Management of Common Bile Duct Stones in the Gastroenterology and Hepatology Teaching Hospital

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Abstract

Backgrounds; common bile duct (CBD) stones are the most common cause of obstructive jaundice and cholangitis, and can produce significant morbidity and mortality. The management of CBD stones is in evolution, many modalities of investigation and treatment have been introduced, and each has its advantages and drawbacks. Thus, it is important to know about the pathophysiology of these stones as well as the diagnostic and therapeutic manoeuvres that are most useful for managing patients with this disorder.

Aim of the study;
To study and evaluate the management of common bile duct stones in the Gastroenterology and Hepatology Teaching Hospital.

Patients and Methods; Prospective study of 258 patients with clinical, laboratory and imaging features suggestive of common bile duct stones or Mirizzi syndrome who underwent management at the Gastroenterology and Hepatology Teaching Hospital over the period from January 2007 to November 2008. The workup of each patient included history, physical examination, laboratory tests and ultrasound examination. MRI-MRCP and EUS were used selectively. Same patients were subjected to endoscopic management and some patients were sent directly for surgery. Surgical treatment was also offered for those patients in whom endoscopic treatment failed.

Results; of the 258 patients included in this study, 13 patients were found to have a periampullary lesions and were excluded from the study, so the total number of the patients became 245, 111 males and 134 females. All of them were symptomatic and had abnormal liver function tests. Ultrasound examination was done for all the patients; MRI-MRCP was done for 67 patients and EUS for 45 patients. Forty one patients had primary CBD stones, 161 patients had secondary CBD stones and 32 patients had retained CBD stones. Eleven patients had Mirizzi syndrome. The stones were of different sizes, 144 patients had single stones and 101 patients had multiple stones. Endoscopic stone management was done for 218 patients with a success rate of 72.4%. Primary surgical treatment was performed for 27 patients including those with large and multiple stones and those with Mirizzi syndrome. Surgical treatment was also performed for the remaining 60 patients in whom endoscopic management failed. The overall success rate of the surgical treatment was 98.85%.

Conclusion; All patients who are suspected to have CBD stones must have MRCP, ERCP or EUS examination before any surgical intervention. Endoscopic sphincterotomy and stone extraction followed by laparoscopic cholecystectomy is still the orthodox treatment of secondary CBD stones. Open surgical treatment is required to deal with large and multiple stones and to treat Mirizzi syndrome.

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INTRODUCTION

Common bile duct (CBD) stones are the most common cause of obstructive jaundice and cholangitis[1]. In many patients, the stones may also be associated with pancreatitis[1,2]. Thus it is important to know about the pathophysiology of CBD stones, as well as the diagnostic and therapeutic manoeuvres that are most useful for managing patients with this disorder. CBD stones may be primary arising de novo within the bile duct or secondary which are formed in the gallbladder and migrated in the biliary system. Almost all primary CBD stones are brown pigment stones[2]. There have been few reports, however, of primary CBD stones and intrahepatic stones composed of cholesterol[3,4]. The surgical significance of primary CBD stones is that they are the product of two conditions that the surgeon must correct in treating the disease. These conditions are bile duct stasis and infection[5]. Stasis occurs with conditions that obstruct the flow of bile into the duodenum such as sphincter fibrosis, periampullary tumours, chronic pancreatitis and perivaterian duodenal diverticula. Patients with cystic diseases of the biliary tract usually have stasis as a major component of their condition[2,5]. Bacterial infection of the biliary system occurs in approximately two third of patients with CBD stones. In most cases it is thought that the infection is secondary to either the stones themselves, many of which have come from the gallbladder or to the obstruction caused by the stones[1]. In cases of primary stones which occur much less frequently than secondary stones, the role of bacteria is thought to be primary in their formation. Gram negative such as E.coli and Bacteroid fragilis elaborate and release betaglucorunidase in the bile. This enzyme is implicated in the hydrolysis of conjugated bilirubin with consequent precipitation of insoluble calcium bilirubinate[2].

Bacterial infection of the biliary system can also be associated with indwelling biliary endoprosthesis, internalised clips and non-absorbable suture material and parasitic infestation with consequent primary CBD stones formation[1,2].

Secondary CBD stones are those that have formed in the gallbladder and migrated to the CBD through the cystic duct. Approximately 11% of patients with gallbladder stones will have associated CBD stones at the time of operation. This incidence may climb to 18% in older patients who had gallstones for a longer period of time[2]. Between 5% and 7% of CBD stones found at operation may be unsuspected by preoperative evaluation and are discovered by cystic duct cholangiography during the cholecystectomy[2,5].

