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Original Research Paper

General Surgery

VARIABLES IN THE LAPAROSCOPIC MANAGEMENT OF CBD STONE

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ABSTRACT

Background and objectives: To evaluate operative feasibility of Laparoscopic choledocholithotomy

Material and Methods: The present study was conducted on patients presenting with complaints suggestive of stone in common bile duct in the Emergency or Out-patient Department of M.L.B. Medical College, Jhansi in the Department of Surgery in duration between May 2013 to Oct. 2014

Result and Discussion: In our study all 31 patients underwent transductal. Rigid nephroscope was used in all patients except 01 patient in which ureteroscope was used. Stone clearance was 100% with mean operating time was 62.34 min. with conversion to open CBD explorationin 02 patients. Primary closure was done, T-tube was inserted in 04 patients. Suture used was vicryl 3-0 continuous in all except one in which monocryl was used and average hospital stay was 5.8 days. No other complications were reported.

Conclusion: Laparoscopic CBD exploration is a safe, feasible and single stage option for the management of CBD stones and probably better option to ERCP.

KEYWORDS : Common bile duct stones, Biliary drainage, Laparoscopy, Choledocholithiasis

INTRODUCTION

The term laparoscopy was coined by Hans Christian J Acobaeus of Sweden in 1911. Alfred Cushieri and George Berci suggested the utility of laparoscopic exploration to minimize nontherapeutic laparotomy. Laparoscopic examination of the abdominal cavity was introduced in 1901 by G. Kelling using a cystoscope inserted under local anesthesia.

Prior to the introduction of laparoscopic cholecystectomy, choledocholithiasis was documented in approximately 9-16% of those patients who presented for open cholecystectomy. The reported incidence of CBD stones found during laparoscopic cholecystectomy ranges from 3 to 10%. It is unclear whether an asymptomatic choledocholithiasis requires treatment. Furthermore, it is well established that small stones may pass through the ampulla of Vater. Moreover, it is not clear what stone size precludes transpapillary migration into the duodenum nor which criteria will predict complications of pancreatitis or cholangitis if CBD stones are not treated. Therefore, it is generally recommended to treat CBD stones whenever detected. Definitive treatment of these patients includes cholecystectomy and clearance of the ductal system.

In 1890, nearly eight years after Langenbuch performed the first "open" cholecystectomy, Courvoisier showed that indeed the CBD could be cleared at the time of cholecystectomy. Around one hundred years later, laparoscopic cholecystectomy (LC) became the standard of care for treatment of symptomatic gallbladder disease. Within a few years several laparoscopic techniques proved successful in the treatment of choledocholithiasis at the time of laparoscopic cholecystectomy.

Apparent advantages of less pain, scarring, and less hospitalization are enough to pursue this novel technique despite early controversies regarding surgeon training and complications related to lack of experience with this new technique. Management of CBD stones is one such rapidly developing field.

AIM

- To evaluate operative feasibility of Laparoscopic choledocholithotomy
- To analyse the operative parameters
- To evaluate safety & efficacy of Laparoscopic CBD exploration.
- To evaluate complications of laparoscopic CBD exploration

MATERIAL AND METHODS

The present study was conducted on patients presenting with complaints suggestive of stone in common bile duct in the Emergency or Out-patient Department of M.L.B. Medical College, Jhansi in the Department of Surgery in duration between May 2013 to Oct. 2014. The patients were then subjected to :

1) Detailed history & physical examination
2) Investigations
- Blood Investigations
- Full blood count
- Liver function test - SGOT and SGPT, S. Bilirubin, S. Albumin, Total Protein, A:G,
- Alkaline phosphatase
- S. Amylase
- S, Glucose

3) Imaging of the biliary system
- Ultrasound
- CT Scan, where indicated

Operative method:

In all patients transdochal approach is used.

The standard 4 port configuration for laparoscopic cholecystectomy is used, a fifth port between the right midclavicular and epigastric port just below the subcostal margin for inserting the choledochoscope is optional.

