

Original Article

A Comparative Study of Common Bile Duct Drainage by T-tube and Choledochoduodenostomy in Cases of Common Bile Duct Stones

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To study and compare the cases of 'T'-tube drainage and Choledochoduodenostomy done for Common Bile Duct stones.

Methods : A prospective study was conducted from October 2019 – September 2021 (24 months including follow-up period) in patients diagnosed to have Choledocholithiasis in MGM Medical College and Hospital, Kishanganj, Total 50 patients were Included in this study. Those patients in whom CBD stones detected incidentally on investigation like Ultrasonography upper abdomen done for chronic calculus cholecystitis or detected during surgery for cholecystectomy ie, asymptomatic stones were also included in this study.

Results : In the cases of our study, most of the patients (62%) didn't has sludge. Choledochoduodenostomy was more frequently performed when sludge was present (P=0.043), whereas 'T'-tube drainage was performed when sludge was absent. only 19 cases (38%) had sludge. And also it was present more commonly with larger diameter CBD (P value =0.016).

Conclusion : In this study, both the surgical procedures did not produce any mortality. Some patients developed complications. This could be because much of the study population was elderly and most of the complications were noted in patient with acute cholangitis. In both the group, wound infection was noted to be most common complication. All of the patients treated conservatively successfully.

[J Indian Med Assoc 2022; 120(7): 36-40]

Key words : Cholelithiasis, Common Bile Duct, Choledochoduodenostomy, T-tube drainage.

Cholelithiasis is frequently associated with stones in the Common Bile Duct (CBD). From varying published data it can be seen that of all patients subjected to cholecystectomy for gallstone, Atleast 15% of patients with cholelithiasis have Choledocholithiasis conversely, 95% of patients with CBD stones also have Gallstones¹. The presence of this stone in the CBD increases the morbidity and mortality of patients, particularly those presenting with jaundice and pancreatitis.

External drainage of the common duct is the oldest and most widely practised procedure of draining the CBD. But surgeons soon began to think of some other methods of drainage which would avert the unnecessary loss of bile into exterior and which would lower the incidence of over looked stones and subsequent obstruction of the CBD. Choledochoduodenostomy was soon discovered and was designed with the idea of draining the bile internally into the duodenum and that residual stones, if any, would pass into the duodenum through the stoma. Though it is almost more than 90 years from now that the operation was first performed

Editor's Comment :

- This study evaluates the efficacy and safety of T-tube drainage method of CBD repair after Common Bile Duct exploration and provides more evidence for duct closer after choledocholithotomy in cases of Common Bile Duct stones.

and published and though quite a number of papers were published subsequently from various centres in its favour, it is still to be accepted universally as an effective procedure in cases of benign biliary obstruction. The uncertainty is probably due to the fact that the long-term effects of this operation on the CBD and the liver has not been analysed satisfactorily on any large group (Capper, 1961).

Choledochoduodenostomy which is described as an anastomosis between the lower end of the CBD and duodenum has limited but specific indications. This procedure has been described long back but the indications have remained the same over years².

The present series consists of 50 cases where CBD was explored for stones of which in 30 cases Choledocholithotomy followed by T-tube drainage was performed and in the rest 20 cases lateral Choledochoduodenostomy was the choice of operative procedure. All the patients were admitted in MGM Medical College & Hospital during the period of 2017 - 2019 in the Department of Surgery. All the patients were investigated thoroughly during the pre-operative period, by biochemical and radiological methods. The choice of operation was decided upon the findings at

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Received on : 23/06/2022

Accepted on : 30/06/2022

pre operative investigation and during exploration. All the patients were assessed post operatively with regard to recurrence of jaundice, deterioration of liver function and ascending infection by clinical, biochemical and radiological investigation. Finally, quite a number of literatures on this topic were reviewed and the results of the present series were corroborated with the other published series.

MATERIALS AND METHODS

A prospective study was conducted from October 2017 – September 2019 (24 months including follow-up period) in patients diagnosed to have Choledocholithiasis in MGM Medical College and Hospital, Kishanganj, a tertiary hospital of northern India. They were followed up for a period of 3 months. The cases were recruited from surgical outdoor patients or emergency services. Patients who presented with signs and symptoms (like pain in right hypochondrium, biliary colic, fever with or without chills and rigor, vomiting and past history of or presence of Jaundice) suggestive of stones in the CBD were included in the study. Those patients in whom CBD stones detected incidentally on investigation like Ultrasonography upper abdomen done for chronic calculus cholecystitis or detected during surgery for cholecystectomy ie, asymptomatic stones were also included in this study. The cases of benign ampullary stenosis which were detected only after exploration were also included in this study. Cases of biliary obstruction like biliary stricture, carcinoma of CBD or periampullary carcinoma etc. were excluded from the study. Those cases in which no stone was found within the common duct on exploration were also excluded from this study.