Retained CBD stones are those that present themselves in the postoperative period by T-tube cholangiogram or present with recurrent symptoms usually within two years of cholecystectomy with or without exploration of the CBD. CBD stones which present themselves beyond this interval are generally considered primary[2,5]. Gallstones might reach the common hepatic duct (CHD) or the CBD through a cholecystobiliary fistula. The offending stone remains impacted in the Hartmann pouch or the cystic duct and the resultant inflammation causes first adherence to and then perforation into the CBD. This condition is called Mirizzi syndrome[1,2,5,6,7].

Csendes classified Mirizzi syndrome into four types, type I consists of external compression of the common duct by the impacted stone, type II consist of a cholecystobiliary fistula involving less than one third the circumference of the CHD, type III consist of a fistula involving between one third and two third the circumference of the CHD and type IV represent destruction of the entire anterior and lateral walls of the common duct 8. Patients with CBD stones can present with a variety of symptoms and signs. Although 15-20% of patients with CBD stones are asymptomatic, the majority preset sooner or later with severe symptoms and by and large incur a significant morbidity as the pathological potential of ductal stones high and may contribute to the death of the patient. Ductal stones may present with recurrent bouts of biliary colic accompanied by intermittent jaundice and dyspepsia; stone impaction with progressive jaundice; cholangitis with fever,

rigor and jaundice; gallstone pancreatitis or they may present with secondary biliary cirrhosis and portal hypertension[2,5].

The diagnosis of CBD stones requires a laboratory and imaging studies. Laboratory tests include the serum alkaline phosphatase and gamma glutamyl transpeptidase. These are among the most sensitive laboratory indicators of biliary obstruction and may be elevated even when the total bilirubin is in the normal range[4]. Patients with fully developed obstruction will show elevation of the alkaline phosphatase, gamma glutamyl transpeptidase and bilirubin. The alanine aminotransferase (ALT) and aspartate aminotrasferase (AST) are mildly elevated with longer standing obstruction[4,18,5].

Imaging studies include abdominal ultrasound (US), magnetic resonance imaging including magnetic resonance cholangiopancreaticography (MRI-MRCP) and endoluminal ultrasound (EUS). Abdominal US examination is a non-invasive, inexpensive and readily available modality for assessment of the biliary tree[9]. The sensitivity of the US to dilatation of the bile ducts makes it the technique of choice for the evaluation of jaundice and it can often determine the cause of obstructive jaundice[10]. The demonstration of a stone in the CBD depends on their sizes and position, larger stones "more than 5 mm" usually can be visualized, smaller stones may not cast an acoustic shadow and more difficult to detect because they lodge further down the duct where duodenal gas may degrade the image[9,10]. MRI-MRCP is an imaging technique used to evaluate the biliary system. Heavily T-2 weighted images are used to provide an overview of the biliary system and pancreatic duct[11]. Excellent diagnostic quality images are obtainable with high sensitivity and specificity for evaluation of biliary duct dilatation, strictures and intraductal abnormalities[12,13,14,15].

The basic principle of MRI-MRCP is to use T2-weighted images, in which stationary or slowly moving fluid, including bile, is high in signal intensity and all the surrounding tissues, including retroperitoneal fat and the solid visceral organs are lower in signal intensity. Cross sectional images and projection images may be produced easily with the current MRCP techniques. The projection images are similar to direct contrast-enhanced cholangiograms obtained by either ERCP or PTC[4,16]. MRI- MRCP is non invasive, eliminating the morbidity associated with ERCP[16]. CBD stones as small as 2mm in diameter can be visualized effectively by MRCP[16,17]. MRCP can also be obtained to evaluate if retained stones are present after cholecystectomy, if no stones are present on MRCP this may negate the need for ERCP[16]. MRI-MRCP is also very useful in differentiating common hepatic duct obstruction by Mirizzi syndrome from obstruction by gallbladder cancer or enlarged lymph node[8,18]. MRI is contraindicated in patients with cardiac pacemaker and those with claustrophobia. MRI could not be done in those patients who have metallic implants[11]. EUS is an invaluable test for the diagnosis of CBD stones. The close proximity of the echoendoscope to the extrahepatic bile ductal system, Lack of radiation and safety make it an excellent method for examining the CBD and gallbladder such that, small stones, biliary sludge and even microlithiasis can be demonstrated[11]. CBD stones are identified on EUS as a curvilinear hyperechoic focus with strong acoustic shadow[11]. Additionally EUS can provide an alternative diagnosis in 14-21% of cases[19].

