

# Results of laparoscopic for the management of bile duct stones

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**Keyword:**

Bile duct stones, Biliary drainage, Laparoscopy, Choledochotomy.

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**Abstract**

*Introduction:* To describe clinical and para-clinical characteristics of bile duct stones and results of laparoscopic choledochotomies in management of bile duct stones.

*Materials and methods:* Retrospective and prospective study in 152 bile duct stones patient, who underwent laparoscopic choledochotomy with or without usage of flexible bile ducts scope and electrohydraulic technique, from January 2009 to May 2019 at Hue Central Hospital.

*Results:* Mean age 54,2 (22 - 84), 66 male and 86 female, mean operative time: 135 minutes (90 - 235), intraoperative complications: 3,29%, open conversion: 5,92%. Complete stone clearance was achieved in 91,6% patients. Postoperative complications: 7,69%.

*Conclusions:* Management of bile duct stones by laparoscopic choledochotomy is safe and effective with high percentage of stones clearance, as well as low intraoperative and postoperative complications. This procedure can achieve good results if bile ducts scope and electrohydraulic technique were concomitantly applied.

**Introduction**

Bile duct stones are common diseases in Vietnam and South East Asia. Stones can be found in different part of bile duct such as: common bile duct, common hepatic duct, intra-hepatic duct, or combination between common bile duct and gallstones,... Biliary colic was usually the first onset followed, fever and jaundice. Bile duct obstruction can cause severe complications such as Gram Negative Bacteria sepsis, hemobilia, or bile peritonitis. In the past, bile duct stones was treated by laparotomy, choledochotomy for stones removal and T-tube insertion.

Nowadays, with the development of modern technologies, bile duct stones can be treated by minimally invasive approach such as endoscopic retrograde cholangiopancreatography (ERCP) by sphincterotomy or papillary ballon dilatation

with stones extraction, extracorporeal shock wave lithotripsy (ESWL), percutaneous trans-hepatic, lithotripsy... However, in cases that patients have large stones or, multiple stones combined with gallstones or failure in ERCP, stones should be removed through surgery, conventional or laparoscopic.. In 1987, Phillippe Mouret (a French surgeon) has performed the first laparoscopic cholecystectomy, beginning the new minimally- invasive era to perform worldwide. Since then, laparoscopic surgery has rapidly been spreading for all types of surgeries. In Vietnam, laparoscopic cholecystectomy was first performed at Cho Ray Hospital in 1992, at Viet Duc University Hospital in 1993, and Ho Chi Minh University Medical Center in 1995.

Laparoscopic cholecystectomy has been performed in Hue Central Hospital in 1998, then

in 2000, the first laparoscopic surgery for check of common bile duct was performed for management of bile duct stones associated with gallstones. Later, the advanced techniques such as intrahepatic lithotomy and intraductal electrohydraulic lithotripsy have been applied [1], [2], [3], [4]. Even laparoscopic surgery combined with flexible endoscope for bile duct stones is not the new technique but always a new challenge. The aims of this study were:

- To investigate clinical and para-clinical features of bile duct stones and the indications for laparoscopic management of bile duct stones.

- To evaluate the outcomes of laparoscopic surgery in bile duct stones disease.

## Patients and methods

### Patients

- From 1/2009 to 5/2019, 152 patients underwent laparoscopic for common bile duct exploration, in which 61 cases used intraductal electrohydraulic lithotripsy, 143 cases used laparoscopic common bile duct lithotomy for removing stones, 9 cases were converted to open choledochotomy for lithotomy.

- The diagnosis of common bile duct stones (CBDS) was suspected on the basis of clinical, laboratory (liver function), ultrasonography twice with experienced radiologist, Multislice Computed Tomography (MSCT) findings, concordant indications for surgery.

### Methods

Retrospective and prospective study.

### Patient criteria

- Inclusion criteria:

- Choledocholithiasis, choledocholithiasis combined with gallstone.

- ERCP failure to extract stone.

- Big stones > 2cm or multiple stone.

- Common bile duct diameter > 10mm (twice on ultrasonography).

- Exclusion criteria:

Patients with contraindicated for laparoscopic surger.

**Surgical instruments:** Karl Storz endoscopy

equipment.

- Image equipment: Telecamera focal distance 25 - 50mm, 43 inch monitor, Hopkins Telescope, cold light fountain Xenon 300 scb, neutral electrode connecting cable.

- Surgical equipment: laparoscopic instruments, flexible choledochoscope 5mm, electrohydraulic lithotripter, stone retrieval devices (Dormia), Mirizzi forceps.

### Steps of procedure:

- Anesthesia: Intubated anesthesia, monitoring equipment Saturation of peripheral oxygen.