Number of cases — 50 cases (prospective)

Much attention was given to differentiate surgical from medical jaundice from the history clinical examination and investigations

A total of 50 cases were prospectively recruited in the study. After enquiring the patient's particulars, a detailed history was taken. Chief complains like pain in abdomen, fever, jaundice, nausea or vomiting and their duration were noted. The onset of pain, its character, radiation, aggravating or relieving factor, relation with food were noted carefully. History of jaundice, its onset, duration and progression (gradually deepening or fluctuating) were noted. History of fever with or without chills and rigor, nausea, vomiting, colour of stool, and itching were also noted. In regards to past history previous attacks of biliary colic, jaundice, typical fever, and recurrent blood transfusion were noted. Any history of surgical intervention in the past was also noted. History of any major medical illness or history suggestive of diabetes mellitus,

hypertension, and ischemic heart disease were also noted. Personal history of dietary habits and any addiction was enquired. In female patients obstetrical history like parity, number of living children or abortion, if any was enquired. History of taking oral contraceptive pills was also noted.

Every patient was clinically examined very carefully and systematically. In general examination the Built of Patient, Weight, Pallor, Oedema, Jaundice, Pulse, Blood Pressure, Respiration, Temperature, etc were noted.

On local examination of abdomen, abdomen was inspected especially for its shape, its movement with respiration, presence or absence of any lump. On palpation tenderness and temperature were noted especially in right hypochondrium. Presence of any lump and any other organomegaly was noted Other systemic examination of cardiovascular system, respiratory system and nervous system was done carefully.

OBSERVATIONS

All the patients were followed up on 4th post operative week and then 3rd postoperative months. In case of any abnormality in any follow up, patients were followed up closely depending on clinical, blood and radiological investigations.

Both group of patients were followed up by –

(1) Clinical examination — All of the patients were examined and asked for history of pain, fever or jaundice, urine and stool colour.

(2) Liver function test — All of the patients were investigated for serum Bilirubin (total,direct and indirect) and serum Alkaline phosphatase.

(3) Ultrasonography upper abdomen — It was done only when clinical examination or liver function test showed any abnormality.

Statistical Methods :

Data analysis was done using Epi Info Software and appropriate tests were applied where applicable.

RESULTS

A total of 50 cases were recruited in the study, in which 30 cases (60%) underwent T-tube drainage and 20 cases (40%) underwent Choledochoduodenostomy.

Out of total cases, 16 (32%) were males and 34 (68%) were females (Table 1).

Sex	No of Cases	Percentage
Male	16	32
Female	34	68
Total	50	100

The incidence of choledocholithiasis was found to be more (46%) in the age group of 40-49 years.

Choledochoduodenostomy was more frequently performed in older (more than 50 years) age group whereas T-tube drainage was performed more commonly in relatively younger age group (less than 50 years) (Table 2).

Table 2 — Showing the age distribution of choledocholithiasis and the type of surgery performed in different age group

Age (Year)	T-tube drainage		Choledochoduodenostomy		Total No	Percentage
	No	%	No	%		
<20	1	2	0	0	1	2
21-29	4	8	3	6	7	14
30-39	5	10	3	6	8	16
40-49	13	26	5	10	18	36
50-59	4	8	7	14	11	22
≥60	3	6	2	4	5	10
Total	30	60	20	40	50	100

Both the surgeries T-tube drainage as well as Choledochoduodenostomy were performed more common in absence of cholangitis, but statistically Cholangitis was not found to be the important factor in decision making of procedure performed (P= 0.630) (Table 3).

Table 3 — Showing the relation of Cholangitis with the procedure performed

Procedure	Cholangitis (Fever)				Total	%
	present		Absent			
'T' tube drainage	10	20	20	40	30	60
Choledochoduodenostomy	8	16	12	24	20	40
Total	18	36	32	64	50	100

$\chi^2 = 0.231, P \text{ value} = 0.6304$

Cholangitis was found to be more common (15 out of 18 cases *ie*, 83.33%) when CBD was dilated more than 10 mm (P=0.007), whereas 20 out of 32 cases (62.5%) has shown CBD diameter less than 10 mm in absence of cholangitis (Table 4).

Table 4 — Showing the relation of common bile duct diameter (mm) with cholangitis

CBD diameter	Cholangitis (Fever)				Total	%
	Present		Absent			
≤10 mm	03	06	20	40	23	46
11-15 mm	09	18	07	14	16	32
> 15mm	06	12	05	10	11	22
Total	18	36	32	64	50	100

$\chi^2 = 9.751, p \text{ Value} = 0.007$

T-tube was performed more commonly when CBD diameter was less than 10 mm. Choledochoduodenostomy performed only when diameter of CBD was more than 12 mm. When CBD diameter was more than 15 mm, only choledochoduodenostomy was performed (Table 5).