Methodology:

Approach – Transcholedochal

Position – Reverse trendelenberg position with 20 deg left down tilt Slightly tilted to left side

- 6° nephroscope with a working channel
- 1.2 mm Grasper

- First telescope port- 10mm 30° umbilical port.
- Second port - 10mm to the left of midline in epigastrium.
- Third port – 5mm port in right midclavicular line.
- Fourth port – 5mm port right mid axillary line
- Fifth port –high para xiphisternal port for nephroscope

The duct exploration is performed after ligation/clipping of cystic duct and cystic artery but before the gall bladder is removed so that the gall bladder can be used to elevate the liver and apply tension to the cystic duct and CBD. After opening up of the Calot's triangle, the anterior surface of the CBD is dissected carefully and choledochotomy is performed in the anterior wall below the junction of cystic duct with the help of endoscopic knife or harmonic shears. The choledochotomy is made only as long as the diameter of the larger calculi to minimize the suturing required for closure.

The stone is retrieved by spontaneous evacuation while incising the bile duct or by blunt instrumental pressure with atraumatic forceps, or irrigation and suction or by forcep extraction.

Choledochoscopy is performed with a 6^0 nephroscope to assess the completeness of the procedure and during forcep extraction.

- Choledochotomy was closed either primary or over a T-tube with continuous 3'0 vicryl or monocryl suture.
- After bile duct closure, cholecystectomy was completed in the usual manner. We place an infrahepatic tube drain which is removed on day 2-3 after the output decreases below 30 ml /day.

Parameter assessed included:

Intraoperative –

Parameters noted and assessed comparison between laparoscopic and open method

- No. of ports
- Types of instruments
- Time of repair
- Intraoperative complications
- Type of suture
- Type of anesthesia

Different types of telescopes used –

- Cystoscope
- Nephroscope
- Ureteroscope

Postoperative

- Recovery period
- Post operative pain
- CBD stone recurrence
- Cost of laparoscopic surgery
- Postop complications

The results of LCBDE would may be compared with parameters of open CBDE to be done in same unit.

DISCUSSION

Before the introduction of laparoscopic and endoscopic procedures, choledocholithiasis was treated only by open CBD exploration.

However, the traditional approach to CBD exploration has been supplemented by newer, less invasive procedure.

In the present laparoscopic era, the best treatment for patients with choledocholithiasis is a matter of debate and management of choledocholithiasis continues to evolve. The principal minimally invasive option for treatment of CBD stones include endoscopic sphincterotomy (ES) and Laparoscopic CBD Exploration (LCBDE).

The major challenge of a successful LCBDE with choledochotomy include using choledochoscopy to remove CBD stones laparoscopically, with or without an indwelling 'T-tube' through the choledochotomy, and intracorporeal suturing and knotting.

However, once the surgeon is familiar with these procedures, LCBDE can be performed as smoothly as conventional surgery.

LCBDE offers significant benefit, including minimal invasiveness and it enables appropriate patients to undergo complete management of their calculous biliary tract disease with one invasive procedure when compared with ES.

The drawback of LCBDE include substantial requirements for equipment, including two sets of video system (one for Laparoscopy and one for choledochoscopic procedures).

The discussion on CBD exploration comparing prior study with my present study will be done under following heads :-

1. Age / Sex
2. Number of port
3. Operative time
4. Hospital stay
5. Conversion rate
6. Suture used for CBD closure
7. Comparison of open with lap/endo CBD exploration
8. Comparison of LCBDE with ERCP
9. Comparison of LCBDE of others with our study
10. Comparison of LCBDE transcholedochal vs transcystic approach

Age/Sex:

- In studies of **Suc et.al.(1998),** average age of presentation of CBD calculus was 35 to 40 years. To the best of our knowledge, no study has shown Lap. CBD exploration at 20 years.
- In our study youngest age was 12 yrs. and eldest age was 85 yrs. and the average age was 44.8 yrs.

Port:

- Conventionally, no. of ports used in studies of **Targarona et.al. (1996)** for Lap. CBD stone was either 4 or 5.
- In our study, we used 4 ports (Two 10 mm ports and two 5 mm ports) in most of cases and 3 ports in 04 patients and 5 ports in 03 patients.

Operative time:

- In studies of **Hammerstron et.al (1995),** time taken for Lap. CBD exploration varied from 1 hrs. 30 min to 2 hrs.
- In our study, we had a time of 32 to 130 min.

Hospital stay:

- In study conducted by **Hammerstron et al (1995).,** and **Suc et al.**, average length of hospital stay were 16 days (which was highest).
- In **Rhoes et al.(1998),** average hospital stay was 1 day which is shortest in any study conducted till date.
- In our study, average hospital stay was 5.8 days.

