Management of cholecystectomy-induced biliary injuries at Zagazig University Hospital

Ahmed M.A. Yehia

Surgical Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

Correspondence to Ahmed M.A. Yehia, MD, Lecturer in Surgery Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt
Tel: 01000089676;
e-mail: A7med_ye7ia_67@hotmail.com

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Objective
To evaluate the management strategies following bile duct injuries.
Design and duration
This was a prospective analysis conducted from March 2015 to March 2017.
Setting
The study was conducted at the Department of Surgery, Zagazig University Hospitals.
Patients and methods
The study included all patients who were admitted with iatrogenic biliary injuries during this period. The patients were evaluated according to their clinical features and certain laboratory and imaging investigations. After appropriate preparations, they were managed based on Bismuth Classification.
Results
A total of 27 patients presented with iatrogenic biliary injuries over a period of 2 years among all 420 cases that underwent cholecystectomy during this period. There were 16 females and 11 males, with a median age of 40 years. A total of 18 patients had laparoscopic cholecystectomy, whereas nine had open cholecystectomy. Twelve cases belonged to our unit whereas 15 were referred from other institutes. Four patients were detected intraoperatively, 15 patients presented with obstructive jaundice, four patients presented with biliary fistula, and four patients presented with collection. Of which, one had ultrasound-guided aspiration and five had endoscopic retrograde cholangiopancreatography (ERCP) stenting done, whereas two underwent peritoneal lavage with drain placement, 16 patients had hepaticojejunostomy, and one patient had choledechodoudenostomy. We had one postoperative mortality owing to hepatorenal failure.
Conclusion
Strategies need to be developed for dealing with bile duct injuries, with a view to reduce morbidity and mortality, as early recognition and timely management improve the outcome of these patients.

Keywords:
biliary strictures, cholecystectomy, hepaticojejunostomy, iatrogenic bile duct injuries

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Introduction

Surgery remains the gold standard treatment for the management of patients with symptomatic gallstone disease [1]. The universal implementation of laparoscopic cholecystectomy has brought significant advantages of shorter hospital stay, decreased postoperative morbidity and mortality, and quicker return to normal activity [2].

Major complications following cholecystectomy include bile leak, bile duct injury, and acute pancreatitis. Of these, biliary injuries are the most serious. Patients with biliary stricture may experience long-term problems with recurrent cholangitis and a risk of developing biliary cirrhosis [3]. Recent studies have shown that laparoscopic cholecystectomy has approximately twice the risk of bile duct injury as compared with the open procedure (0.6 vs. 0.3%), and this is attributed to the learning curve [4–6].

Early recognition of bile duct injury is essential to prevent major morbidity. This paper presents the management and outcome of bile duct injuries sustained during laparoscopic and open cholecystectomy.

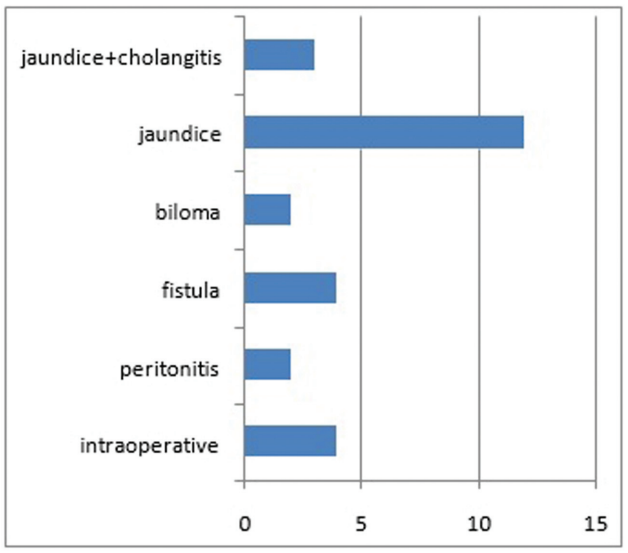
Patients and methods

This study was conducted in the Surgical Department, Zagazig University. An analysis was done prospectively for iatrogenic biliary injuries after both open and laparoscopic cholecystectomy over a period of 2 years (March 2012 to March 2014). These patients were either operated in our unit or referred from other units.

Figure 1

Male to female ratio.

Figure 2



Presentation of injured patients.