Table 5 — Showing the relation of CBD diameter with the surgical procedure performed

Procedure Performed	CBD diameter (mm)			Total	Percentage
	≤10	11-15	>15		
'T' tube drainage	23	07	00	30	60
Choledochoduodenostomy	00	09(>12mm)	11	20	40
Total	23	16	11	50	100

$\chi^2 = 33.594, p \text{ Value} = <0.001$

In this study, it was found that the number of stones didn't affect the CBD diameter. No association was seen between multiplicity of stone and CBD diameter (P=0.663) (Table 6).

Table 6 — Showing the relationship of number of stones with CBD diameter

Number of Stones	CBD diameter (mm)						Total	
	≤10 mm		11-15 mm		>15mm		No	%
	No	%	No	%	No	%		
Single	12	24	06	12	05	10	23	46
Multiple	11	22	10	20	06	12	27	54
Total	23	46	16	32	11	22	50	100

$\chi^2 = 0.820, p \text{ Value} = 0.663$

In the cases of our study, most of the patients (62%) didn't has sludge. Choledochoduodenostomy was more frequently performed when sludge was present (P=0.043), whereas 'T'-tube drainage was performed when sludge was absent (Table 7).

Table 7 — Showing the frequency of sludge in relation to surgery performed

Procedure	Sludge				Total	
	Present		Absent		No	%
	No	%	No	%		
'T' tube drainage	08	16	22	44	30	60
Choledochoduodenostomy	11	22	09	18	20	40
Total	19	38	31	62	50	100

$\chi^2 = 4.089, p \text{ Value} = 0.043$

Mean duration of surgery was significantly lower in T-tube drainage by 48 minutes (Table 8).

Table 8 — Showing the average duration of surgery

Operation	Time (minutes)
T-tube drainage	78
Choledochoduodenostomy	126

Hospital stay was calculated from the day of surgery performed till the patient was in dischargeable condition. Average hospital stay duration was around 4 days longer for T-tube drainage surgery (Table 9).

Table 9 — Showing average number of days of hospital stay after the surgery

Operation	Hospital Stay (Day)
T-tube drainage	14.4 days
Choledochoduodenostomy	10.7 days

In our study, wound infection was more common with T-tube drainage (20% versus 15%). A total of 6 cases (4 in each T-tube group and 2 in Choledochoduodenostomy group) were developed bile leak in postoperative period. One case of bile leak developed with T-tube in situ, whereas 2 cases developed after T-tube removal. One case of leak occurred due to dislodgement of upper tip of T-tube outside of CBD, when T-tube was in situ and was diagnosed by T-tube cholangiogram. On 10th postoperative day leak subsided within 2-3 days of removal of T-tube. Bile leak occurred after removal of T-tube was stopped within 3 days. However, all of these patients were asymptomatic and treated conservatively. There were 2 cases of missed stones in T-tube drainage (10%) (Table 10).

Complication	T-tube		Choledochoduodenostomy	
	No	%	No	%
Wound infection	06	12	03	06
Residual Stones	02	04	00	00
Cholangitis	00	00	00	00
Bile leak	03	06	02	04
T-tube dislodgement	01	02	00	00

2 cases of bile leak occurred after choledochoduodenostomy (10%). In both cases the diameter of CBD at the time of anastomosis was 13mm and 16mm. However both patients were asymptomatic and treated conservatively and bile leak stopped within 4-5 days. There were no complications of bile collection, bile peritonitis, cholangitis, anastomotic stricture or sump syndrome.

There was no mortality noted in both the group of our study.

Follow up :

Out of 50 patients, 46 patients (92%) came for one month follow up, and 38 patients (76%) came for 3 months follow up. All the patients in both the groups didn't complain any symptoms in the follow ups. Clinical examinations didn't revealed jaundice, tenderness and hepatomegaly. Liver function of all the patients in both the group was normal in the follow ups. Ultrasonography was not required for any of the patients.

DISCUSSION

Incidence of Choledocholithiasis has been found to be higher in females compared with males in our study (2.125:1). This was in accordance with the study conducted by Way, *et al*, who reported female: male ratio of 3:1³ and by Kumar, *et al* with reported ratio of 2:1 to 1:1⁴. However, Soon, *et al* reported male preponderance in their study with female male ratio of 1.3:1.

In our study, the most common age group affected is between 40 to 49 years. The mean age of the patients is 42.92 years. The incidence and prevalence of choledocholithiasis tends to increase with age. Nathanson, *et al* have reported the median age affected to be 59.6 years⁵. Sgourakis reported the age range to be between 46 to 89 years⁶. Hermann has shown that the incidence that begins in childhood, progresses steadily with a sharp increase between 35 to 55 years and continues to show a gradual increase after 55 years⁷. With the proper indication and meticulous technique, it can be performed even in younger patients. Our study showed incidence choledocholithiasis maximum in middle aged women probably because of geographical variation and local dietary habits.