Conversion rate:

- Conversion rate was highest in study of **Sees and Matin (1997)** 20 % and lowest in **Rhoes et al.(1998)**, 2%.
- In our study conversion rate was 06.45%

Laparoscopic CBD exploration poses doubt about the effectiveness of ERCP in CBD clearance and its potential advantages in terms of morbidity or mortality

Several studies (Hammerston et al., Suc et al., Rhoes et al., have emerged to manage synchronous CBD stones: i.e. Open CBD exploration, laparoscopic CBD exploration or post-operative ERCP with stone extraction.

Our study reveals that inadvertently discovered CBD stone at the time of lap. Cholecystectomy has to be addressed laparoscopically if this technique is mastered by the surgeon, otherwise posing the dilemma between converting to an open procedure or relying on postoperative ERCP for stone retrieval.

The policy of selective preoperative ERCP before laparoscopic cholecystectomy has been proposed, as in study of Stain et al, Barkeen et al., performed preoperative ERCP in all patients with an elevation of more than twice as normal in one of LFT measurements.

Approximately 57.6% of those had stones.

In another study of **Barkun et al**.(2004), independent predictors were Bilirubin (> 30 mmol /L). Presence of dilated CBD on ultrasonography >6mm and suspected or detected bile duct stone (at ultra-sonography), performed pre-operative ERCP in all patients. Approximately 74.6% of those had stone.

In our study on the basis of clinical symptomatology, LFT & ultrasonography. We performed Lap. CBD exploration in all patients with a success rate of 100%

Suture used in cbd closure:

1. Vicryl – Continuous Interrupted
2. Monocryl dyed (3-0)
3. Silk (3-0)

In the study done by **SUN dong lin(2008-2011)** for CBD exploration all the CBD were closed with 4-0 vicryl (Interrupted sutures) and only 1 patient suffered from bile leakage.

Zhang Hangto et al(2009) performed CBD closure by 5-0 monocryl with no bile leak in 149 patients.

In our study we used continuous vicryl 3-0 with 02 patients having bile leakage.

Comparison of open with lap / endo cbd exploration:

In the study done by **Grubnik VV et al.(2005-2009)** 138 patient underwent LCBDE & 118 patients underwent open CBD exploration. Mean duration of LCBDE was 82 min and open surgery was 90 min. Post operative complication were observed in 9 patient of LCBD group and 15 patient of open group.

External drainage was used in 32.8% patient in LCBDE & 65% patients in open.

Morbidity in open group was higher (12.7%) & LCBDE (6.5%)

In the study done by **YiNJ et al.** 59 patient underwent LCBDE 22 treated by open surgery & 7 converted from lap to open. Operating time was 230 min in laparoscopy group 182 min in open group and 247.9 min in conversion group. Time to diet & hospital stay was longer in the last group. Post operative complication were maximum 40.9% in open group. Cholangitis was maximum in the last group.

In the study done by **Na Ra Moon et al.(2010)** 66 patients underwent open surgery and 123 LCBDE stone clearance was equivalent but mean operation time incidence of post operative complication & hospital stay was not significantly different. Cases of T-tube insertion & recurrence of CBD stone were significantly more in open group.

In our study all 31 patient underwent LCBDE with 100% stone clearance and in 4 patients open CBD exploration was done.

Mean time for surgery in LCBDE was 62.34 mins with conversion to open CBD exploration in 02 patients.

Average hospital stay was 5.8 days.

Lap CBDE is associated with much less intra operative complication & short hospital stay so it should be practiced if the expertise is available.

In our study 4 patients underwent open CBDE. Range of hospital stay was 9-30 days.The parameters can be seen in page number 41. 01 patient developed biliary ascites for which patient was reoperated and T tube was inserted.

T tube insertion was done because of ---

1. Suspect CBD closure
2. Doubtful CBD clearance

No definitive comparative conclusion can be drawn because of small number of cases in the open group.

LCBDE of others with our study:

Alessandro M. Paganini et al. Did LCBDE in 284 patient
163 cases transcystic LCBDE
117 cases lap choledochotomy
4 converted to open surgery

Biliary drainage was done in 264 patients, bile leakage was seen in 5, haemoperitonum in 2 because of bleeding by cystic artery and acute pancreatitis in 1.

