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Post Cholecystectomy Biliary Injuries; 25 Years' Experience in Management Using Different Treatment Strategies and Modalities in Tertiary Centers

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Abstract

Purpose: the aim of this study was to assess management protocols for post-cholecystectomy biliary injuries.
Patients & Methods: 510 patients were enrolled between 1998 and 2023, and were treated with surgery (153), endoscopy (421), and percutaneous techniques (41).
Results: The results showed that biliary injuries were still commonly encountered and were managed in a stepwise manner. Endoscopy was very successful as an initial treatment of 421/510 patients (82.5%), as it was less invasive, had low morbidity and mortality, and was competitive with surgery in treating mild/moderate biliary leakage in 80% of cases and biliary strictures in 70% of cases. The addition of percutaneous techniques increased its success rate by 3% to 5% for strictures and leakage respectively. However, endoscopy was complementary to surgery in major leakage, and massive stricture, where surgery was resold to in 20-23% of cases. When all other treatments fail, surgery is still the preferred course of action for biliary peritonitis, CBD transection, ligation, and compounded complicated damage in 70% of cases. In nearly all cases, bilio-enteric anastomosis was the preferred method (performed in 77 cases). Seven individuals (4.6%) had a stricture complication; three of these instances were treated by percutaneous ablation, and four cases required repeat surgery. The learning curve appears to have an impact, and experience builds up over time to improve success and reduce problems.
In summary, endoscopy was found to be complementary to surgery in complex disorders where surgery plays a major role, but it was found to be competitive with surgery in simple conditions and recommended as the initial treatment choice. Experience affects care and is required for management with other facilities.

Introduction

Injuries to the biliary system resulting from cholecystectomy[5], liver transplants[7], trauma[8], or infections[9] still pose a serious threat. Surgery has always been the norm for treating these injuries. Many endoscopic techniques have been employed lately as these patients' preferred modalities[8,10], as they allowed for a less invasive approach and had comparable or lower rates of morbidity at surgical treatment[11,12], and since the 1990s, these endoscopic techniques have all but replaced surgical treatment[13]. Because endoscopic intervention can integrate both the investigative and therapeutic arms of the surgery into a single procedure, it is a safe and effective means of treating biliary damage following cholecystectomy[14]. But depending on variables like outpatients or inpatients, the existence of a stone, stricture, ligature, or coagulopathy, treatment needs to be tailored specifically[15]. However, less intrusive therapy is now possible thanks to new endoscopic techniques[16]; as a result, delaying or even avoiding surgical treatment[17], and should be the initial management of choice[18].

The final resort is surgery, which entails anastomosing an isolated jejunal loop to a healthy, vascularized part of the bile duct. According to conventional surgical thinking, the diseased and scarred area of the bile duct should be avoided for the anastomosis. Roux-en-Y hepatico-jejunostomy is a single-use, well established, longlasting approach to treating postoperative bile duct injuries, including recurrent strictures, and has been demonstrated to produce good longterm outcomes [19]. Depending on the unique characters of each patient and the surgeon's experience, transanastomotic splintage may be necessary in cases. However, its application is advised for tiny ducts (<4mm) anastomosis [20].

While endoscopic treatment can be less intrusive, it may require numerous sessions and is not appropriate for all

patients. Endoscopic stenting has a high failure rate in individuals with strictures affecting the biliary bifurcation region and in those who have seen a large reduction of bile duct length[21].

Our aim in a major referral tertiary center in Upper Egypt (Assuit University hospitals - Sohag University hospitals), to emphasize and evaluate the role of both endoscopy and surgery, whether it is complementary or competitive, in managing each aspect of post-cholecystectomy problems. The experience curve in this field spanning over 20 years is respected.

Patients and methods

Over a 25-year period, 510 patients from the surgery department and the gastro-intestinal endoscopy unit of Assuit University Hospitals and Sohag University Hospitals—two of the largest tertiary referral institutions in Upper Egypt—were randomly included in this study. With a female to male ratio of 1.5:1, the majority was female, with 305 females (or 59.8%) compared to 205 males (40.2%). All patients presenting with complaints of post-cholecystectomy biliary injuries (those without biliary complications or those linked with vascular injuries are not included). Patients' presentations varied depending on when they were first insulted during surgery and when they were transferred to our clinic for care.

Cases underwent

• A thorough and in-depth history was taken.

• Careful clinical assessment.

• Tests for liver function and abdominal ultrasonography were performed on each instance in order to make the diagnosis.

• A cholangiogram was done in all cases (the gold standard evaluation for biliary damage[14]) by:

- In practically all suspected damage cases, a magnetic resonance cholangio-pancreatogram (MRCP) is performed. -Trans-tube cholangiogram, should the patient still have a T tube in place.

- Most often, endoscopic retrograde cholangio-pancreatograms (ERCP) are performed, particularly as a first diagnostic and therapeutic measure.

- Percutaneous trans-hepatic cholangiograms (PTC) in certain circumstances where endoscopic methods were unsuccessful.

• When further lesions or masses were suspected, some patients had an abdominal CT or MRI.

Patients were grouped based on how they presented, and their conditions were addressed step-by-step, beginning with the least invasive methods (endoscopic treatment, either by itself or in conjunction with percutaneous manipulation in more challenging cases), and working up to more invasive surgical procedures.