EUS is a minimally invasive procedure and involves conscious sedation and requires the per oral introduction of the echoendoscope. However, the entire procedure can be performed efficiently in less than 15-20 minutes with a procedural risk identical to that of OGD[11]. In the 1970s and 1980s endoscopic retrograde cholangio- pancreaticography (ERCP) transformed the diagnostic approach to suspected biliary disease and jaundice[14]. Similarly, endoscopic sphincterotomy "ES" in the years since it was first performed in human has had a dramatic impact on the management of biliary disease and specifically the treatment of CBD stones[11]. ERCP is currently one of the gold standards for the diagnosis and treatment of CBD stones[11]. ES is usually the first therapeutic step and immediately follows diagnostic ERCP which delineates the problem to be treated and allows the acc management of biliary disease and specifically the treatment of CBD stones[11]. ERCP is currently one of the gold standards for the diagnosis and treatment of CBD stones[11]. ES

is usually the first therapeutic step and immediately follows diagnostic ERCP which delineates the problem to be treated and allows the accurate placement of instruments within the CBD. After doing the ES, the next step is to attempt stone extraction from the CBD. The two accessory instruments used most commonly for this are the Dormia basket and the Fogarty balloon which are greater than 90% successful in clearing the CDB". Sometimes endoscopic management of CBD stones cannot be achieved due to many factors. An inaccessible papilla related to aberrant anatomy or unfavorable duodenal or papillary structures such as a periampullary diverticulum or prior surgery such as Billroth II or Roux-en-Y reconstruction can hinder deep biliary cannulation and ES. When endoscopic sphincterotomy has been successfully performed, a variety of stones factors may hinder extraction including size, number consistency, shape and intrahepatic location and ductal factors such as contour and the presence of coexisting stricture or narrowing. Stones that appear larger than the endoscope on radiographic imaging "usually> 15mm"; numerous stones; stones that are hard in consistency; stones that are faceted in shape that tightly fit the bile duct or that are packed against each other or stones that are located proximal to a stricture or narrowed distal bile duct or in a sigmoid shape duct are likely to be more difficult to extract and may require adjuvant technique to remove them. Techniques that have been developed to reduce stone size and facilitate endoscopic removal include mechanical lithotripsy, extracorporeal shock wave lithotripsy and intracorporeal lith-otripsy with laser or electrohydraulic probes". Even for those patients in whom the upper gastrointestinal anatomy was altered due to previous surgery like Billroth II or Roux-en-y reconstruction, a new technique is available to overcome this problem. This technique is the double balloon enteroscopy?"

. The management of CBD stones with or without cholangitis depends upon many variables including patient's conditions, skill of interventional radiologist and endoscopist, location of treatment and experience of the surgeon"[2]

Aim of the Study To study and evaluate the management of CBD stones at the Gastroenterology and Hepatology Teaching Hospital.

Patients and Methods Two hundred fifty eight patients with clinical, laboratory and imaging features suggestive of CBD stones who underwent management at the Gastroenterology and Hepatology Teaching Hospital from January 2007 to November 2008 were included in this study. The work-up of each patient started with history, physical examination followed by laboratory investigations including liver function tests, renal function tests, and haematological tests and clotting profiles. Abdominal US examination was done for all the patients. MRI-MRCP and EUS were used selectively according to the result of the abdominal US. If initial diagnosis of CBD stone"s" can be made by abdominal US then the next step is to prepare the patient for ERCP, otherwise a request for MRI-MRCP or EUS is made. The approximate size, the number whether single or multiple, and the type of CBD stones were reported for each patient. The stones were considered primary if the patient had a cholecystectomy before more than 24 months, secondary if the patient has associated gallstones or if the gallbladder shows chronic inflammatory changes and retained if he had a cholecystectomy within a period of 24 months after the cholecystectomy. The diagnosis of Mirizzi syndrome was suspected by US examination, confirmed by MRCP and/or ERCP and proved at the time of surgery. For those patients who were presented with severe illnesses like septic cholangitis or acute pancreatitis with or without renal impairment resuscitation was done with intravenous fluid, antibiotics and vit K. ERCP was arranged for each patient, except those with large and multiple stones and those with Mirizzi syndrome in whom the diagnosis was reached by MRCP or EUS, for both confirmation of the diagnosis and for endoscopic sphincterotomy "ES" and balloon extraction of the stone"s". Following this procedure the patients were observed for 24-48 hours and any complication was recorded. Cholecystectomy, laparoscopic or open was arranged for those patients with intact gallbladder either during the same admission or during the next few weeks provided that the patients are fit for this procedure. For those patients in whom endoscopic stone extraction failed and who presented with septic cholangitis, nasobiliary drainage was applied until open surgical treatment arranged. Some patients were given another trial of endoscopic stone extraction according to the opinion of the