Retained stone were seen 15 were removed by biliary drainage fact in 9 and ERCP in 6.

In the study of **Song Liang et al.(1991-2006)** did LCBDE tried in 371 patients.

271 underwent transcholedochal LCBDE & 97 underwent transcystic LCBDE 3 were converted to open surgery, no patient was sent for ERCP.

Transcholedochal operating time was 140.7 ± 9.7 min and for transcystic 101.6 ± 39.8 min. 20 patients developed complications 13 from transcholedochal & 7 from transcystic. Length of hospitalization for transcholedochal 2.4 days and for transcystic was 2.6 days.

In the study done by **Curet M. J. et al.(2000)** 28 patient underwent lap CBD exploration stone extraction was successful in 24 patients & 4 were converted to open surgery. 1 patient expired due to cardiac arrest. 6 patients underwent biliary leakage 3 suffered from pancreatitis and severe sepsis seen in 1. Over all significant morbidity was seem in 7 patients and mean hospital stay was 6.4 days. 1 patient had stone during followup.

In our study 31 patients underwent lap CBDE with 100% stone extraction, 02 patients was converted to open surgery. No patient suffered from pancreatitis, severe sepsis, retained stone. Average hospital stay was 5.8 days.

T-tube in LCBDE

- **Leida Z et al. (2000-2004)** Conducted LCBDE with equal no. of patient assigned for primary closure and T-tube drainage. In the primary closure group post operative stay and time to work were significantly lower but post

operative complication and biliary complication were not significantly lower.

- **Ha JP et al. (2000-2003)** conducted 38 lap CBDE 12 underwent primary closure, 26 underwent T-tube drainage. Median operative time & post operative stay were shorter in the primary closure group when compared with T-tube group.
- Primary closure of the CBD is feasible and as safe as T-tube insertion after lap choledochotomy for stone disease.
- T- Tube insertion done in patients with-

1. Suspect CBD Closure
2. Doubtful CBD Clearance
3. Initial 2 cases of LCBDE- as a safety measure as operator was not experienced.

Laparoscopic CBD exploration vs ERCP:

Operative feasibility & methodology for calculous biliary tract disease.

Pre operative diagnosis of CBD calculous is made.

In the study done by **Berken et al.(2006)** 26 choledocholithiasis underwent ERCP and 14 had successful stone clearance, 8 had stones at the end of the procedure and in 3 patient stents were placed.

Thus according to this study ERCP is an effective means of dealing with cholangitis and stone in CBD.

In our study 31 choledocholithiasis underwent laparoscopic CBD exploration with successful clearance of the duct and no patient were sent for ERCP. ERCP is a quick and often painless procedure successful in more than 90% of patients. However there are few adverse effects of the procedure like pancreatitis, bleeding and failure to clear bile duct, cholangitis, recurrent stone formation and malignancy in the long term.

Lu J Chang et al (2011) did meta analysis taken from 5 trials (621 patients) comparing pre-operative ERCP with LCBDE. There was no significant difference in stone clearance from common bile duct, post operative morbidity, mortality, conversion to other procedure, length of hospital stay and total operative time. They concluded that single stage management is equivalent to two stage management but requires fewer procedure.

Per operative suspicion of CBD calculus.

An intraoperative cholangiogram at the time of cholecystectomy will document the presence of CBD calculous.

Option available are

- Lap CBD exploration
- ERCP

In the study done by **Qi Wei et al.(2002-2003)** 45 patients underwent LCBDE & 57 patients underwent LC plus IOES. Stone clearance was equal in two groups but conversion rate was higher in LC plus IOES and morbidity was higher with 3 patients having pancreatitis & 1 having bleeding & total hospital cost was also higher.

In the study **El Geidie AA et al** 226 patients were taken. 115 underwent LCBDE while 111 underwent LC+IOES. There was no statistically significant difference in the success rate of CBD clearance between the two intervention, no difference in terms of surgical time & length of stay in hospital. Pancreatitis & bleeding were prevalent in the LC – IOES group. Bile leakage was more prevalent in LC – LCBDE group.

