MANAGEMENT OF STONES IN THE COMMON BILE DUCT

MODERATOR; Dr. BH. PIENAAR
COMMENTARY; NC. MAGAGULA
COMMON BILE DUCT

• The common bile duct begins at the union of the cystic and common hepatic ducts and ends at the papilla of Vater in the second part of the duodenum.

• It varies from 5 to 16 cm depending on the actual position of the ductal union.
• The duct can be divided into four portions;
  1. supraduodenal
  2. retroduodenal
  3. Pancreatic and
  4. intraduodenal
Galbladder

R. & L. hepatic ducts

Common hepatic duct

Cystic duct

Supraduodenal portion

Retroduodenal portion

Pancreatic portion

Intraduodenal portion

Pancreatic duct (Wirsung)

Duodenum

Common bile duct
• Northover and Terblanche showed that blood supply to the bile duct is axial.
• Inferiorly, the CBD receives arterial supply from the gastroduodenal artery.
• The arteries pass on bile duct at 3 and 9 o'clock positions and run along the CBD providing blood supply.
• Superiorly, from the main hepatic artery, or LHA or and RHA, onto the CHD at the confluence of the hepatic bile ducts.
BLOOD SUPPLY OF THE COMMON BILE DUCT.
BLOOD SUPPLY OF THE COMMON BILE DUCT; CONTINUED: VARIATIONS.
<table>
<thead>
<tr>
<th>Segment</th>
<th>Artery anterior</th>
<th>Percent frequency</th>
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<tr>
<td></td>
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<td>Posterior superior pancreaticoduodenal artery</td>
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<td></td>
<td>Gastroduodenal artery</td>
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<td>Supraduodenal artery</td>
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• Major supply from below 60% retroduodenal artery, and 38% from RHA.

• The bile ducts in the hilum and the retropancreatic bile duct have an excellent blood supply.

• Ischaemia can be avoided with a high or low transection, but bleeding of edges should be checked prior to anastomosis.
INTRAOPERATIVE CHOLANGIOGRAM

• Introduced by Mirizzi in the 1930s.
• Minute opening into the anterior wall of the cystic duct with a No. 11 blade.
• Insert a Reddick balloon catheter, securing by inflating the balloon.
• Take two x-rays: the first after injecting 7 ml of 30 percent urografin, and the second using 14 ml of contrast.
• The anaesthesist will stop ventilating the patient during exposure.
• If no pathology, remove the catheter and doubly ligate the cystic duct.
• If CBD stones or other pathology is found, proceed with CBD exploration.
COMMON BILE DUCT EXPLORATION

INDICATIONS

• Biliary pancreatitis
• Presence of stone in CBD
• Failure of stone extraction by ERCP
• Radiographic evidence of a dilated ductal system
• Positive intraoperative cholangiogram
• Jaundice in absence of ERCP
• Cholangitis
• Elevated (ALP, GGT and Bilirubin)

Pioneered by Ludwig Courvoisier 1890
SURGICAL TECHNIQUE

• Duodenal kocherisation, incision of the lateral peritoneum and palpation of the duodenum, head of the pancreas, and distal CBD.
• Dissect tissue overlying CBD no more than 1–2 cm distal to the cystic stump.
• Skeletonisation of more than 2½ –3 cm can result in ischaemia.
• Stay sutures 4–0 Vicryl medial and lateral to CBD area.
• Aspirate CBD to make sure you are in the right place.
• Incise the elevated anterior wall of the CBD to a 1 cm length.
• Remove stones by instrumentation (biliary Fogarty catheter) or extrinsic pressure by milking the stones to the upward choledochotomy.
• Demonstrate ampullary patency by French catheter or a Bakes No. 3 dilator to avoid false passage.

• Conduct irrigations of the biliary ducts to remove small stones or sludge. If stones impacted in the ampulla, papillotomy will be necessary.

• Insert a T-tube and close the common bile duct with 4–0 interrupted Vicryl.
• After clearing the duct direct vision using a flexible fiber choledochoscope needs to be performed.
• If a stone is seen, then a retrieval basket is passed beyond the stone, opened, and gently pulled back to ensnare the stone.
• Once caught, the basket is closed, and all is removed from the common bile duct.
• Impacted stone remains, intracorporeal electrohydraulic or laser lithotripsy can be attempted.