It is the most important criteria in decision making of drainage procedure.

L H Blumgart, suggests that a dilated duct is the *sin qua non* for the choledochoduodenostomy. It should not be performed with ducts less than 1.4 cm in diameter & a duct narrower than 1.2 cm is absolute Contraindication. Thus Two technical criteria are essential for a proper choledochoduodenostomy a common duct of 1.4 cm in diameter at the minimum & a stoma size of 2.5 cm.

Wood MD, Glidman ML, 1981 showed in his 200 cases of Choledochoduodenostomy that when the calculus containing CBD measures 1.2 cm in internal diameter & anastomotic width is at least 2.5 cm, Choledochoduodenostomy is an excellent procedure⁸.

Similar results were shown by George A Degenshein MP, *et al* 1974 who published the study of 175 consecutive cases of Choledochoduodenostomy among which 153 were for benign biliary disease.

In our study, 15 out of 18 (83.33%) patient with cholangitis had CBD diameter more than 10 mm, whereas in the absence of cholangitis, only 12 out of 32 patients had CBD diameter more than 10 mm. this was in accordance with the study conducted by Tomizawa *et al*, in which 70.13% of (11.2±2.9mm)⁹. CBD dilatation aids in the diagnosis of acute cholangitis¹⁰. The sensitivity of cholangitis is 95 to 100% for CBD stones¹¹.

The most popular and age-old method of draining the common duct after exploration is a T-tube drainage. The bile is a most irritating fluid to the peritoneum. It produces an intense inflammatory reaction, which is mostly followed by dense peritoneal adhesion and if the extravasation is large, septic peritonitis follow which eventually leads to fatality. By draining the common duct such complications can be avoided. The drain should be left in place till its track is safely sealed off from the general peritoneal cavity which takes about 10 days (Sir Ogilvie¹², 1957).

Operative Cholangiogram is a relative safe guard against residual stones, particularly when there are multiple stones in the common duct. Where the facility of operative cholangiogram is not available, it appears that choledochoduodenal bypass prevents subsequent bile duct obstruction by any residual stone which, if small, will pass into the duodenum through the stoma easily.

The primary objection of many to perform Choledochoduodenostomy is that it, pre-disposes to ascending cholangitis, from intestinal contents passing into the biliary tract. But this objection is not borne out by any confirmatory factual clinical data. Madden, *et al* (1970), in a convincing experiment, proved that in none of the 20 animals subjected to biliary – colic anastomosis did cholangitis develop, although barium enema studies demonstrated an immediate reflux of the barium into the biliary system. This has been convincingly proved by many authors that cholangitis really occurs in cases of stomal obstruction where the outflow of bile is impeded and not due to regurgitation of intestinal contents. Florcken, as early as in 1923 stated that the danger of cholangitis was purely theoretical and the objections came only from those who never did the operation or those who made a small anastomosis. Madden¹³ *et al*, in a collected series of 1,255 Choledochoduodenostomy, found only 5 patients (.4%) with recurrent cholangitis.

Mortality rates in patients undergoing surgery for CBD calculi ranges from 1% in relatively fit younger patients to 28% in the unfit and the elderly¹⁴. It increases to 12-14% in younger patients undergoing surgery for Cholangitis¹⁴. Moreover the mortality/morbidity is increased if a drainage procedure is included¹⁵.

In our study, both the surgical procedures did not produce any mortality. Seventeen (34%) patients developed complications. This could be because much of the study population was elderly and most of the complications were noted in patient with acute Cholangitis.

In both the group, wound infection was noted to be most common complication. There were 3 cases (10%) of bile leak in T-tube drainage group. One was due to dislodgement of upper end of T-tube and other two developed after removal of T-tube. However, all of the 3 cases recovered over next 2-3 days and fistula stopped. In Choledochoduodenostomy group there were only 3 cases of wound infection (15%) and 2 cases of bile leak (10%). All of the patients treated conservatively successfully.

Mean duration of surgery was significantly lower in T-Tube drainage. The mean number of days of hospital stay for the patients who underwent treatment by T-Tube was 14.4 days and those who underwent choledochoduodenostomy was 10.7 days, which was significant in our study ($p < 0.001$).

CONCLUSION

In this study, both the surgical procedures did not produce any mortality. Some patients developed complications. This could be because much of the study population was elderly and most of the complications were noted in patient with acute cholangitis. In both the group, wound infection was noted to be most common complication. All of the patients treated conservatively successfully.

ACKNOWLEDGMENT

I thank our Department of Faculties for their support and also Institute for providing Free of cost Facilities for patient care.

Conflicts of Interest : Nil

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