Endoscopic approaches: utilizing a side-viewing Pentax video scope, standard instruments, and blended current for sphincterotomy, 421 patients underwent one or more endoscopic sessions. In certain cases, however, balloon sphincteroplasty was employed to prevent bleeding in coagulopathic patients.
Patients were categorized using the Strasburg and Soper classification [22]. In mild cases of biliary leakage, sphincterotomy was used as a treatment method, and in moderate to significant cases, ordinary plastic stents with a minimum convenient size of 10 Fr. were used. If stones were found within the CBD, they were extracted concurrently using every technique that was practical, including retrieval baskets, balloon extractors, and manual mechanical lithotripsy (either internal or external).

The Strasberg classification[22] was used to classify biliary strictures, and endoscopic treatment involved dilatation and stenting with standard plastic stents that were at least 10 fr. Stent size during first dilatation session, then multiple endoscopic treatments spaced three to four months apart, with stent size and number upgrades. But just 8 fr in some harsh, robust strictures. After the stent was implanted, it was repeatedly dilated every two weeks until it reached an appropriate size, at which point it was controlled appropriately. The loss of the waist in the endoscopic stricture treatment indicates that the stricture segment was fully dilated before the cure was obtained, or after 2 years of repeated dilation sessions **(Fig. 2-3-4).**

Illustrative cases

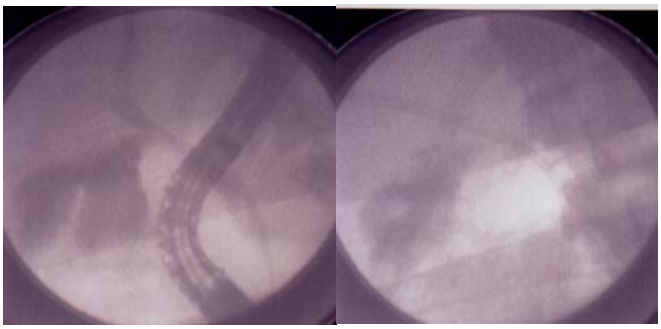

Fig. (2) ERCP showing biliary leakage, treated by sphincterotomy and stenting

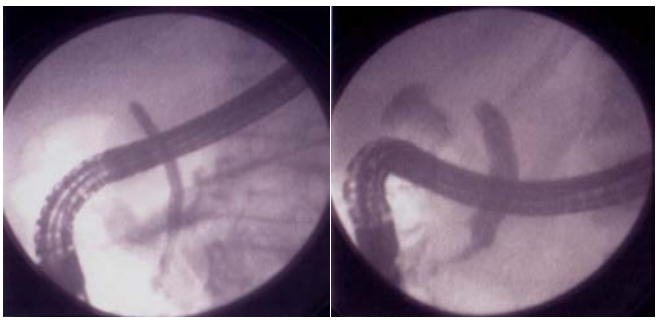

Fig. (3) ERCP showing ligated CBD, and transected CBD with major leakage

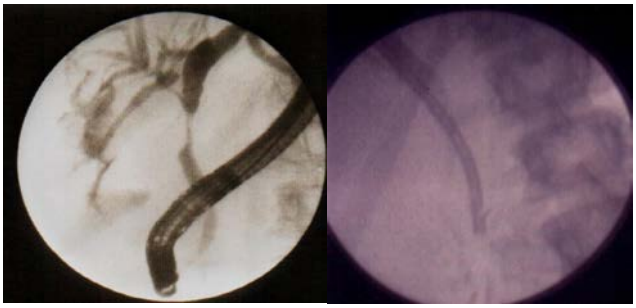

Fig. (4) ERCP showing CBD stricture treated by dilation and stenting

Percutaneous Manipulation: Percutaneous trans hepatic cholangiogram (PTC) was used in 41 cases in an attempt to opacify the proximal biliary tree (e.g., major CBD injuries, transection, or ligation). This was done either before surgery (road mapping to opacify the proximal biliary tree), or during percutaneous dilatation and stenting for strictures, or injury, particularly in post-operative strictures where the Roux-en-Y loop can induce endoscopic impediment **(Fig. 5-6).**