Table 1 Timing of presentation

Time of presentation	*n* (%)
Intraoperative	4 (14.8)
<1 week	8 (29.6)
1 week to 1 month	12 (44.4)
1–3 months	3 (11.4)
Total	27 (100)

Table 2 Results of abdominal ultrasound

Finding	*n* (%)
Dilated intrahepatic biliary radicals	17 (73.9)
Collection	8 (34.6)
Negative	2 (8.6)

The criteria that were evaluated included presenting symptoms, nature and site of biliary tract injury, diagnostic modalities and treatment given and its outcome.

Inclusion criteria

All patients with postcholecystectomy biliary injury admitted at the Department of General Surgery, Faculty of Medicine, Zagazig University, during the study period (March 2012 to March 2014) were included.

Exclusion criteria

Patients with any discovered growth in the gall bladder and those with traumatic injury to the biliary tract or injury sustained during some other procedure were excluded from the study.

Results

During the 2-year study period, 12 patients had iatrogenic biliary injuries in our department, whereas 15 cases were referred from elsewhere, thus making a total of 27 patients. Among these, 16 were females and 11 males, giving a female to male ratio of 1.4 : 1 (Fig. 1). Overall, 420 cases underwent cholecystectomy in this period.

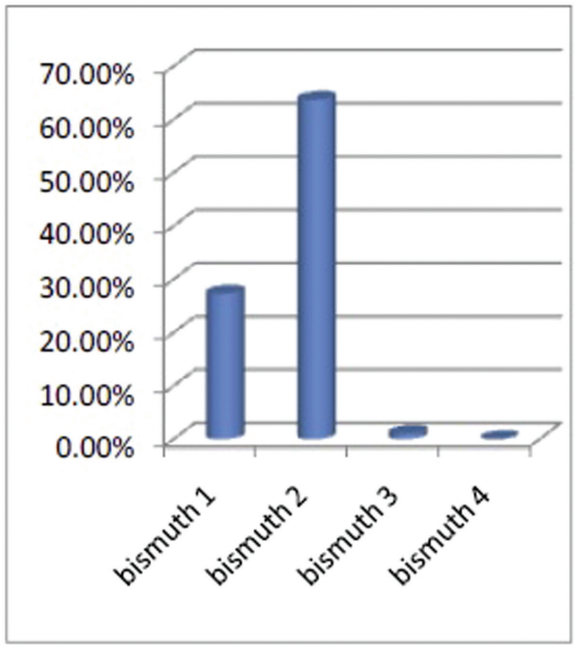
The mean age of the patients was 40 years (range: 15–55 years). Eighteen patients had cholecystectomy done laparoscopically, whereas the remaining underwent open procedure. The time of presentation of the biliary injuries varied from intraoperative to early postoperative (during the first week postoperatively) and late postoperative (after 1 week to 3 months) (Table 1).

Of the 23 patients who presented postoperatively, two presented with a biloma, two had biliary peritonitis, and four had continuous discharge of bile from the drains placed during surgery. Twelve cases presented with obstructive jaundice alone and three cases presented with jaundice with cholangitis (Fig. 2).

Ultrasound was carried out as the first-line investigation in all 23 patients presented post-operatively. It helped in detecting the site of injury and the extent of any collection, besides playing a therapeutic role in the aspiration of localized collections (Table 2).

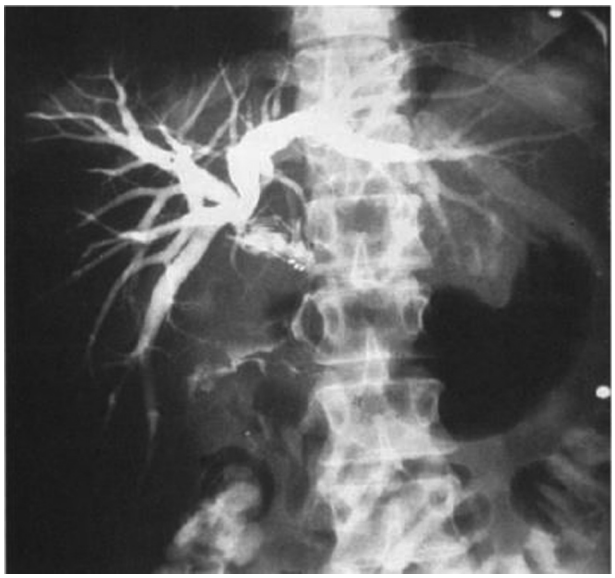
Magnetic resonance cholangiopancreatography (MRCP) was carried out in eight patients who either presented late after surgery or had persistent symptoms despite the initial management. MRCP delineated the ductal anatomy and the site and extent of the lesion. Endoscopic retrograde cholangiopancreatography (ERCP) was done in fifteen

Figure 3



Types of strictures after ERCP evaluations.