- Position of patients and surgeons: Patients were in supine positioned - Main surgeon is on the left of patients, assistant is at the same site of main surgeon, the monitor is on the right of patients.

- The surgical techniques:

- 10mm trocar under navel for laparoscope, 12mm trocar in epigastric region, 5mm trocars (x2) in the right hypochondriac. Intra-abdominal pressure was set at 12mmHg.

- Dissect to reach the common bile duct.

- Open the common bile duct in a horizontal incision, all the stone were retrieved and clearance by basket or Mirizzi's forceps at 5mm trocar in the right hypochondriac or 12mm trocar in epigastric region.

- Flexible choledochoscope was used to detect and remove the stones with Dormia.

- In cases of large or multiple stones, electrohydraulic lithotripter was used to break the stones.

- T-tube insertion secured with sutures. CBD can be closed by primary suture if after careful checking, it is not stenosed, all stones were cleared, bile fluid is clear, the biliary tract is not inflamed.

- Subhepatic drain was placed.

- In case of the stones in the right and left hepatic duct cannot be removed, they will deliberately left behind, waiting 3 weeks for the T-tube tunnel to be matured.

- Other techniques: Cholecystectomy if indicated - Dilate the Oddi's sphincter if the lower part of common bile duct was stenosed.

### Data analysis

Medical statistic SPSS 20.0 soft ware.

## Results

Table 3.1: Gender distribution

Sex	Patients	%
Male	66	56,58
Female	86	43,42
Total	152	100

Average age: 54,2 (22 - 84).

Table 3.2: Surgical history

Surgical history	Patients	%
Gastric perforation	1	8,33
Splenectomy	1	8,33
Bile duct stones	10	83,34
Total	12	100

Table 3.3: Clinical presentations

Clinical presentations	Patients	%
Biliary colic	140	92,10
Fever	102	67,10
Jaundice	87	57,23

Table 3.4: Laboratory

Laboratory	Patients	%
Hyperbilirubinemia	63	41,45
Hyper liver enzymes	34	22,37
Prothrombine time $\geq$ 70%	82	53,95
Leucocyte $\geq$ 10.000	95	65,5

Table 3.5: Location of stones in sonography

Location of stones	Patients	%
CBD stones	79	51,97
CBD stones + gallstones	34	22,37
CBD stones + gallstones + hepatic duct stones	12	7,89
CBD stones + hepatic duct stones	20	13,16
Hepatic duct stones	7	4,61
Total	152	100

Table 3.6: Laparoscopic methods

Laparoscopic methods	Patients	%
CBD stones removal. Primary suture	9	6,29
CBD stones removal + T- Tube drainage	62	43,35
CBD stones removal + intra-hepatic duct electrohydraulic lithotripsy + T-tube drainage	33	23,07
CBD and hepatic duct stones removal, T-tube drainage	11	7,69
CBD and hepatic duct stones removal, intraductal electrohydraulic lithotripsy, T-tube drainage	21	14,68
Hepatic duct stones removal, intraductal electrohydraulic lithotripsy, T-tube drainage	7	4,89
Total	143	100

Cholecystectomy in 44 patients, intraductal electrohydraulic lithotripsy in 61 patients.

Clearance stones ratio: 131/143 (91,6%).

Table 3.7: Surgical Complications

Complications	Patients	%
Hemorrhage	4	2,63
Dudodenal injury*	1	0,66
Total	5	3,29

\* Surgical history: Bile duct stones disease.

Table 3.8: Conversion to Laparotomy

Reason	Patients	%
Hemorrhage	2	1,31
Adhesion	3	1,97
Dudodenal injury*	1	0,66
Difficulty in removing stones	2	1,31
Stuck and broken Dormia basket	1	0,66
Total	9	5,92

Laparotomy ratio: 5,92%.

Table 3.9: Complications after laparoscopy

Complications	Patients	%
Injury of cystic artery	2	1,39
Bile peritonitis	1	0,69
Bile leakage	2	1,39
Surgical Site (Wound) infection	3	2,09
T tube infection	2	1,39
Sub-phrenic abscess	1	0,69
Total	11	7,69

Hospital stays : 8,5 days.

## Discussions

### Subject demographic

Bile duct stones present in both gender, at any age, especially between 40 - 70 years old. In our study, the mean age was 54,2 years old (ranging from 22 to 84), male/female ratio 76,74%. The clinical presentations of bile duct stones are diversified, or absence of clinical signs, the diagnosis was taken by accident with cholangitis or pancreatitis. The most common symptom was pain in right hypochondriac or epigastric region. Clinical presentations were Charcots triad (pain, fever, jaundice). Our patients were admitted with 92,10% abdominal pain, 67,10% fever, 57,23% jaundice.

