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ORIGINAL RESEARCH

Management of Common Bile Duct Stones in a tertiary care center: A cross-sectional study

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Abstract

Background: The incidence of gall stone disease has increased significantly worldwide including India as has the incidence of CBD stones.The target is to diagnose CBD stones early and treat them with an appropriate treatment modality. There are many modalities of treating common bile duct stones depending upon the availability of resources and expertise, therefore this study was undertaken to found out how common bile duct stones are managed in present era of advanced surgery.

Material and Methods: A Cross-sectional study was conducted in the department of Surgery, Rohilkhand Medical College and Hospital, Bareilly from 1st November 2020 to 31st October 2021. Cases diagnosed with common bile duct stones were included in the study.

Results: A total of 90 patients with Common Bile Duct stones admitted in the surgery ward of RMCH formed the study population for this study.Alkaline phosphatase was raised from the normal value in all the cases (100%) and there is positive correlation of raised Alkaline Phosphatase(ALP) in diagnosing CBD stones ($r=1.000$, $P<0.001$). The sensitivity of USG in detecting ductal dilatation(>6mm) which is an indirect evidence of CBD stones is very high.As per our observations MRCP is the best modality for detecting CBD stones.The stone clearance rate of CBD by open CBD exploration in the present study was 95.59%. Thus the benefit of open CBD exploration exceeded its morbidity with zero mortality in well chosen cases.

Conclusion: The management of Common Bile duct stones depends upon numerous factors and cannot be generalized for all patients rather it needs to be tailor made depending upon patient to patient.

Keywords: Choledocholithiasis, T-tube, Laparoscopic cholecystectomy, ERCP

Introduction

Choledocholithiasis, presence of calculi in the common bile duct, is most commonly a complication of gallbladder stones, only in a minority of patients they arise in the bile ducts[1].

The incidence of Common Bile Duct Stones has increased significantly worldwide including India.

In north Indian population, it is three times more common in females than males. The most common age group affected is 40-49 years. Multiparous females are most commonly affected. Common bile duct stones can be symptomatic or asymptomatic,if symptomatic the

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most common presenting features include pain (94%), jaundice(57%), fever(34%), pancreatitis(5.7%)[2].

CBD stones may be discovered preoperatively, intraoperatively or postoperatively. Several modalities such as blood investigations, ultrasound, CT scan, mangnetic resonance cholangiopancreatography (MRCP) are available for the assessment of patients of choledocolithiasis. Among the radiological investigations Ultrasonography serves as a screening procedure for CBD stones.

According to some studies a normal USG result with normal total bilirubin and alkaline phosphatase levels has been shown to have an excellent negative predictive value.[3] MRCP has emerged as an alternative to ERCP for the detection and exclusion of choledocolithiasis. Stones as small as 2 mm can be detected even in the absence of billiary dilatation.[4]

As thetreatment may be endoscopic, open or laproscopic there is availability of a wide range of surgical procedures and interventions, which a surgeon can choose according to his capability and patients age and general condition.

The target is to diagnose the cases of CBD stones and treat them with an appropriate treatment modality.

There are many modalities of treating Common Bile Duct stones depending upon the availability of resources and expertise, therefore the study has been undertaken to find out the modalities of treatment of CBD stones in this era of advanced surgery.

Materials and methods

This was a Cross-sectional study done in the Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, from November 1, 2020 to October 31, 2021. USG Whole Abdomen was used as a preliminary investigation while MRCP was used as a confirmatory investigation. As per the condition of the patient, procedure was chosen from ERCP, Open CBD exploration with T tube placement, laproscopic CBD exploration or Choledocoduodenostomy.

Inclusion Criteria

All Adult Patients > 18 years who were diagnosed with CBD stones.

Exclusion Criteria

Patients who had intrahepatic stones and biliary strictures.

Results

A total of 90 patients with Common Bile Duct stones admitted in the surgery ward of RMCH in the time period from 1st November 2020 to 31st October 2021 were included in this study.

In our study of 90 cases 76(84.4%) were females and 14(15.5%) were males.

Table 1: Showing Age group distribution (gender wise)

	Male		**Female**	
Age group in yrs	**Number**	**%**	**Number**	**%**
21-30 yrs	2	14.3	12	15.79
31-40 yrs	2	14.3	23	30.26
41-50 yrs	3	21.4	27	35.53
51-60 yrs	4	28.6	10	13.16
61-70 yrs	3	21.4	4	5.26
Total	**14**	**100.0**	**76**	**100.00**
Mean ± SD(in years)	**62.0 ± 7.82**		**43.0 ± 11.45**	

Maximum number of patients (27) were female in the fifth decade of life who constituted 35.53% of the total patients.