Figure 4



Percutaneous trans-hepatic cholangiography.

patients. In three cases, it showed the exact site of biliary leakage (which was the cystic duct stump in two cases and hepatic duct fistula in one case). Sphincterotomy and stent insertion was used with adequate drainage for the three cases. In 11 cases, it demonstrated ductal stricture or obstruction and the site of the distal stump. [stricture in the upper common bile duct (CBD) in three patients, stricture of hepatic duct in seven cases, and stricture of hepatic duct confluence in one case]. It was failed in one case where cannulation of the duodenal papilla could not be performed.

Types of strictures after ERC evaluation: after ERCP evaluation, the site of injuries were discovered, where stricture was seen in the upper CBD in three patients, stricture of hepatic duct in seven cases and stricture of hepatic duct confluence in one case (Fig. 3).

Percutaneous transhepatic cholangiography was performed in two cases. First case was the one with failed ERCP and the other one was unfit for anesthesia to do ERCP. In one case, it showed biliary stricture at the confluence of right and left hepatic duct (Bismuth type III). The other case of percutaneous trans-hepatic cholangiography (PTC) showed complete CDB obstruction at the level of entry of the cystic duct leaving a remnant of ~2.5 cm of the CBD (Bismuth type 1) (Fig. 4).

Two groups emerged from the point of management:

The first group was the one where injury was discovered intraoperatively in patients (n=4).

In one case, partial injury of the anterior wall of CBD was noticed and it was repaired primarily after T-tube insertion. In two cases, there were complete transections of the CBD. The proximal and distal stumps of the bile duct were easily approximated together without tension. T-tube insertion was done via separate incision. In one case, there was proximal CBD injury near the confluence of hepatic duct (Bismuth type 3), and an immediate Roux-en-Y hepaticojejunostomy was performed for the patient (Fig. 5).

The second group was the one where injury was discovered postoperatively in patients (n=23). The patients in this group were managed through the following two procedures:

(1) Patients managed with conservative treatment (six patients):
Ultrasound-guided drainage of the collected bile was performed in one case, that is, 4.3% of the cases. ERCP was used as a therapeutic modality in five patients of the 23 (21.7%) cases that presented with postoperative injury. Sphincterotomy and stent insertion was used with adequate drainage in three cases (60% of total cases) that presented with bile leakage. In two cases (40% of total cases), the presentation was obstructive jaundice. ERCP showed partial occlusion of the CBD denoting partial clipping

or ligation. Balloon dilatation was done followed by sphincterectomy, and a stent insertion was done for this patient.

(2) Surgical treatment (17 patients):
Roux-en-Y hepaticojejunostomy was done for 16 patients whereas choledechodoudenostomy was done for only one patient.

Postoperative complications

The commonest early complications were wound seroma and infection, which occurred in five patients. Moreover, two patients developed a subphrenic collection, where in one of them, the collection responded to conservative management, and in the second one, catheter drainage under ultra sonography (US) guidance was needed. One patient developed a pelvic collection and had catheter drainage under CT guidance. Another patient developed deep vein thrombosis. Patient was obese with past history of deep venus thrombosis (DVT) 2 years ago (Table 3).

Table 3 Postoperative complications observed in this series

Postoperative complications	*N*=19 [*n* (%)]
Wound infection	5 (26.3)
Subphrenic collection	2 (10.5)
Peritonitis	1 (5.3)
Pelvic collection	1 (5.3)
DVT	1 (5.3)
Totals	10 (52.7)

DVT, deep venus thrombosis.