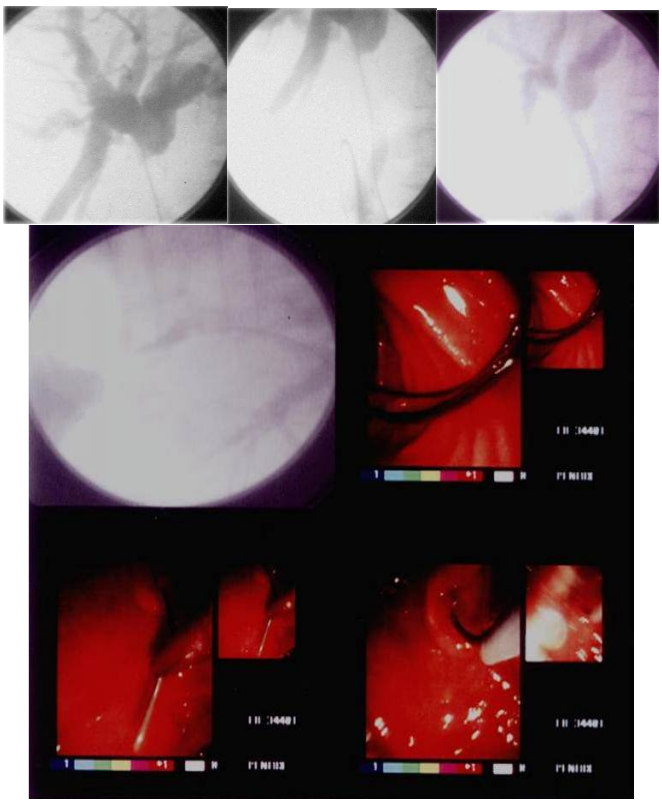

Fig. (5) Rendez-Vous Techniques with endoscopic stenting for CBD stricture

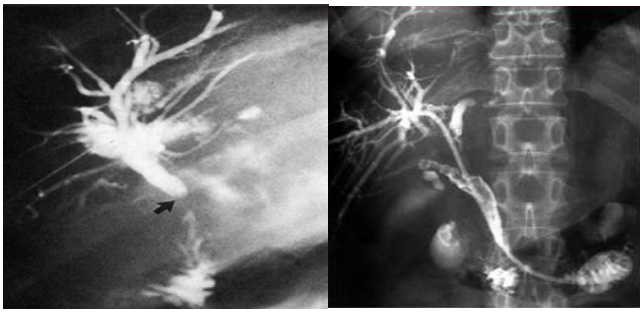

Fig. (6) PTC for ligated CBD, and PT stenting for post op. anastomotic stricture

Surgical approaches: 153 instances involved attempts at the following maneuvers:

- either open or laparoscopic peritonitis drainage and lavage of the abdomen.
- In cases of small biliary laceration injuries, CBD repair using a T tube splint is recommended, particularly if the biliary damage is detected shortly after surgery.
- Choledocho-lithotomy procedure either through open or laparoscopic routs (LCBDE) either separately or in conjunction with other interventions.
- Ligation or clipping of slipped cystic ligature or clips leading to leakage.
- Undo CBD ligation, clipping and/or stricturoplasty with biliary splint either T. shaped tube, or internal biliary stent especially if CBD injury was discovered very soon after insult or intra-operatively.

Almost all significant injury instances (77 cases) involved a bilio-enteric shunt operation due to either massive biliary laceration, transection, stricture fibrosis, or poor patient compliance with repeated endoscopic sessions. Using the Roux-en-Y loop, it was carried out at a variable level as CBD, CHD, or HD in accordance with the Strasberg classification[22].

A tension-free choledocho-jejunostomy with a 2-3 cm stoma anastomosis, mucosa to mucosa, posterior continuous, anterior interrupted, and a single layer of 3/0 or 4/0 PDS sutures is performed. Occasionally, using a shuttling maneuver toward the left hepatic duct to achieve a convenient stoma size, and splinted in very small ducts (≤ 4 mm duct) by biliary splintage, either through the Roux limb rout using small caliber Nelaton's catheters as the preferred method or, in a minority of cases, through percutaneous trans hepatic rout. The catheter was left insitu for 2-3 months post operatively till extraction after trans catheter cholangiogram assurance **(Fig. 7-8-9-10-11-12-13).**

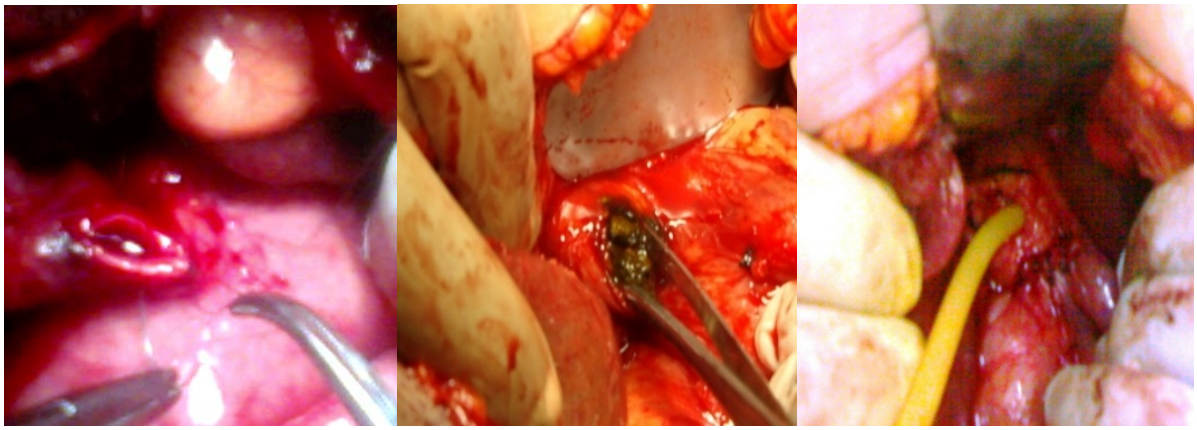

Fig. (7) Op. photo of biliary injury, leakage, with CBD stone, and repair over T-tube

Fig. (8) Op. photo of biliary injury with leakage, treated by repair over stent splint.