• If mentioned maneuvers fail, the final step is a transduodenal sphincterotomy.
Laparoscopic CBD Exploration

ADVANTAGES:

• Gallbladder and stones are taken care of simultaneously in a minimally invasive manner
• Shorter hospital stay
• Less pain than open procedure or laparoscopic cholecystectomy/ERCP combination.
• Morbidity 2% to 17%, mortality 1% to 5%
Transcystic versus Transductal Approach

• Transcystic approach is successful in >90% of cases for stones <8 mm, and for stones below the cystic duct.

Hindering factors;
1. acute angulation of the cystic duct-CBD junction.
2. Multiple valves of Heister in cystic duct.
3. Tortuous cystic duct
• Transductal approach indicated for stones >8 mm, and stones proximal to the insertion of the cystic duct.

• Should not be performed in a CBD <10 mm diameter.

• Transcystic CBD exploration is preferred over transductal CBD exploration as it has lower morbidity and shorter length of stay.
• Laparoscopic choledochotomy is technically demanding
• This procedure offers effective therapy and is associated with morbidity rate of 10-15%, and mortality rate of 1%, retained stone rate of <6%. 
Equipment needed during the procedure

- Second video camera
- Cholangiogram catheter
- Pneumatic dilators
- 4 or 5 Fr Fogarty balloon catheter
- Stone extractor basket
- T-tube
- Flexible choledochoscope
- Glucagon 1 mg
Routine or selective IOC?

• IOC during cholecystectomy reveals the anatomy of the biliary tree and stones contained within it.
• IOC decreases the risk of major CBDI while adding little time to the procedure.
• The use of IOC may be routine or selective.
• Up to one-third of CBDIs might be prevented with routine cholangiography, Fletcher et al.
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<th>Demographic</th>
<th>All (n = 1,411)</th>
<th>Routine (n = 381)</th>
<th>Selective (n = 1,030)</th>
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• Literature: incidence of complete transection of the CBD is rare for both routine and selective IOC policies, and did not differ between them.

• Rates of minor bile duct injury did not differ between groups, but was more likely to be recognised in the routine
Retrospective cohort analysis patients undergoing cholecystectomy from January 1, 1992, to December 31, 1999

• **Main Outcome Measure** Frequency of CBD injury in patients who did and did not have IOC performed during cholecystectomy.

• **Conclusions:** the risk of CBD injury was higher when IOC was not used, this study suggests that routine use of IOC may decrease the rate of CBD injury.
• Some studies have suggested routine use of IOC may decrease the risk of injury and improve injury recognition.

• In registrarship programs, a policy of routine cholangiography may be supported by the need to train registrars how to do that portion of the procedure.
• A meta-analysis performed in 2004 revealed that the incidence of unsuspected retained stones was 4% with only 15% of these going on to cause clinical problems.
• The conclusion from that study was that a selective policy should be advocated.
Selective IOC users believe it changes management in relatively few cases and should be applied only in situations where choledocholithiasis is considered likely, and to those they describe as “high risk” for CBD injury.
• Meaningful conclusions for IOC use has been difficult because all reports include relatively small numbers of patients.

• CBD injury is a relatively uncommon event, whether IOC is used or not (0.002% to 0.5%).
Choledochoduodenostomy

INDICATIONS

1. BENIGN CAUSES
   • Recurrent bile duct stones
   • Strictures of the bile duct.
   • Biliary fistulas
   • Stenosis of the sphincter of Oddi
   • Choledochal cysts

2. MALIGNANT CAUSES
   • Obstruction from unresectable cancers of the bile duct and pancreas.
Surgical Technique

• A right subcostal incision
• Duodenum is mobilised by a Kocher manoeuvre, so it can be approximated close to the CBD without tension.

• A 2.0-2.5 cm longitudinal incision on distal CBD, closer to the area of stenosis or obstruction.
• The duodenum and duct joined by a posterior interrupted 3-0 monofilament sutures.

• The duodenum is opened longitudinally for about 2.0-2.5 cm interrupted 3-0 or 4-0 chromic catgut sutures are placed to approximate ductal and duodenal mucosa.
• A T-tube is used in patients with thin-walled ducts or difficult anastomoses.
• A final row of interrupted 3-0 silk sutures completes the anastomosis.
Sphincteroplasty

INDICATIONS

• Pancreatitis associated with stenosis of the sphincter of Oddi (inability to pass a No. 3 Bakes dilator into the duodenum),
• Recurrent or impacted bile duct stones
• Distal (Type C) choledochal cyst.
Sphincteroplasty (Surgical technique)