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Table 2: Showing Presenting Complaints

Presenting Complaints	Number	Percentage%
Pain	85	94.4%
Jaundice	84	93.3%
Nausea/ vomiting	53	58.9%
Fever	20	22.2%
Pale stools	18	20.0%
Itching	6	6.6%

Most of the patients in our study 85(94.4%) presented with pain in the right upper abdomen. 84(93.3%) patients also had jaundice along with pain. Another common symptom was nausea and vomiting which was present in 3(58.9%) patients. 20 (22.2%) patients had the classical triad of cholangitis (Pain, fever, Jaundice).

Table 3: Showing Routine Blood investigations

Hb (mg/dl)	Number	Percentage%
<8	6	6.7%
8-10	19	21.1%
>10	65	72.2%
TLC (per cumm)		
<4000	0	0%
4000-11000	66	73.3%
>11000	24	26.7%
S.Urea (mg/dl)	**Number**	**Percentage%**
<40	90	100%
>40	0	0%
S.Creatinine (mg/dl)	**Number**	**Percentage%**
<1.3	90	100%
>1.3	0	0%

Total Leukocyte count was raised in only 24 patients and most of these patients also had cholangitis. Serum bilirubin was raised in 60(66.7%) cases. Mean Serum Bilirubin was 5.12 ± 5.09 mg/dl.

Table 4: Showing levels of Alkaline Phosphatase and Serum Bilirubin

Alkaline Phosphatase IU/L	Number	Percentage%
< 150	0	0.0%
150 to 300	12	13.3%
>300 to 450	20	22.2%
>450 to 600	22	24.4%
>600	36	40.0%
Sensitivity	**86.6**	
PPV	**100**	
Serum Bilirubin (mg/dl)		
≤ 1.2	**30**	33.3%
>1.2	**60**	66.7%

Alkaline phosphatase was raised from the normal value in all the cases (100%) and there is positive correlation of raised Alkaline Phosphatase(ALP) in the diagnosis of CBD stones ($r=1.000$, $P<0.001$).

The role of ultrasonography is quite controversial in different studies for detection of CBD stone as the expertise to visualise the distal CBD is operator dependant. In general the

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absence of bile surrounding the stone makes it difficult to cast shadows and differentiate it from the other surrounding peridochal structures.

Table 5: Representing USG as a modality of detecting CBD stones

	USG
Sensitivity	81.1%,
Specificity	70.5%
Positive Predictive value	100%
Negative Predictive value	23.53%

However the sensitivity of USG in detecting ductal dilatation(>6mm) which is an indirect evidence of CBD stones is very high. In our study the sensitivity of USG for dilated duct was 81.1%, specificity was 70.5% while positive predictive value and Negative predictive value were 100% and 23% respectively.

MRCP was used for the confirmation of diagnosis in all the patients. As per our observations MRCP is the best modality for detecting CBD stones. It not only helps in visualizing the stones in the CBD but also the number of stones in the CBD as well as the imaging the whole extrahepatic biliary tract.

The sensitivity of MRCP was 93.5% and specificity was 100%. Positive predictive value was 100% and the negative predictive value was 70.5%. There was positive correlation of MRCP in CBD stones(r=1.000).

Table 6: MRCP as a modality for detecting CBD Stones

	MRCP
Sensitivity	93.5%
Specificity	100.0%
Positive Predictive value	100.0%
Negative Predictive value	70.5%

There are various procedures for managing CBD stones. In the present study the type of surgery has been selected on the basis of number, size of CBD stones and diameter of the CBD. Majority of the patients underwent open Choledocholithotomy with T tube drainage (75.6%) followed by Choledochoduodestomy which was done for multiple stones within the dilated CBD and impacted stone in duodenal papilla in 12.2% patients. In remaining patients choledochojejunostomy(4.4%), Primary Closure (4.4%) of the CBDand ERCP stenting(3.3%) was done. The stone clearance rate of CBD by open CBD exploration in the present study was 95.59%. In 5 cases Laparoscopic CBD exploration was attempted but the procedure has to be converted to open CBD exploration.