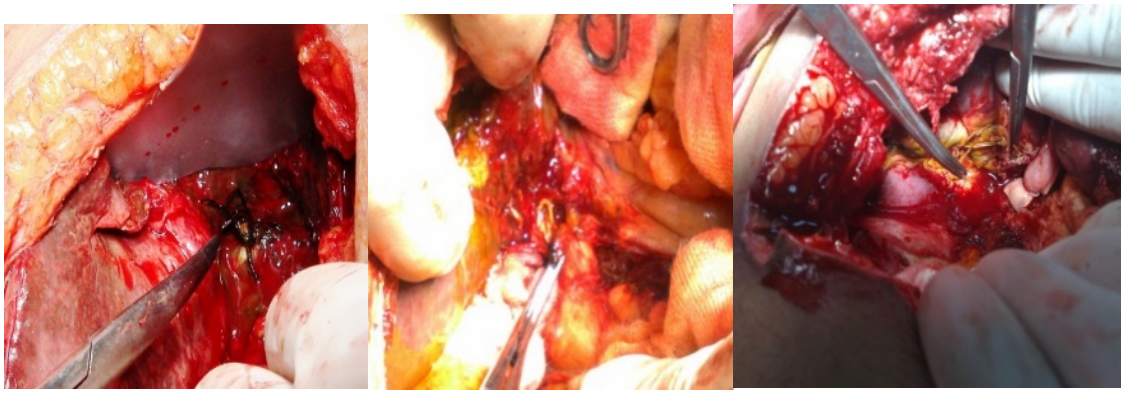

Fig. (9) Op. field showing ligated, excised CBD, and field with many stitches in porta hepatis

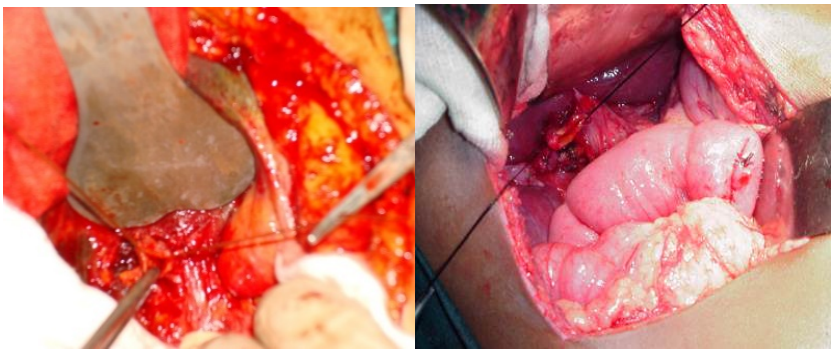

Fig. (10) Operative dissection of hepatic ducts with Roux-en Y loop hepatico-jejunostomy anastomosis

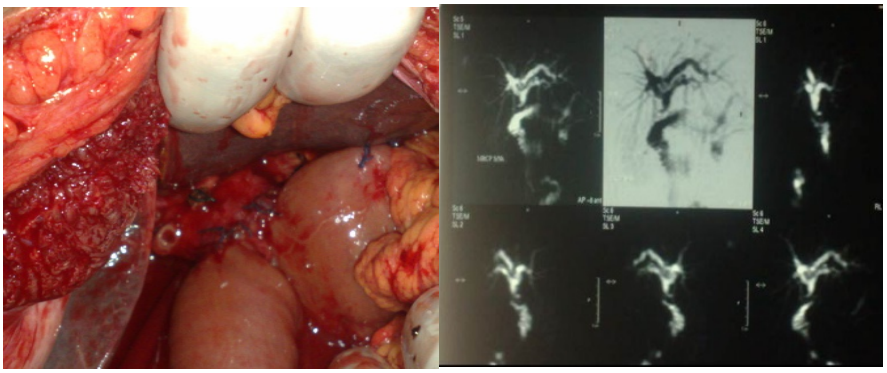

Fig. (11) Roux-en Y hepatico-jejunostomy completed with post-operative MRCP assurance.

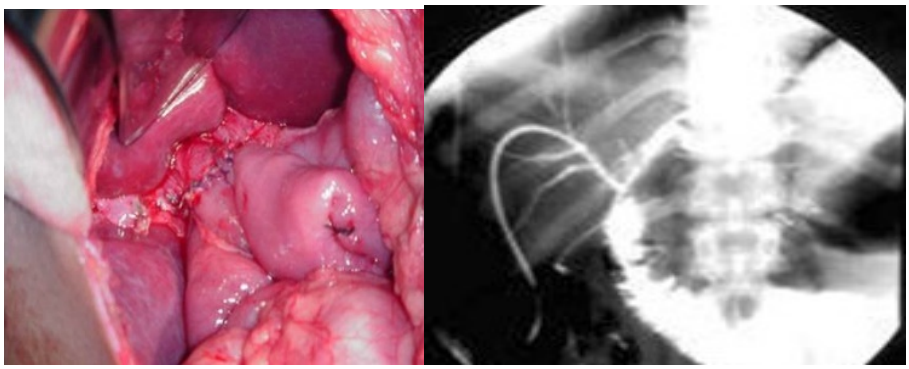

Fig. (12) Hepatico-jejunostomy splinted by PTD catheter, with post op. cholangiography