pancreatitis with or without renal impairment resuscitation was done with intravenous fluid, antibiotics and vit K. ERCP was arranged for each patient, except those with large and multiple stones and those with Mirizzi syndrome in whom the diagnosis was reached by MRCP or EUS, for both confirmation of the diagnosis and for endoscopic sphincterotomy "ES" and balloon extraction of the stone"s". Following this procedure the patients were observed for 24-48 hours and any complication was recorded. Cholecystectomy, laparoscopic or open was arranged for those patients with intact gallbladder either during the same admission or during the next few weeks provided that the patients are fit for this procedure.For those patients in whom endoscopic stone extraction failed and who presented with septic cholangitis, nasobiliary drainage was applied until open surgical treatment arranged. Some patients were given another trial of endoscopic stone extraction according to the opinion of the gastroenterologist.Open surgical treatment was arranged for those patients with failure of endoscopic stone extraction and as a primary treatment for those patients with large and multiple stones and for those with Mirizzi syndrome. The procedure was done under general anaesthesia with antibiotic cover after full assessment of the patients and controlling or correcting any systemic illness. Right subcostal or midline incision was used. If the gallbladder was present, it was removed first. Choledochotomy was done with extraction of the stone"s". Irrigation of the ductal system was done followed by choledochoscopic examination to ensure complete stone removal and patency of the system and to exclude any proximal or distal pathology. The choledochotomy was either closed over a T-tube or anastamosed to the duodenum "side to side choledochoduodenostomy" depending on the size of the CBD and the potential for new stone formation in the future. Bakes dilators were used when there is distal narrowing in those patients in whom T- tube was inserted. Transduodenal sphincteroplasty was done for those patients with large impacted stone provided that they can tolerate the procedure, otherwise the stoprovided that they can tolerate the procedure, otherwise the stone was left inside and side to side choledochod- uodenostomy performed.For those patients with Mirizzi syndrome , partial cholecystectomy with removal of the stone through the gallbladder from the common hepatic duct was done followed by direct closure of the gallbladder remnant or Roux-en-Y hepaticojejunostomy depending on the type of Mirizzi syndrome. The first option was used for type I, II and III and the second option was used for type IV. After any operation, the patients were closely observed and any complication was recorded. T- tube, when used, was removed in the 14th to the 16th postoperative day after doing T-tube cholangiography.

Results

Of the 258 patients included in this study, 119 were males and 139 were females. Thirteen patients were found to have distal pathology in the periampullary region and were excluded from the study, so the total number of the patients became 245,

111 males and 134 females (male :female ratio of 4:5) with age range between (17-87) years, table 1.

Table 1. Age and sex distribution

Age group	Males	Females
1 -20	3	5
2 -30	3	17
3 -40	10	20
4 -50	22	28
5 -60	23	25
6 -70	3	28
7 80	15	6
8 90	4	3

Clinical features

One hundred forty seven patients presented with recurrent bouts of biliary colic accompanied by intermittent jaundice, 23 patients presented with episodic upper abdominal pain and dyspepsia, 30 patients presented with stone impaction and progressive jaundice, 34 patients presented with cholangitis and 11 patients presented with gallstone pancreatitis.

Table 2. Mode of presentation of the patients

Mode of presentation	No. Of patients
Biliary colic with intermittent jaundice	147
Upper abdominal pain and dyspepsia	23
Progressive jaundice and stone impaction	30
Cholangitis	34
Gallstone pancreatitis	11

Laboratory findings

All patients had abnormal liver function tests. Increased level of serum alkaline phosphatase was documented in all patients , conjugated hyperbilirubinaemia was found in most of the patients and the level of ALT and AST ranged from upper normal to double normal . Renal impairment was found in those patients with severe cholangitis and pancreatitis with associated dehydration, leucocytosis was found in those patients with cholangitis and those who had associated cholecys titis and pancreatitis

.Imaging studies

Abnormal US examination was done for all the patients, 146 patients had initial diagnosis of CBD stones by this modality, fig 1, and were sent directly for ERCP as a diagnostic and therapeutic procedure.

Fig.1 abdominal US shows CBD stones

It was possible to obtain MRI-MRCP examination for 67 patients, fig. 2, and EUS examination for 45 patients, fig. 3, before proceeding to surgery or endoscopic management.