Table 7: Showing Procedures done for CBD stones

Procedure	**Number**	**Percentage%**
Choledocholithotomy with T-Tube placement	68	75.6
Choledochoduodenostomy	11	12.2
Choledochojejunostomy	4	4.4
Primary Closure	4	4.4
ERCP with stenting	3	3.3
Total	90	100.0

Post operative morbidity in the our study was 37.8 %, Surgical Site Infection (SSI) was the most common post operative complication (26.5%), followed by Bile leak (5.6%) and retained stone(3.3%).

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In our study the procedure which was done in maximum patients was choledocholithotomy with T tube placement and the most common post operative complication was surgical site infection which was present in 18(26.5%) cases. In 3(4.4%) cases retained stones were present.

Table 8: Showing Post op complications in different Procedures

Procedure	Bile leak		Retained stone		SSI		None		Total		
	No	%	No	%	No	%	No	%	No	%	P-Value
Choledocholithotomy with T-Tube placement †	0	0.0	3	4.4	18	26.5	47	69.1	68	100.0	<0.001**
Choledochoduodenostomy	1	9.1	0	0.0	3	27.3	7	63.6	11	100.0	
Choledochojejunostomy	1	0.0	0	0.0	1	0.0	2	0.0	4	0.0	
Primary Closure	3	75.0	0	0.0	4	100.0	0	0.0	7	75.0	
ERCP with stenting	0	0.0	0	0.0	0	0.0	3	100.0	3	100.0	
Total	**5**	**5.6**	**3**	**3.3**	**26**	**28.9**	**59**	**65.6**	**90**	**100.0**	

**P<0.001 statistically significant.

† Data considered for P value estimation

In Choledochoduodenostomy also the most common complication was surgical site infection which was present in 3(27.3%) patients and in one patient(9.3%) bile leak was present.While in primary closure bile leak was the most common complication seen in 4(57%) patients.

Table 9: Representing pain score in different procedure

	Pain Score								
Procedure	Mild		Moderate		Severe		Total		
	No	%	No	%	No	%	No	%	P-Value
Choledocholithotomy with T-Tube placement †	41	60.3	18	26.5	9	13.2	68	100.0	<0.001**
Choledochoduodenostomy	6	54.5	3	27.3	2	18.2	11	100.0	
Choledochojejunostomy	0	0.0	2	50.0	2	50.0	4	100.0	
Primary Closure	3	75.0	1	25.0	0	0.0	4	100.0	
ERCP with stenting	2	66.7	0	0.0	1	33.3	3	100.0	
Total	**52**	**57.8**	**24**	**26.7**	**14**	**15.6**	**90**	**100.0**	

**P<0.001 statistically significant.

† Data considered for P value estimation

Only14 patients had severe pain post operatively. The patients who had severe pain were the patients who underwent open CBD exploration with T tube drainage.

The average hospital stay was calculated in different procedures. The average hospital stay was 15.69 ± 4.02 days among all procedures while the shortest stay was in ERCP in which all the patients (3 patients) were discharged within 3 days while in primary closure and choledochojejunostomy all the patients were discharged within two weeks. The maximum number of patients having stay more than 2 weeks were the patients who underwent Choledocholithotomy with T-tube closure.

Table 10: Representing the length of stay among different procedures

	Hospital stay in days										
Procedure	1-7 days		8-14 days		15-21 days		>21 days		Total		
	No	%	No	%	No	%	No	%	No	%	P-Value
Choledocholithotomy with T-Tube placement †	0	0	20	29.4	40	58.8	8	11.8	68	100	
Choledochoduodenostomy	0	0	7	63.6	4	36.4	0	0.0	11	100	

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Choledochojejunostomy	0	0	4	0.0	0	0.0	0	0.0	4	0	<0.001**
Primary Closure	0	0	4	100.0	0	0.0	0	0.0	4	100	
ERCP with stenting	3	100	0	0	0	0.0	0	0.0	3	100	
Total	0	0	38	42.2	44	48.9	8	8.9	90	100	

**P<0.001 statistically significant.

† Data considered for P value estimation

Discussion

In the present study, 90 patients admitted in the surgery department at Rohilkhand Medical College and Hospital with choledocholithiasis were studied to evaluate the best modality for diagnosing and treating Common Bile Duct stones.