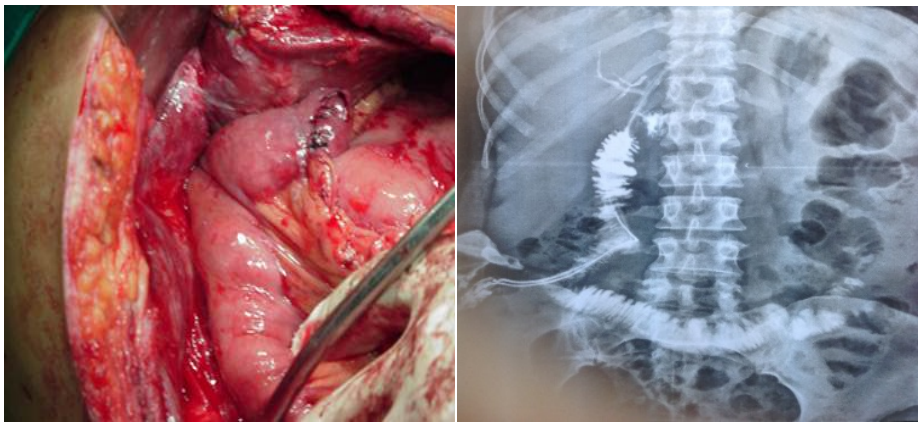

Fig. (13) Hepatico-jejunostomy with post op. trans catheter splint cholangiography

Follow up: Antibiotics were prescribed. Endoscopically and percutaneously treated cases were discharged at the next day after assurance of the stable condition of the patient. However, surgically treated cases were followed up in hospital for a variable period prior discharge (3-10 Days) with the appropriate treatment and follow up.

Following the procedure, all cases were monitored for a duration of 1 to 5 years, during which time problems were noted.

All patient data was gathered, classified, and the specific outcomes of the treatment plan were thoroughly discussed. In order to come to a consensus, the treatment modalities used for each category were evaluated. The results showed that either endoscopic maneuvers could be used in place of surgery as the only option for treating the issue, or that surgery was still necessary and these maneuvers were only supplementary measures before surgery or a way to put off surgery. Throughout the course of 25 years of experience, therapy modalities and methods were modified and customized for each patient in accordance with their unique circumstances to arrive at the most practical therapeutic intervention plan. Years of treating patients allowed for the accumulation of ever-more-large experience. More and more cumulative

experience was gained over years of treating such challenging surgical problem and management by each technique either endoscopic or surgical intervention, that resulted in better diagnosis, better anticipation of prognosis, better techniques, with the least morbidities and complications.

Results

From Mars 1998 to Feb. 2023, 510 cases of post cholecystectomy biliary injuries were incorporated in this study, the mean age was 45.3 years with a range of 18-68 years, 305/510 were females (59.8%), and only 65/510 cases (12.7%) of them were operated in our centers. Cases presented either early within a month post operatively in 330/510 cases, or late after in 180/510 cases.

Most of our cases (300/510 cases about 58.8%) presented after open access approaches (cholecystectomy alone in 215 cases, and with CBD exploration in 85 cases), versus 210 cases presented after laparoscopic approaches, with increasing incidence towards lap. versus open in the nearby years, with subsequent increasing post lap. Cholecystectomy biliary injuries incidence.

Investigations

Cholangiogram was the main step of diagnosis in these cases, and it was done for all patients either by one method alone or multiple methods through its diagnostic and therapeutic routs. MRCP was done in most of cases 440/510 (86.3%), however; endoscopic cholangiogram (ERCP) was done in 421 patients (82.5%), complemented by percutaneous trans hepatic rout (PTC) in 41 patients (8%), or through T. tube in patients with T. tube insitu in 45 cases (8.8%) of cases. All these data were shown in **table 1.**

Table (1) Showed cholangiographic finding.

Cholangiogram findings	***MRCP*** *(440/510)*		***ERCP*** *(421/510)*		***PTC*** *(41/510)*		***T. tube*** *(45/510)*	
	No.	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***
**Biliary dilatation*	120	23.5	21	4.1	18	3.5	12	2.4
**Bile leak: - Minor*	185	44.1	170	36.3	-	-	13	2.5
- Major	170	39.4	150	3.3	5	1	25	2.2
**Biliary stricture*	107	21	89	17.5	11	2.2	27	1.4
**Complex problems: ? ligation - Transection Stone+ leak - Stricture+ leak - Stone+ stricture – Post operative anastomotic stricture*	169	33.1	135	26.5	25	4.9	34	2.7
** No abnormality detected in the cholangiogram*	15	2.9	21	4.1	-	-	-	-
Total number of cases	440	86.3	421	82.5	41	8	45	8.8

Intervention

The management of biliary injury cases was based on the Strasburg and Soper classification[22]. Surgical or endoscopic techniques were used, either alone or in combination with percutaneous approaches in certain situations, to treat the injuries. There was some overlap in the therapy between the three modalities, but overall, the plan was initiated with endoscopy alone or with additional percutaneous manipulation, followed by surgery, if necessary, earlier. In this way, the management was carried out step-by-step.

Endoscopic treatment

injury. 42 cases (8.2%) showed leakage with a stone shadow from CBD, and 19 cases (3.7%) showed leakage with CBD stricture. However, in 15 patients, the cholangiogram clearly failed to show leakage, most likely due to minor ductuli or the gall bladder liver bed leak. In addition to stone extraction and stricture modification by dilatation, sphincterotomy and/or stenting were used in the treatment of all these cases.

Through pre-procedural cholangiography, biliary strictures and injuries were suspected in 390 cases (76.5%).