Fig. 2 MRCP shows CBD stones

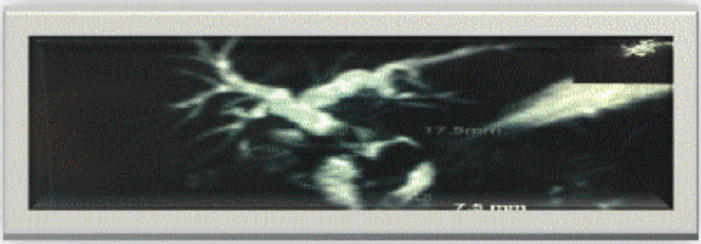

Fig. 3 EUS shows CBD stone

Thirteen patients were found to have periampullary tumors, 12 of them had only abdominal US examination and one patient had MRI-MRCP. The suspicion of the tumor was made during the ERCP and proved by EUS with FANC. These 13 patients were excluded from the study.

Types of CBD stones: Forty one patients "16.7%" had primary CBD stone"s" 5 of them were recurrent primary CBD stones with history of previous sphincterotomy and stone extraction, 161 patients "65.7%" had secondary CBD stone"s" 10 of them had no more gallstones but the gallbladder of each patient shows ultrasonic features of chronic cholecystitis, 32 patients "13.1%" had retained stone"s" and 11 patients "4.5%" had Mirizzi syndrome , fig4. The stones were of different sizes , table 3.

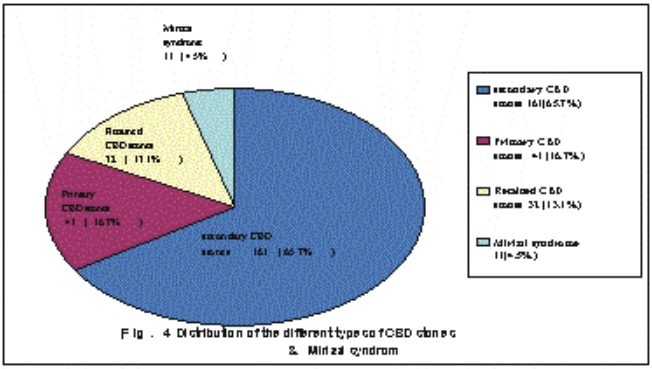

Fig. 4 Distribution of the different types of CBD stones & Mirizzi syndrom

Table 3. Sizes, types and number of CBD stones.

Sizes of CBD stones	Primary stones		Secondary stones		Retained stones		Mirizzi syndrome	
	single	multiple	single	multiple	single	multiple	single	multiple
1-5 mm	-	-	50	29	8	2	-	L
6-10 mm	3	1	20	16	7	5	-	-
11-15 mm	4	1	18	4	3	4	-	1
16-20 mm	5	6	4	10	1	1	1	2
21-25 mm	6	10	3	5	1	-	4	-
>25 mm	2	3	1	1	-	-	3	-

From this table we can see that 144 patients had single stone and 101 patients had multiple stones.

Endoscopic Management: ERCP was done for 218 patients for both confirmation of the diagnosis, especially for those who had no MRI-MRCP or EUS examination and for ES and balloon extraction of the stones. ES and balloon extraction of the stones was the only endoscopic method available for stone extraction. It was possible to extract the stones of 158 patients "72.4%" by this technique, 10 of them had primary CBD stones , 122 had secondary CBD stones and 26 patients had retained CBD stones. Fig. 5 and 6 and table 4.

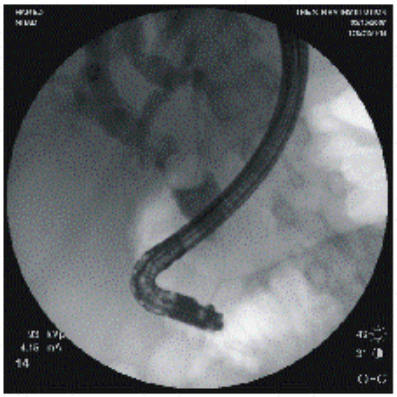

Fig. 5

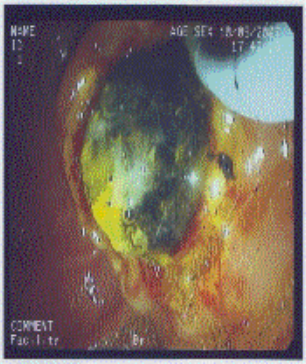

Fig. 6

Table 4. Number of cases treated by ES and balloon extraction of the different types of CBD stones.

Size of stones	Primary stones		Secondary stones		Retained stones	
	Single	Multiple	Single	Multiple	Single	Multiple
1-5 mm	-	-	50	29	8	2
6-10 mm	3	1	15	16	7	4
11-15 mm	4	-	10	1	3	1
16-20 mm	1	1	1	-	1	-
21-25 mm	-	-	-	-	-	-
>25 mm	-	-	-	-	-	-

Nasobiliory drainage was done for 19 patients in whom ES and stone extraction failed. The recorded complications following ERCP include cholangitis, pancreatitis, duodenal perforation and bleeding as shown in table 5. All these complications responded to conservative management except one patient from those with perforation who died in the 3rd post ERCP day with an overall mortality of 0.45%.

