factors effecting the complications in the natural history of acute cholecystitis. Hepatogastroenterology 2001;48:1275–8 [PubMed].
[18] Abu-Dalu J, Urca I. Acute cholecystitis with perforation into the peritoneal cavity. Arch Surg 1971;102:108–10 [PubMed].
[19] Menakuru SR, Kaman L, Behera A, Singh R, Katariya RN. Current management of gall bladder perforations. ANZ J Surg 2004;74:843–6 [PubMed].
[20] Alvi AR, Ajmal S, Saleem T. Acute free perforation of gall bladder encountered at initial presentation in a 51 years old man: a case report. Cases J 2009;2:166.
[21] Huang CC, Lo HC, Tzeng YM, Huang HH, Chen JD, Kao WF, et al. Percutaneous transhepatic gall bladder drainage: a better initial therapeutic choice for patients with gall bladder perforation in the emergency department. Emerg Med J 2007;24(12):836–40.
[22] Chau WK, Na AT, Feng TT, Li YB. Ultrasound diagnosis of perforation of the gallbladder: real-time application and the demonstration of a new sonographic sign. J Clin Ultrasound 1988;16(5):358–60.
[23] Kim PN, Lee KS, Kim IY, Bae WK, Lee BH. Gallbladder perforation: comparison of US findings with CT. Abdom Imaging 1994;19(3):239–42.
[24] Lin Hsin-Chi, Chen Tseng-Shing. Gallbladder perforation in cholecystitis with liver abscess formation and septic thrombophlebitis of portal vein mimicking presentation of liver malignancy. Adv Digest Med 2014;1(3):95–9.
[25] Bakalakos EA, Melvin WS, Kirkpatrick R. Liver abscess secondary to intrahepatic perforation of the gallbladder, presenting as a liver mass. Am J Gastroenterol 1996;91(8).
[26] Donati M, Biondi A, Basile F, Gruttadauria S. An atypical presentation of intrahepatic perforated cholecystitis: a modern indication to open cholecystectomy. Report of a case. BMC Surg 2014;14(1):1.
[27] Alessiani M, Peloso A, Tramelli P, Magnani E. Successful non-operative management of spontaneous type II gallbladder perforation in a patient with Alzheimer's disease. BMJ Case Rep 2014;23:2014.
[28] Hussain T, Adams M, Ahmed M, Arshad N, Solkar M. Intrahepatic perforation of the gallbladder causing liver abscesses: case studies and literature review of a rare complication. The Annals of The Royal College of Surgeons of England; 2016.
[29] Alghamdi HM. Acute Acalculous Cholecystitis Perforation in a Child Non-Surgical Management. Gastroenterol Res 2012;5(4):174–6.
[30] Stefanidis D, Sirinek KR, Bingener J. Gallbladder perforation: risk factors and outcome. J Surg Res 2006;131(2):204–8.