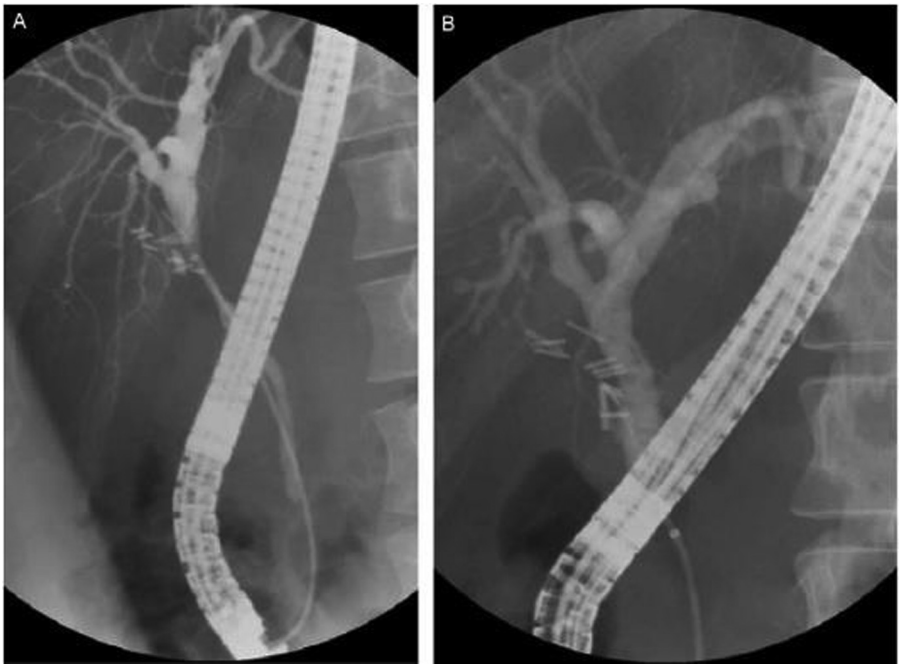
Postoperative investigations

An analysis of the changes in the liver function test preoperatively, within 5 days postoperatively, and then before hospital discharge has shown significant decrease in serum bilirubin and alkaline phosphatase. Serum transaminases levels, however, showed an insignificant change in the immediate postoperative period, and a significant change was observed only before hospital discharge (Figs 6 and 7). The average length of stay in hospital was 6 days. Nevertheless, we had one postoperative mortality owing to hepatorenal failure (3%).

Discussion

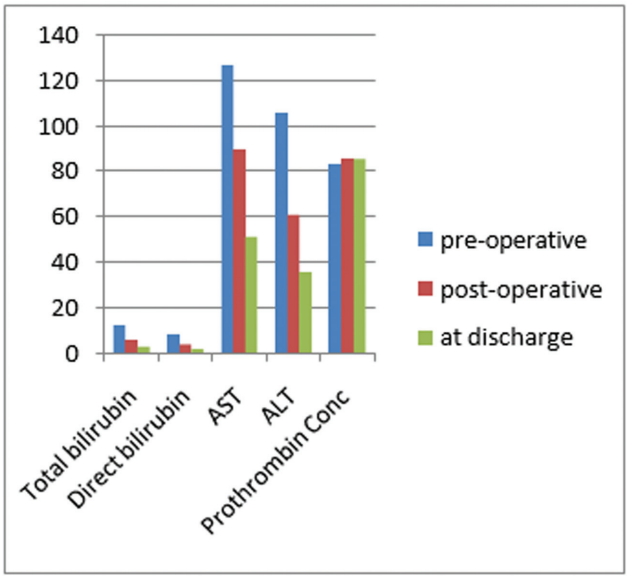
Injuries to the bile ducts during cholecystectomy represent a dreaded problem, which is easier to prevent rather than cure. The management of these injuries is difficult, and satisfactory results are not always obtained. The management of these problems provides an enormous challenge, even to experienced biliary surgeon. Major bile duct injury may require biliary enteric reconstruction. Many patients, their consultants and their lawyers believe that the treatment results in life time of disability. In this study, 27 patients with postcholecystectomy bile duct injuries were studied. There was a predominance of female, middle-aged patients, as they are classically the population group most susceptible to calcular gall bladder disease, which is, by far, the most common indication for elective cholecystectomy procedures performed for the patients presented in this study.

Figure 5



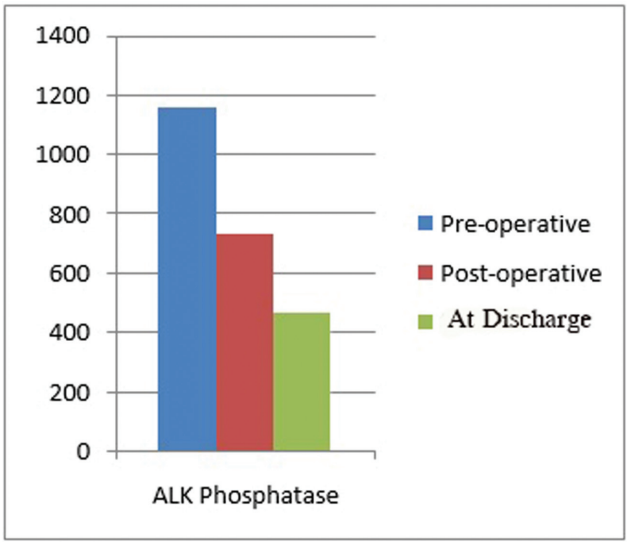
Therapeutic.