Treatment involved endoscopic dilatation and/or stenting in a single session (350 cases) or many consecutive sessions (71 cases), with stent size upgrading. A stent ≥10 fr. was the convenient size. It is appropriate for CBD draining because it can correct excessive bilirubin levels (it was used in 138 cases, or 27.1% of all cases). This stent size was increased in consecutive endoscopic sessions based on the degree of stricture dilatation; multiple stents were deployed in 53 cases (10.4% of cases) with intervals of 3–4 or 6 months; in tough resilient strictures, this size cannot be achieved and only 8 fr. Stent was deployed (18 cases- about 3.5%) necessitating upgrade dilatation within 2 weeks apart for acceptable size 10 fr. or more, as shown in **table 2.**

Table (2) showed endoscopic therapeutic techniques

The Endoscopic Treatment Modality	*No.*	*%*
Sphincterotomy ± Stenting for leakage	*164*	*32.2*
Sphincterotomy, stone extraction± Stenting	*64*	*12.5*
Dilation of CBD stricture, stone extraction, and stenting	*47*	*9.2*
Sphincterotomy, stricture dilation and stenting	*128*	*2.4*
Rendez-vous techniques and stenting	*22*	*4.3*
Stent size used (total 546 attempts)		
8 fr. Stent	*18*	*3.5*
10 fr. Stent	*138*	*27.1*
11.5 fr. Stent	*136*	*26.7*
12 fr. Stent	*104*	*20.4*
Double stents	*97*	*19*
Multiple stents (≥ 3 Stents)	*53*	*10.4*
Failed endoscopic treatment at any step	*33*	*6.5*
bad patient compliance to endoscopy	*21*	*4.1*
Endoscopic attempts for patient treatment (567):		
Patients treated by single endoscopic session	*350*	*68.6*
Patients treated by multiple consequative sessions	*71*	*13.9*
Total number of patients treated by endoscopic attempts	*421*	*82.5*

Percutaneous manipulations

According to **table 3**, this method was used in 41 patients (8%), either in combination with endoscopy (Rendez-Vous techniques) in 22 cases, or with other percutaneous procedures in the remaining cases, where it was therapeutic in 8 cases and consisted only of road mapping prior surgery in the other 14 cases.

Table (3) showed percutaneous treatment of complex biliary problems.

PTC in complex injuries	*No.*	*%*
Diagnostic P.T.C. prior surgery for CBD stricture	*5*	*1*
Rendez-vous techniques plus endoscopic completion	*22*	*4.9*
P.T.C. and stricture dilation with stenting	*6*	*1.2*
P.T.C. and stenting for stricture and leakage	*2*	*0.4*
P.T.D. for ligated CBD in bad patient condition prior surgery	*9*	*1.8*
P.T.C. and percutaneous dilation and stenting for post-operative anastomotic stricture	*3*	*0.6*
Total attempts by percutaneous rout	*41*	*8*

Surgical treatment

It was performed in 153 cases (30%) for a variety of reasons, including acute biliary peritonitis treatment in 46 patients (for only peritoneal toileting in 27 cases), additional surgical treatments in 19 cases, or elective surgical intervention in the other cases. Of the cases that required surgical treatment, 57 cases (11.2%) had variable surgical procedures performed, but 77 instances (15.1%) required bilio-enteric anastomosis, which was the gold standard procedure in 35/77 cases (45% of cases) with a trans-anastomotic splint, particularly if tiny ducts with a diameter of less than 4 mm. Despite this, there were 7 cases (9.1%) of post-operative anastomotic stricture; 3 patients had non-surgical treatment for this condition, and 4 cases required repeat surgery. **Table 4** displayed all surgical techniques.

Table (4) showed surgical treatment of complex biliary problems.

Surgery of complex problems	No.	*%*
Surgical exploration for biliary peritonitis (46 cases):		
Drainage, and peritoneal toileting	46	*9*
Added choledocholithotomy plus T. tube	2	*0.4*
Added CBD repair over T tube splint	2	*0.4*
Added ligation of slipped cystic ligature or clips	15	*2.9*
CBD repair over T. tube splint	24	*4.7*
Choledocholithotomy, and CBD repair over T tube splint	18	*3.5*
Choledocholithotomy, stricturoplasty, and T tube splint	9	*1.8*
CBD stricturoplasty, and repair over T. tube splint	6	*1.2*
Bilio-enteric anastomosis (77 cases) by:		
Roux-en Y hepatico-jejunostomy for Bismuth I injuries	31	*6.1*
Roux-en Y hepatico-jejunostomy for Bismuth II injuries	25	*4.9*
Roux-en Y Choledocho-jejunostomy for Bismuth III injuries (Hepp-Couinaud hepaticojejunostomy)	12	*2.4*
Roux-en Y Choledocho-jejunostomy for Bismuth IV injuries with	4	*0.8*
2 ducts anastomosis with trans anastomotic stent	1	*0.2*
3 duct anastomoses with trans anastomotic stent)	4	*0.8*
Re-do anastomosis of Roux loop Choledocho-jejunostomy for post op. stricture (out of 7 cases)		
Total number of cases treated surgically either single or multiple surgical sessions	153	*30*
Total surgical attempts in treatment of biliary injuries	180	*35.3*

The learning experience curve of endoscopic interventions and biliary reconstructive surgery

As the number of referral cases to the center increased (10–20 cases per month in 2000 to 10-15 cases per day in 2015, and more in the following years), the cumulative experience learning curve gradually showed up in direct proportion to the number of successful cases (with an incidence of 60% at initial ERCP attempts in 2000, reaching about 90–95% in 2010, up to 98–99% in 2015). The advent of percutaneous manipulation techniques in 2003 improved experience by preventing ERCP case failure (e.g., difficult cannulation, dilatation of tough tight stricture, opacification of proximal biliary tree, and stenting for some resilient stricture).