Table 5. Complications of ERCP.

Complications	No. and percentage of cases
Cholangitis	10 "4.6%"
Pancreatitis	6 "2.8%"
Duodenal perforation	2 "0.9%"
Bleeding	2 "0.9%"

Many factors were associated with the failure of the endoscopic management. The size "more than 15 mm" and the number of the stones were the most important, other factors included duodenal diverticula, papillary stenosis, lower CBD stricture, intrahepatic location of the stones, previous gastrectomy and unco-operation of the patient, as shown in table 6.

Table 6. Causes of failure of ES and balloon extraction of the stones.

Causes of failure	No. of cases
Size and number of CBD stones	39
Duodenal diverticula	8
Papillary stenosis	5
Lower CBD stricture	3
Intrahepatic location of the stones	3
Previous gastrectomy	1
Unco-operative patient	1

Following endoscopic stone extraction, laparoscopic cholecystectomy was performed for 72 patients and open cholecystectomy for 30 patients. The other 20 patients who were elderly with co morbid illnesses were managed conservatively. The cholecystectomy was performed for 23 patients during the same admission and for the remaining 79 patients during the next few weeks. Postoperatively 3 patients developed wound infection, 10 patients developed atelactasis 15 patients developed superficial thrombophlebitis and one patient developed myocardial infarction and died in the 3rd postoperative day.

Surgical treatment: Primary surgical treatment was performed for 27 patients including those with Mirizzi syndrome "11 patients" and those with large and multiple stones "16 patients". Surgery was also performed for the 60 patients who had failure of endoscopic stone extraction. Five type of operation performed. Cholecystectomy "if the gallbladder is present" followed by choledochotomy and stone extraction followed by T-tube insertion was done for 34 patients. The second operation was as above but here the choledochotomy was anastamosed to the duodenum "choledochoduodenostomy", this operation was done for 39 patients. The third operation was transduodenal sphincteroplasty. This operation was done for 3 patients. The fourth operation was partial cholecystectomy and extraction of the stones from the common duct through the gallbladder followed by closure of the stump of the gallbladder remnant. This operation was done for 9 patients with Mirizzi syndrome, one of them had type I, 4 of them had type II and 4 of them had type III. The fifth operation was stone extraction with Roux-en-Y hepaticojejunostomy and was done for two patients with type IV Mirizzi syndrome, Table 7.

Table 7. Types of surgical operations.

Types of operation	Primary stones	Secondary stones	Retained stones	Mirizzi syndrome
Cholecystectomy "if the GB is present" followed by choledochotomy and stone extraction and T-tube insertion	7	23	4	-
Cholecystectomy "if the GB is present" followed by choledochotomy and stone extraction follow- e d by choledochoduod-ostomy	22	15	2	-
Transduodenal sphincteroplasty	2	1	-	-
Partial cholecystectomy with extraction of the stone from the common duct through the GB	-	-	-	9
Stone extraction with Roux-en-Y hepaticojejunostomy	-	-	-	2

Postoperatively , two patients developed external biliary fistula that were closed spontaneously , one had choledochoduodenostomy and the other had Roux-en-Y hepaticojejunostomy . The other patient with Roux-en-Y hepaticojejunostomy developed postoperative adhesive intestinal obstruction and was relieved spontaneously. One patient from those with transduodenal sphincteroplasty developed acute pancreatitis and was managed conservatively with complete recovery. Other recorded complications include supraventricular tachycardia "one patient", deep venous thrombosis "one patient", wound infection "4 patients", atelactasis "8 patients" and superficial thrombophlebitis "12patients". One patient with primary CBD stone who underwent choledochotomy and T-tube insertion died in the 1st postoperative day due to myocardial infarction,table 8, no other major complications or mortality was recorded. The discharge from the hospital was between the 4th and the 34th postoperative day.

Table 8. Postoperative complications.

Complications	No. of patients
External biliary fistula	2 "2.29%"
Intestinal obstruction	1 "1.14%"
Acute pancreatitis	1 "1.14%"
Supraventricular tachyandia	1 "1.14%"
Deep venous thrombosis	1 "1.14%"
Myocardial infraction	1 "1.14%"
Wound infection	4 "4.59%"
Atelactasis	8 "9.1%"
Superficial thrombophlebitis	12 "13.79%"

Table 9 and 10 summarizes the different modalities of treatment of patients with CBD stones and mirizzi syndrome

Table 9. Modalities of treatment of different types of CBD stones and Mirizzi syndrome.