The ratio between female to male cases diagnosed with choledocholithiasis was 5:1 which is similar to the studies done by Mohan et al (2005) who reported M:F ratio of 1:6.4,while Khanna et al (2006) found M:F ratio of 1:4.8.[5,6]

Most of the patients in our study 85(94.4%) presented with pain in the right upper abdomen. 84(93.3%) patients also had jaundice. These findings are similar to the study done by Kumar N et al who reported right upper quadrant pain and jaundice as most common symptoms[2]and with the study done by Goyal A et al.[2,7]

Most of the patients diagnosed with CBD stones had a normal Haemoglobin. Total counts and Renal function tests were also within normal limits.20 (22.2%) patients had the classical triad of cholangitis, and similar findings were observed byTozatii et al (2015).[8]

Alkaline phosphatase was raised from the normal value in all the cases (100%) and there is positive correlation of raised Alkaline Phosphatase(ALP) in the diagnosis of CBD stones (r=1.000, P<0.001). Observations of our study regarding the levels of various parameters is similar to the finding made by Goyal A et al, Kadah A et al, Tozatti et al(2015).[7,8,9]

As per our observations MRCP is the best modality for detecting CBD stones. Our observations are in accordance with the study done by You M et al who reported the Sensitivity of MRCP as 73.3%, specificity as 88.9%, PPV as 95.7%, NPV as 50%.[10]

In the present study the type of surgery has been selected on the basis of number, size of CBD stones and diameter of the CBD.

Post operative morbidity in the present study was 37.8 %, Surgical Site Infection (SSI) was the most common post operative complication (26.5%), followed by Bile leak (5.6%) and retained stone(3.3%). Our observations are similar to the study of Khan Z et al(2019).[11]

In our study the rate of surgical site infection was higher as compared to the above study as most of the patients who developed SSI were diabetics.

The average hospital stay was calculated in different procedures. The average hospital stay was 15.69 ± 4.02 days among all procedures while the shortest stay was in ERCP in which all the patients (3 patients) were discharged within a week while in primary closure and choledochojejunostomy all the patients were discharged within two weeks. The maximum number of patients having stay more than 2 weeks were the patients who underwent Choledocholithotomy with T-tube closure. In our study the length of hospital stay is slightly longer as compared to other studies. In the study by **Hajong et al** the stay was reported and was 6.33 days for T tube drainage, 7.82 for choledochoduodenostomy, 6.85 days for Primary Closure and 3.57 days for ERCP.[12] In study published by **Goyal A et al** the hospital stay was reported as 10.16 days in T tube closure, 5.86 days in primary closure.[7] Some other studies such as by **Zhang et al** the mean stay for Primary closure was 5.1 days and for T tube closure was 8.4 days[13] and in a study done by **Gurusamy et al** the mean stay for Primary closure was 9.12 days while in cases of T tube closure was 13.84 days).[14] Most of the patients in our study were from the rural areas and they were usually discharged after T tube removal and suture removal as they cannot afford the expenses of the conveyance. Hence the length of

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hospital stay was extended.

Conclusion

In our study choledocholithiasis mostly affected the people in their fifth decade of life with a female preponderance. Most of the patients of Choledocholithiasis had right upper abdominal pain followed by jaundice and in 20 (22.2%) with features of cholangitis.

Serumbilirubin and alkaline phosphatase above 150 IU/l were significantly predictive for detection of Common Bile Duct stones. USG is the preliminary investigation to screen patients who present with right upper abdominal pain or obstructive jaundice.All the patients with an elevated Alkaline Phosphatase and having dilated CBD or IHBRD must undergo MRCP as it is the Gold standard for visualising CBD stones and is also accurate in detecting the exact number of stones in the CBD.Our most common treatment modality was open CBD exploration with T-tube closure followed by Choledochoduodestomy was done for multiple stones within the dilated CBD and impacted stone in duodenal papilla.

In a few cases of Open CBD exploration with T Tube closure patients had severe pain with mean hospital stay of around two weeks as patients were discharged after T tube cholangiogram was while in all other procedures only mild pain was present and were discharged in a week.

Choledocholithiasis can be treated by a number of surgical modalities. Choledocholithotomy with T tube closure still remains the most popular method of treating CBD stones because of easy availability of surgical instrumentation. ERCP is limited by size and site of stone as well as expertise which is available so it can be safely concluded that management of CBD stones needs to be tailormade to patient's disease, evaluation of resources and skill of the surgeon.

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