Technical and Procedural Problem of ERCP in per Operating Setting

- Need to coordinate and synchronise the surgical and endoscopic teams to were together.
- Endoscopic team must be familiar before hand with the patient surgery program.
- Endoscopist should have to position between patient left arm usually extended during surgery and the patient's hand which cause a certain degree of discomfort.
- ERCP should be performed with the patient in the supine position and the radiological quality needed in traditional x-ray rooms will not be available.
- Rendezvous technique can produce Glisson's capsule haematomas if the guide wire is introduced deep into the bile duct without radiological control.
- In case of stone measuring more than 15-20 mm, intraoperative ERCP may not be as definitive and conclusive as in our usual radiological environment.
- Some group have manifested concern on difficulties in relation to the air insufflation during ERCP.

Post operative CBD calculous:

In the study done by **J. P. Dorman et al (1990-1991)** on ERCP in the management of CBD calculous after cholecystectomy 32 patients were selected of which 10 had under gone open cholecystectomy and 22 had under gone lap cholecystectomy. 28 underwent ERCP with success in 21 and surgery was required in 7. There were 3 complication related to ERCP i.e. 2 had pancreatitis and 1 had bleeding.

This study reveals that retained or recurrent stones following cholecystectomy are best treated endoscopically and ERCP is better option.

Comparison of lcbde transcholedochal vs transcystic approach:

- **Rojas Ortega et al(1992-2002)** conducted transcystic CBD exploration in 34 patients. Success rate for stone removal was 94.1% with two failure related to multiple stones and impaction at ampulla. Mean operating time was 120±40 min, morbidity rate was 8.8% with no death.
- **Lyaes S et al** said that indication for transcystic approach is stones smaller than 10 mm, less than 9 stones and possibility tumor. Contraindication are stone larger than 1 cm, stone proximal to cystic duct entrance into CBD, small friable cystic duct more than 10 stones.
- **Tokumara H et al** did LCBDE

Transcystic approach was choosen for stones less than 5 in number and smaller than 9 mm in diameter and whose CBD was less than 15 mm in diameter on cholangiogram. Transcystic approach was done in 91 of 104 patients attempted, rest 126 underwent choledochotomy.

In transcholedechol approach, transcystic drainage was done in 59 patients, T-tube drainage in 46, primary duct closure in 19 and 1 underwent choledochoduodenostomy.

Transcystic approach was associated with shorter hospital stay and less morbidity, bile leaks were more common in those with primary closure. Residual stones were found in 2 patients with transcystic approach and 10 with choledochotomy. Stone were removed by choledoscope.

- **Song Ling et al(1991-2006)** (374 patients) underwent LCBDE

	Transcholedochal	Transcystic
Patients	277	97
Operating time (min)	140.7 ± 69.7	101.6 ± 39.8
Bile leakage	6	2
Retained stone	2	5
Pancreatitis	1	0
T-tube dislodgement	4	0
Hospital stay (days)	2.4 ± 1.1	1.7 ± 0.9

Transcystic approach should be preffered method for LCBDE.

- **Khan M et al(2007-2012)** used Rigid Nephroscope for transdochal approach for LCBDE in 80 patients. 72 had multiple stone with mean CBD diameter about 15.3 mm. Choledochotomy was managed by placing T-tube in 21, primary closure in 58 and choledochoduodenostomy in 1. Mean operating time was 83 min and post operative stay was 4.2 days. 1 patient developed cholangitis 5 months after LCBDE.
- **Tekin A et al.(2010)** LCBDE using rigid scope by choledochotomy in patient with stone ranging from 9.5 – 24 mm. Stone clearance was 100%. Mean operating time was 124±26.7 min and mean hospital was 4±1.7 days.
- **In our study** all patients underwent transductal. Rigid nephroscope was used in all patients except 01 patient in which ureteroscope was used. Stone clearance was 100% with mean operating time was 62.34 min. Primary closure was done, T-tube was inserted in 04 patients. Suture used was vicryl 3-0 continuous in all except one in which monocryl was used and average hospital stay was 5.8 days. No other complications were reported.

CONCLUSION

- Laparoscopic CBDE requires advanced expertise of operating surgeon
- Choledoscope is not essential as can be substituted with rigid Nephroscope or Ureteroscope.
- T-tube is not mandatory –
- To be preferred in patients with
- Suspect CBD closure
- doubtful CBD clearance
- in some patient of >10mm CBD diameter – it may be considered.
- Laparoscopic CBD exploration is a safe, feasible and single stage option for the management of CBD stones and probably better option to ERCP.

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