Modalities of treatment	Primary stones	Secondary stones	Retained stones	Mirizzi syndrome
ES and balloon extraction of the stones	10	122	26	-
Surgery following failure of endoscopic management	17	37	6	-
Primary surgical treatment	14	2	-	11

Table 10. Comparison of different types of modalities used in treatment of CBD stones and Mirizzi syndrome

Modalities of management	Duration of hospitalization	Success rate	Minor complication	Major complication	Mortality rate
Endoscopic management ±cholecystectomy	2-7 days	72.47%	32.3%*	4.6%	1.54%**
Surgical management	4-34days	98.85%	27.48%	6.9%	1.15%

*for ERCP alone the complication rate is 4.6%.

**for ERCP alone the mortality rate is 0.45%.

Discussion

This study deals with the types, clinical features, diagnosis and the various methods of treatment of CBD stones. It also deals with Mirizzi syndrome because this syndrome produces jaundice which is clinically indistinguishable from CBD stones[6]. It is generally accepted that most CBD stones originated in the gallbladder and later passed down through the cystic duct in the CBD. These stones are called secondary[9]. Usually patients with CBD stones also have gallstones, but when they do not, the gallbladder almost always shows chronic inflammatory changes[9]. One hundred sixty one patients "65.7%" of those included in this study had secondary CBD stones, 10 of them had no more gallstones but the gallbladder of each patient show chronic inflammatory changes indicating that these stones passed from the gallbladder to the CBD. Stones also may form in the CBD and when found in patients with congenital absence of the gallbladder, provide an absolute proof of their origin. These stones are called primary[4,5]. Madden "1973" defined primary CBD stones as solitary ovoid, light brown in color, soft and easily crushable[10]. Saharia and co-workers "1977" classified patients as having primary CBD stones if they met all the following criteria: (1) previous cholecystectomy with or without CBD exploration; (2) at least a 2-year asymptomatic period after initial biliary tract surgery; (3) presence of soft friable light brown stones or sludge in the CBD; 4 absence of a long cystic duct or biliary stricture owing to previous surgery[11]. Forty one patients "16.7%" of those included in this study had primary CBD stones, 21 of them had multiple stones. The stones were brown in color but the consistency of them was variable from soft to firm. The criteria of Saharia and coworkers are more consistent with the criteria of the primary CBD stones of the patients included in this study than the description of Madden. Retained CBD stones are those that were left or missed in the CBD after cholecystectomy[4,12]. Thirty two patients "13.1%" of those included in this study had retained CBD stone; thirty patients were referred from other hospitals. Although cholecystectomy is frequently performed in this hospital only two patients had retained stones during the period of this study. This can be explained by the precise preoperative evaluation and the selection criteria for patients with symptomatic gallstones who are not jaundiced and candidates for cholecystectomy. The preoperative evaluation includes a careful history and physical examination; serum chemistry evaluation "serum bilirubin, alkaline phosphatase and ALT and AST" and abdominal US examination by experts sonarist. The selection criteria include a CBD that measures less than 9mm in diameter, normal liver function tests and no recent history of pancreatitis or jaundice. Houdart et al "1995" found that the application of these preoperative clinical, biochemical and ultrasound parameters is associated with excellent negative predictive capability[13]. Patients who do not exhibit any of these parameters preoperatively have been shown to be free of CBD stones in 99% of cases[13].

Clinical features . All the patients included in this study were symptomatic. This can be explained by the fact that this hospital is a tertiary center and only those patients who are referred from other hospital or specialized surgeons or physician are received. The most common presentation was intermittent jaundice and biliary colic. None of the patients was presented with secondary biliary cirrhosis.

Imaging studies Abdominal US. In this study US diagnosed CBD stones in 134 patients with a sensitivity of 54.7%. This result is similar to what was reported by Sugiyama and Atomi "1997"[14], lower than what was reported by Rigouts et al "1992"[15] with a sensitivity of 71.4% and higher than what was reported by Al-Obaidi et al "2007"[16] and Barloon et al "1992"[17]

with a sensitivity of 37,9-40%. In the remaining 112 patients, it was not possible to obtain a clear evidence of CBD stone by US examination and since ERCP is an invasive procedure with well known complications, further imaging studies were needed before subjecting the patients to ERCP.