### Indication

Patients with bile duct stones have indications for surgery required 2 sonograph taken by experienced

radiologists, and MSCT, common bile duct diameter  $\geq 10$ mm. However, during the study period, flexible endoscope and intraductal electrohydraulic lithotripter were sometimes out of order and needed to be fixed, then surgeries were performed on patients with only common bile duct stones or common bile duct stones combined with gallstones. Whenever having full equipment, we performed surgery on patients with multiple stones, intra-hepatic duct stones, especial patients with surgical history of upper abdominal region. It was accordant with of national and international researchers opinions [1], [2], [6], [7], [8], [15].

Nowadays, with the advancement of medical instruments and techniques, treatment for bile duct stones are not only laparotomy and choledochotomy but also use many methods: trans - cystic choledochoscopy or laparoscopic choledochotomy, Endoscopic retrograde cholangio-pancreatography lithotomy combined sphincterotomy or papillary dilatation, on-site choledochoscopic lithotripsy or trans T-tube tunnel, percutaneous lithotomy, percutaneous transduodenal lithotomy. However, choosing indications and methods aid to clear stones, minimize complications in and after operation, decrease mortality rate and these depend on many facts: surgeon's skills, equipment, patients condition [1], [2], [3], [4], [15].

Patients with bile duct stones underwent laparoscopic choledochotomy or ERCP lithotomy with or without intraductal electrohydraulic lithotripsy. In our study, 152 patients underwent laparoscopic choledochotomy for lithotomy: cholecystectomy in 44 cases, intraductal electrohydraulic lithotripsy in 61 cases. Some authors advocated trans - cystic lithotomy (in cases cholecystectomy was performed). However, this method have some disadvantages: We had to dilate cystic duct first, stone must be small, make it difficult in choledochoscopic management. With flexible endoscope, we performed choledochotomy above duodenum by horizontal incision in all cases, different from longitudinal incision of other

researches. In our opinions, with bile duct stones character in Vietnam, most patients are admitted late, the common bile duct is dilated because of bile obstruction in a long time, the size of common bile duct  $\geq 10\text{mm}$  was enlarged in laparoscopy and enough to open by horizontal incision, this reduce common bile duct stenosis post-operation. An issue is needed to discuss about cholecystectomy. Other authors in the world perform cholecystectomy, intra-operative cholangiogram, choledochoscopic lithotomy, T-tube drainage. It was reasonable because of adequate equipment: flexible endoscope 3mm,... We performed cholecystectomy to make it more simple to lithotomy because operation time last long time can cause bile duct injury (tear or bleeding) when we hold [1], [2].

### Results and complications

Mean operation time was 135 minutes: the patients group without choledochoscopic and intraductal electrohydraulic lithotripsy 100 minutes, the 145 minutes. Kadam R 110 minutes, Qi Wei 178 minutes, Tang CN  $129 \pm 57$  minutes. In the beginning of practice this technique, operation time could last 230 minutes, then time is shorter, like other authors opinions: operation time decreases when cases increase [7], [11], [14].

Complication and reason of conversion to laparotomy: in our study the percentage of conversion to laparotomy was 5,92%. Qi Wei: 3,8% in 52 patients; Kadam R 0%; Lee Hyung Mo 3,2%; Waage A 7,4%. The reason were hemorrhage, adhesion, difficulty in removing stones. The posterior wall of common bile duct was perforated in 1 case after dilation, and it was sutured and T-tube drainage [5], [11], [13], [14].

Short term results: in 152 laparoscopic case, completed laparoscopy was 94,08%, higher than some researchers: A. Waage: 92,6%, CN Tang: 93%; and lower than J. Ch. Berthou: 96,2%. This showed that surgeons increase proficient in techniques and there are more equipment to support laparoscopic surgery, to remove stones intra or extra hepatic bile duct. The rate of stones clearance was 91.6%, this

result is similar to some other authors.

Postoperative complications ratio were 7,69%. In other studies, Leslie K. Nathanson: 17%, S.S Rai: 7,5%, J. Ch. Berthou 8,1%. There were two patients which underwent ERCP lithotomy and one case was performed lithotomy trans T-tube tunnel 3 weeks after surgery, wound infection, mild hemorrhage, bile leakage was medical conservative treatment. Two cases with sub-diaphragm abscesses were aspirated under ultrasound and under conservative treatment. There were 3 cases of re-operation due to: 2 cases of bleeding from the tip of the gallbladder artery and one case of biliary peritonitis due to fistula from T-tube base [9], [10], [12].

### Conclusions

Management of common bile duct stones by laparoscopic choledochotomy is safe and effective with high complete clearance of stones, low intraoperative and postoperative complications. This procedure has good effect if it is concomitant with flexible bile ducts endoscopy and electrohydraulic lithotripsy.

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