However, with the opening of the new ERCP facility at Sohag University Hospitals in 2013, there was a decrease in the overall number of patients. From that point on, the number of patients increased. The learning curve for surgical interventions also progressed in a similar way over a cumulative period of more than 25 years with the treatment of such difficult cases. Approximately 77 bilio-enteric shunt procedures were performed at varying levels in these difficult cases involving relatively non-dilated biliary channels. Less problems, particularly the anastomotic stricture that was only seen in the earliest cases, and improved stoma fashioning have demonstrated experience and produced amazing outcomes in recent years. **Figure 1** displayed these data.

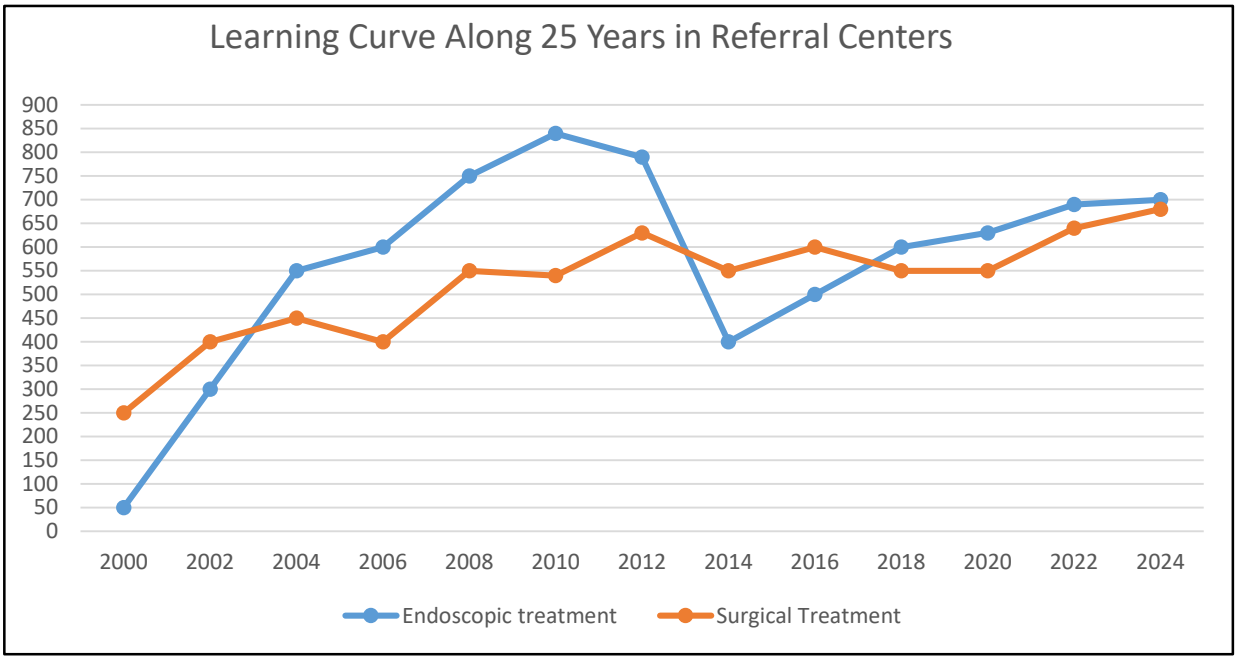

Fig. (1): showed Endoscopic and Surgical Treatment Cumulative Experience.

Discussion

The overall number of injuries encountered in this work was higher after open cholecystectomy (305 cases) more than laparoscopic cholecystectomy (105 cases). However, the incidence of post cholecystectomy biliary injury cannot be assessed because the total number of cholecystectomies done within this period is obscured. Despite the widely acknowledged higher incidence following laparoscopic cholecystectomy (0.6%) compared to open cholecystectomy (0.3%)[3], this may be explained by the low incidence and affinity for laparoscopic procedures in Upper Egypt, where open cholecystectomy is still performed in the majority of district hospitals. This incidence is shifting toward a global incidence with an increasing number of patients undergoing laparoscopic procedures in recent years.

Among our patients, 320 patients had bile leakage as their most common presentation (62.7%), which was identified as bile fistula in 41 patients[5], and bile leak in 279 patients. According to earlier research[23] and explanations offered by others[24], the leakage typically stems from biliary damage or the liver bed. The sphincter of Oddi produces a pressure gradient that causes bile to spill outside of the CBD instead of into the duodenum. A cholangiogram was used to show leakage in 305 out of 320 patients; however, in 2.9% of instances (15 cases), the spillage was very weak and could not be seen with a contrast injection. According to published research, these modest occurrences of biliary leakage may resolve on their own[25].

The extent of leaking dictated the endoscopic treatment plan. Individuals with mild to moderate degrees of leakage, such as gall bladder bed, IHBD, lateral section of CBD/RHD, cystic

duct stump leak, and type A, B, C, and D Strasberg categorization. Numerous studies have confirmed that endoscopic sphincterotomy and stenting for at least a month were effective treatments. As stated by the literature[11,26,27,28,29], endoscopic treatment speeds up the healing process by decompressing the biliary system. In addition, the stents physically close the defect and serve as a bridge at the site of extravasation. As a result, leakage ceased within 3-5 days in the majority of cases in this work for mild and moderate leakage (15/15 and 70/75), with success rates of 100% and 93%, respectively. Furthermore, stenting serves as a mold and prevents stricture formation during the recovery period, and should be the preferred treatment[29].