Magnetic Resonance imaging and Magnetic Resonance cholangiopancr- eaticography "MRI-MRCP"

The diagnosis of 67 patients with CBD stones who are included in this study was reached by MRI- MRCP. In addition to that 3 of patients in whom endoscopic cholangiogram failed due to failure of deep biliary cannulation also underwent MRI-MRCP before subjecting them to surgical treatment. During the next step of management, namely at the time of ERCP, one patient "from the 67" was found to have a filling defect at the distal end of the CBD that was inconsistent with CBD stone, this patient was examined by EUS and found to have a hypoechoic lesion. FNAC was done for this lesion and malignant cells found. The patient then excluded from the study. Putting in consideration that no patient with a false negative results was discovered during this study, we can estimate a 100% sensitivity of MRCP for detection of CBD stones. This result is similar to what was reported by Al-Obaidy et al"[9]

Endoluminal ultrasound: In this study, EUS examination was done for 45 patients. The examination performed by a single endoscopist with a good experience in this field. These patients were subjected to this modality of examination for 3 reasons. The lack of clear diagnosis of CBD stones by transabdominal US, the well known complications of the diagnostic ERCP and the high coast of MRCP. A clear diagnosis of CBD stones was made in 44 patients. In the remaining patient who had clinical and biochemical evidence of CBD stone with dilated CBD on both abdominal US and EUS, no clear evidence of CBD stone was found. Open surgical procedure was arranged for this patient which included cholecystectomy and exploration of the CBD and choledochoscopic examination. A single floating CBD stone 5mm in diameter was found in this patient. From the above mentioned results we can estimate 97.7% sensitivity for EUS to detect CBD stones. This result is similar to what was reported by Sugiyama et al "1997"[11], Chak et al "1999"[15] and Napoleon et al "2003"[16]

Endoscopic management of CBD stones

ERCP is currently one of the gold standards for the diagnosis and treatment of CBD.

In this study 218 patients were subjected to endoscopic management. It was possible to extract the stones of 158 patients with an overall success rate of 72.4% and complications rate of 4.6% and mortality rate of 0.45%. From the success point of view, the result of the endoscopic management of the patients included in this study "72.4%" is lower than what were reported by Fink AS "1993"[17] and cotton PB "1993"[18] who reported a success rate of more than 90%. Obviously this can be explained by the fact that the only endoscopic accessory available in our hospital at the time being is the Fogarty balloon catheter and all the above mentioned new accessories and techniques are not available. From the complication rate and mortality point of view the results are identical to those reported by the above mentioned authors who reported complication rates of 6-10 % and mortality rate of 1%.

Surgical treatment

Primary surgical treatment was done for 27 patients including those with Mirizzi syndrome "11 patients" and those with large and multiple stones "16 patients". Surgical treatment was also offered for the 60 patients in whome the endoscopic management failed. The types of the operations performed are similar to what are recommended by Corvera"[9] and the results are similar to what was reported by Xeroulis and Davies"[9]

. Primary surgical treatment, as mentioned above, was also done for 16 patients, each of

these patients had dilated CBD ">20mm in diameter" with large and multiple stones.Surgical treatment was also offered for the 60 patients in whom endoscopic treatment failed. The types of the operations are identical to what are written in the standard operative and text books. The success rate was 98.85%, the major complications rate was 6.9% and the mortality rate was1.15%.These results are similar to what are written in most operative and textbooks and to what was reported by Girard"

.The management of CBD stones is in evolution. Laparoscopy has got its role in the management of CBD stones especially secondary CBD stones. Laparoscopic CBD exploration was first performed in the early 1990s and is now used increasingly in experienced tertiary referral centers"[1]. Laparoscopy has change the management of secondary CBD stones from a two-stage procedure "ES and stone extraction followed by laparoscopic cholecystectomy" to a single-stage procedure. In a study sponsored by the European Association of Endoscopic Surgeons, patients were randomized to preoperative ERCP followed by laparoscopic cholecystectomy or laparoscopic cholecystectomy with laparoscopic CBD exploration. Ductal clearance was similar in the two groups but there was ahigher rate of conversion to open surgery and decreased length of stay with single stage surgical treatment.

Conclusions and Recommendations

1- All patients who have clinical, laboratory or sonographic features suggestive of CBD stones must have further imaging study like MRCP, ERCP, or EUS before undergoing anysurgical procedure

.2- Endoscopic sphincterotomy and stone extraction followed by laparoscopic cholecystectomy is still orthodox treatment of CBD stones. New ERCP accessories must be available to manage difficult stones

.3-Open surgical treatment is required to deal with larg andmultiple stones and to mange patients with Mirizzi syndrome.

4-The management of CBD stones is in evolution. Laparoscopyshould get its wayin the management of CBD stones in our hospitals.

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