- A right subcostal incision is done
- Duodenum is mobilised.
- A longitudinal duodenotomy directly over the papilla of Vater.
- The posterior (medial) duodenal wall is stabilised with a traction suture, below the papilla of Vater and the papilla is identified and probed with a small probe.
Stay sutures at 3 & 9 o'clock
• The sphincter is opened and divided at 10 or 11 o'clock," with an angled Pott's scissors for a distance of 2.0-2.5 cm.
• The ductal mucosa is sutured to duodenal mucosa with interrupted 4-0 vicryl, taking care to place an apical suture at the upper limit of the opening.
• The pancreatic sphincter should be divided and opened if stenotic.
• The duodenum is then closed longitudinally in two layers.
BENEFITS OF T-TUBE

• Maintaining ductal patency in the setting of edema.
• Providing easy access for postoperative imaging.
• Access for removal of residual stones
• 2 to 3 weeks, a repeat cholangiogram is obtained through the T-tube.
• If study is normal, T-tube can be removed.
RISKS OF T-TUBE

Increased morbidity or mortality secondary to:

• Biliary infection
• Migration of the tube causing CBD obstruction
• Bile duct leaks
• Peritonitis
Primary closure versus T-tube drainage after open CBD exploration

Five trials n=324 patients randomised: 165 to primary closure without stent 159 to T-tube

• Bile peritonitis was higher in the T-tube group (2.9%) than in the primary closure group (1%) (not statistically significant)

• LOS was significantly longer in the T-tube group compared with the primary closure group in three of the four trials.
• Primary closure after common bile duct exploration seems at least as safe as T-tube drainage.
• We need randomised trials that assess whether stents may offer benefits.
Currently preoperative ERCP followed by LC is the treatment policy mostly adopted.

Advantages of ERCP;

1. Reproducible
2. Minimally invasive
3. In experienced hands 90% success in stone extraction
Disadvantages of ERCP

1. Morbidity 10%
2. Mortality 0.5%

Mainly related to Endoscopic Sphincterotomy.
ERCP versus open surgical bile duct clearance


- **Mortality (30 day)** Total: ERCP, 10 deaths/361 patients. Surgical 5 deaths/372 patients.

- **Total morbidity**: there was no significant difference between endoscopy and surgery.
Retained stones after primary intervention (Primary treatment failure)

These data could not be accurately analysed from Bornman 1992 where ERCP was repeated in up to five attempts to obtain CBD stones clearance.

Combination of the other trials found a significantly greater risk of failure in the ERCP arm.
Additional procedures required for duct clearance

- With all trials: a significant benefit favoured surgery with a Peto OR of 4.04 (95% CI 2.76 to 5.92) P< 0.0001.

- This difference was accounted for by the use of repeat ERCPs to gain stone clearance in the endoscopy arms against the high success of the surgical procedure in clearing stones.
Pre-operative ERCP versus laparoscopic surgical bile duct clearance

- N=425 patients randomised (Cuschieri 1999; Sgourakis 2002).

- **Mortality** Total: ERCP 3 deaths/178 patients. Surgical 2 deaths/169 patients.

- **Total morbidity**: In both trials there was no significant benefit.
Retained stones after primary intervention (primary treatment failure)

- In both trials there was no significant benefit favouring either form of treatment.
- Trans-cystic clearance successful in 45 out of 56 patients (80%)
- Choledochotomy in 47 out of 55 cases (85%).
Post-operative ERCP versus laparoscopic surgical bile duct clearance

• Two trials included (Rhodes 1998; Nathanson 2005), randomising, n=166 patients.

• (Rhodes 1998) n=80 patients randomised after IOC to LBDE or post-operative ERCP.

• (Nathanson 2005) n=86 patients randomised after failed transcystic clearance to laparoscopic choledochotomy or post-operative ERCP.
• There were no deaths reported in either of these two trials.
• Total morbidity, no difference in both trials.

Retained stones after primary intervention;
• In the laparoscopic choledochotomy trial there was a greater risk of failure of CBD stone clearance in the endoscopy arm.
• In LBDE trial, equal efficiency in initial treatment in both laparoscopic and endoscopic arms was achieved.

• Combined primary success rates on intention-to-treat data were 75% for ERCP and 84% for laparoscopic surgery.
In summary:

- This report support the view that open bile duct surgery is superior to open cholecystectomy plus ERCP in its ability to achieve CBD stone clearance.

- As for the ERCP versus laparoscopic surgery comparisons, laparoscopic bile duct clearance is proving to be as safe and efficient as ERCP in achieving bile duct clearance.
REFERENCES


• Gurusamy KS, Samraj K. Primary closure versus T-tube drainage after open common bile duct stone exploration. *Cochrane Database of Systematic Reviews* 2007, Issue 1