Only 66.5% of cases (113/170) with severe leakage (type D and E Strasberg classification) responded well to endoscopic therapy with sphincterotomy and stenting. This incidence was similar to other authors' incidences reported in the literatures[26,30,31,32]. In addition, 41 out of the 113 treated patients required additional ERCP and stenting to dilate a resulting stricture and upgrade stenting at a later time; this outcome is also consistent with results reported in the literature[29].

In 75 cases, it was discovered that CBD stone was aggravating leakage. Stone extraction and sphincterotomy were used in conjunction with stenting to successfully treat 65 patients, yielding positive outcomes consistent with previous research[33,34]. Additionally, in 30 of the 57 patients, a CBD stricture with leakage was discovered and treated by appropriate bougies or balloon dilatation and stenting, as agreed upon by other[35,36]. Unfortunately, endoscopic role is week in CBD transection injuries with leakage as only 4/25 patients was endoscopically treated, in agreement with other studies demonstrating this low incidence of endoscopic treatment of such problem[28,32]

In 165/245 patients (67.8%), biliary stricture was successfully treated endoscopically with sphincterotomy, bougies or balloon dilatation, and convenient stenting. ERCP and stenting have comparable efficacy with surgery with lower rates of morbidity and mortality[32,35,36], so endoscopy is the preferred initial therapy. In conjunction with CBD stone extraction in 39 patients, and repeated ERCP sessions to substitute or upgrade stent then after in 35 cases of them[44,45], but it requires a lengthy time (about 24 months), numerous endoscopic sessions[28], and a progressive increase in the number of stents to better calibrate the stricture. Stents should be changed every three months to prevent potential clogging that could result in cholangitis, and patients should be informed about the risk of stenting and the duration of treatment[46,47,48,49]; otherwise surgery is indicated as the treatment of choice especially in surgically suitable patient[28]. However, Davis et al., reported equal relapses of 17% for both treatment[46]. Surgery was resold to in 153 cases in this study (30%), for stricturoplasty, choledocholithotomy, and bilio-enteric anastomosis that was done in 77 patients.

According to previous writers' practices[15,37], in 46 cases of biliary leakage complicated with biliary peritonitis, immediate surgery was performed. However, as most authors studies [20,38,39,40,41], have documented, surgery was resold to in 140 patients electively, particularly after other minimally invasive tools failure. It was successful in ligated a slipped cystic clip or ligature, repairing the bile duct over a splint, performing a choledocho-lithotomy and repair over a splint, and performing a bilio-enteric anastomosis, which was performed in 77 cases. As other authors[20,42,43], have done, trans anastomotic stents were used in 43/77 instances in our work with tiny ducts (<4mm). Thus, although being utilized in just 30% of cases (153/510), surgery was promoted as the preferred tool of treatment; in spite of being used in only 30% of cases (153/510); without doubt it has its associated morbidity and mortality, pre-requisites, and necessary facilities.

Surgery was therefore promoted as the preferred course of treatment even though it was only utilized in 30% of cases (153/510); it is undeniably related with risks and complications as well as prerequisites and facility requirements. Roux-en-Y hepatico-jejunostomy has been shown in literatures[20,38,39,40,41], to have good long-term surgical outcomes. This work used single layer approaches (mucosa to mucosa, tension free, at least 2 cm stoma) with PDS 3/0 or 4/0 in combination with trans anastomotic stent (selectively) to prevent complications from post-operative stricture.

Thankfully, there was no death after endoscopic treatment[16]. However, there were a few minor complications, including pancreatitis, cholangitis, stent clogging, and poor patient compliance. Sadly, there were two deaths after surgery, one from cirrhosis-related liver failure and the other from respiratory complications. Other complications included wound infection, bile leaks, incisional hernias, and post-operative anastomotic strictures, which occurred in seven cases, two of which had intrahepatic stones. These are documented in literatures, which states that stenosis can occur in approximately 10% of cases[20,38,42,43,46]. All problems, with the exception of the incisional hernia and post-operative anastomotic stricture, were treated conservatively using alternative methods. Percutaneous dilation and stenting were used to treat anastomotic stricture in 3/7 of the instances, as previous authors have shown to be quite helpful in these situations[50,51], and redo surgery was resold to in 4 patients.

Conclusion

As previously mentioned[15], the management of these difficult cases needs to be customized and individualized for each patient. When surgery is required because of the nature of the injury or because the patient does not respond to other treatments, it should be performed in a specialized unit by skilled surgeons because the learning curve[14], has a significant impact on the outcome, as shown by improvements in the outcomes of both endoscopy and surgery. When done correctly, endoscopy can be used to treat incomplete biliary strictures[28], biliary leakage[31,32,34], and patients who are not candidates for surgery[28]. If successful, the results are

comparable to those of surgery[49], with a lower death rate[16]. However, surgery is still the last resort for biliary peritonitis, leakage with biliary peritonitis, ligated bile duct, tough biliary stricture, bile duct transection, or stricture after bilio-enteric anastomosis15,[44], as patients with total obstruction are not amenable to endoscopic approaches[16].

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