Figure 6



Pre and post-operative investigations.

Figure 7



Pre and post-operative investigations.

The risk of bile duct injury after open cholecystectomy varies between 0.2 and 0.5%. Recent large collective reviews have shown that there is approximately twice the risk (0.6 vs. 0.3%) of bile duct injury following laparoscopic cholecystectomy compared with open cholecystectomy. A recent international study by Barkun *et al.* concluded that 75% of all cholecystectomies performed now are laparoscopic. Therefore, it is a fact that the introduction of laparoscopic cholecystectomy increased the incidence of iatrogenic bile duct injuries. Detection of the injury intraoperatively during the cholecystectomy procedure is not easy and can easily be missed especially with partial duct injuries as the affected duct will cause leak later on or stricture even later. In our study, four (14.8%) patients were diagnosed intraoperatively, whereas 23 (85.2%) patients were diagnosed in the postoperative period.

Obstructive jaundice with or without cholangitis was the cardinal presentation of the patients in this study (56.7%). A variety of other presentations were present, including biliary fistula (13.3%), biliary peritonitis (6.6%) and biloma (6.6%). Our results are nearly similar to those of Cameron and Gadacz [7] where 50% of the patients in their study also presented with jaundice, with occasional cholangitis. Show *et al.* [8] showed marked prevalence of obstructive jaundice as the main presentation of the 50 patients in their study, accounting for 90% of patients, whereas only 4% presented with biliary fistulae. In our study, four injuries were discovered and managed intraoperatively. A recent study by Agabiti *et al.* [2], where 200 cases of biliary injuries following open or laparoscopic were studied, showed that one-third of the lesions were discovered intraoperatively. In the mentioned study, the authors advocated the repair in the same setting. Early repair has its advantages, as the operative field is much clearer with exposed anatomy with the absence of fibrosis and adhesions. The time of presentation of patients following their original cholecystectomies in this study ranged from a few days to 3 months postoperative. This wide variation was owing to the different clinical presentations depending on the type of injuries. Most of patients with less than 1-week presentation had biliary peritonitis owing to major bile leak injuries, whereas those who presented after 1 week to few months had delayed bile duct strictures and external biliary fistulae. Show *et al.* [8] found that 54% of their patients presented in a period less than 1 month following their cholecystectomies whereas 36% presented in more than 1 month. Abdominal ultrasound was done as a routine primary investigation in our study. It detected dilatation of intrahepatic biliary radicles in 84% of patients (those who were presented with jaundice), whereas it confirmed the presence of intraperitoneal collections in 16% of the patients (those who presented with a biloma or biliary peritonitis).

In the study done by Chapman *et al.* [9], US showed biliary dilatation in 35% of patients whereas abdominal collections were detected in 30%. In our study, ultrasonography had a limited role in deciding the level of injury. This is owing to the established fact that ultrasound has poor visualization of the biliary tree, as intestinal gases largely obscure the biliary view

in US. In our study, only one patient underwent US-guided aspiration of bile collection successfully. Show *et al.* [8] advocated this technique and considered it superior to doing an unnecessary laparotomy for the patients. ERCP was successfully preformed as a preoperative diagnostic investigation in 87.5% of the patients in our study. Similar results were seen in the study by Martin *et al.* [10], where 88% of their patients successfully underwent preoperative diagnostic ERCP. It was noticed in our study that ERCP failed in one patient to assess the biliary tree, most probably owing to extensive stricture of bile ducts with severe fibrosis which pulls the proximal stump to a much higher level and pulling the distal stump. Diagnostic workup and treatment of bile duct injuries need a multidisciplinary approach requiring gastroenterologists, radiologists, and surgeon. Three of our patients with diagnosed postoperative biliary injuries underwent ERCP and stenting of the common bile duct, and two cases had sphincterectomy and stenting. This offered a definite therapeutic measure for these patients as an alternative to surgical repair. It had a success rate of 88.9%. Similar results were seen in the study by Show *et al.* [8] in which seven of their 20 patients with biliary strictures were treated by ERCP and stenting, with a success rate of 85.7%. These results are also comparable with those of Martin *et al.* [10], who had a success rate of 89%.

The endoscopic treatment succeeded in all five patients to give the desired therapy with closure of the fistula and complete relieve of jaundice in all five patients within 2 weeks. The fistula was closed after 10 days in one patient, after 2 weeks in two patients, and after 20 days in other two patients. During the period of follow-up (mean 9 months), there was no recurrence of fistula or jaundice. The stent was removed after complete closure of fistula (after 3 months). Martin *et al.* [10] commented that it is unknown whether the results of stent therapy are improved by the use of large-diameter stents, and the optimal duration of stent therapy has not yet been established. In our study, PTC was used in limited numbers (two cases=8.6%) as a preoperative diagnostic, clearly delineating the proximal biliary tree and identifying the level of injury. In the study by Misra *et al.* [11], 32% of their patients successfully underwent PTC as the preoperative diagnostic measure. PTC is helpful in identifying the proximal extent of complete segmental and major bile duct injuries and obstruction but can cause complications such as cholangitis, bile leakage, and even hemorrhage. MRCP was done for eight (32%) patients in our study. (nevertheless, it was of excellent standard in determining the exact site of stricture and in demonstration of the exact anatomy of the proximal biliary tree). In our study, it had a diagnostic accuracy of 100%. In a study performed by Hakansson *et al.* [12], MRC provided additional information that may not be available by PTC in delineating complete anatomy and injury of biliary tract. In our study, 82% of the patients underwent surgical corrective procedures for their bile duct injuries. However, in the study by Li *et al.* [13], 96% of their patients underwent various surgical procedures of repair including Roux-en-Y hepaticojejunostomy in 72%, Roux-en-Y choledechojejunostomy in 18%, and choledechoduodenostomy in 6%. Study of 22 patients presented by Martin *et al.* underwent Roux-Y Hepaticojejunostomy. In our study, primary repair over T-tube was done in one patient and primary end-to-end repair was done in two patients, whose injury was discovered intraoperatively during cholecystectomy procedure. Pujahari [14] reported a 78% rate of stricture following attempts at end-to-end repair in accidental operative section of the common bile duct. However, a Roux-en-Y choledechojejunostomy or hepaticojejunostomy is the procedure of choice if the defect is more than 1 cm long or is detected a long time after the injury. Choledechoduodonostomy was performed for 1 patient in our study. This technique still has its advantages as it allows for later endoscopic access by ERCP to assess the efficiency of the anastomosis or to dilate any stricture that might develop. However, its disadvantage is that it may cause ascending cholangitis. Ascending cholangitis occurred in our study which was treated by conservative measures. Choledechoduodenostomy is more physiological, resulting in better digestion and avoiding peptic ulcer formation. It is easier and faster technique [15]. Most cases underwent hepaticojejunostomy, as most of the injuries presented were proximal. This may be owing to proximal traction on the upper stump by the formed fibrosis together with extending ischemia of the affected duct. The high approach was adopted in all the cases so as to perform the anastomosis with the optimum healthy proximal duct stumps as far as possible from any fibrosis or adhesions. Proper dissections of the hilar plate together with a sound mucosa-to-mucosa anastomosis are the key for a successful repair. Stenting after Roux-en-Y hepaticojejunostomy was performed in one case in our study. The role of stenting remains controversial. There has been an increasing trend away from stenting if an adequate wide anastomosis is done. The use based on each patient duct. Short-term postoperative morbidity of patients in our study had an overall rate of 20% (four cases) in surgically treated patients in the form of ascending cholangitis, and one (5%) case developed stricture at bilioduodenal anastomosis and resurgery was done. In our study, the morbidity rate was 4%, with one case of ascending cholangitis and one case of mild pancreatitis. Postoperative complications were 22%

wound infection, 4% subphrenic collection, 2% peritonitis, and 2% DVT.

We had one postoperative mortality owing to hepatorenal failure (3%). In the last decade, most series reported a mortality rate of less than 5%. The results of surgery were considered excellent if the patient remained symptoms free and required no further surgery. Patients were considered to have a good result if they had only mild symptoms including rare episode of cholangitis and did not require further surgery. Patients were considered to have a poor result if obstructive jaundice or severe cholangitis developed requiring reoperation, died within 30 days postoperative or died from biliary cirrhosis or liver failure. According to that the results in our study were as follow: the results of surgery were excellent in 76.5% compared with 60–90% in the reports of Bittner [6]. Those patients showed excellent final results as symptoms were relieved and liver function tests showed normal results. Overall, 11.7% of patients had good results compared with 8–12% in the previous reports. Poor results were 8% compared with 8–12% in the previous reports.

Conclusion and recommendations

Strategies need to be developed for dealing with bile duct injuries, with a view to reduce morbidity and mortality, as early recognition and timely management improve the outcome of these patients.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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