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# Management of Retained Common Bile Duct Stones

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Case Presentation.. of the **SAME**  
patient...

- POD#7- normal t-tube cholangiogram
- POD#8- discharged home
- POD#16 - Clinic f/u → increase in drain output
- POD#27- t-tube cholangiogram showed distal CBD filling defect



# Case Presentation.. of the **SAME** patient...

- Readmitted POD#36 with cholangitis
  - discharged 5 days later
- Barriers to ERCP- duodenal diverticulum
- Plan: OR for Percutaneous biliary exploration

# Case Presentation

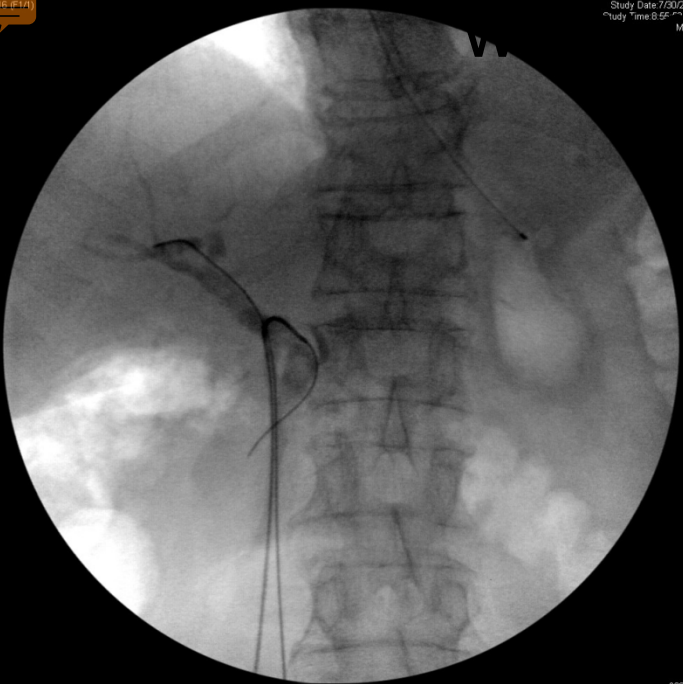
- OR
  - Percutaneous biliary exploration, Intraoperative Cholangiogram (IOC)
  - IOC demonstrated stone, choledochoscope advanced through the biliary tree to the duodenum
  - no stone was visualized
- Repeat on-table cholangiogram showed no evidence of stone



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Study Date 7/30/2012  
Study Time 0:57 AM  
MRN

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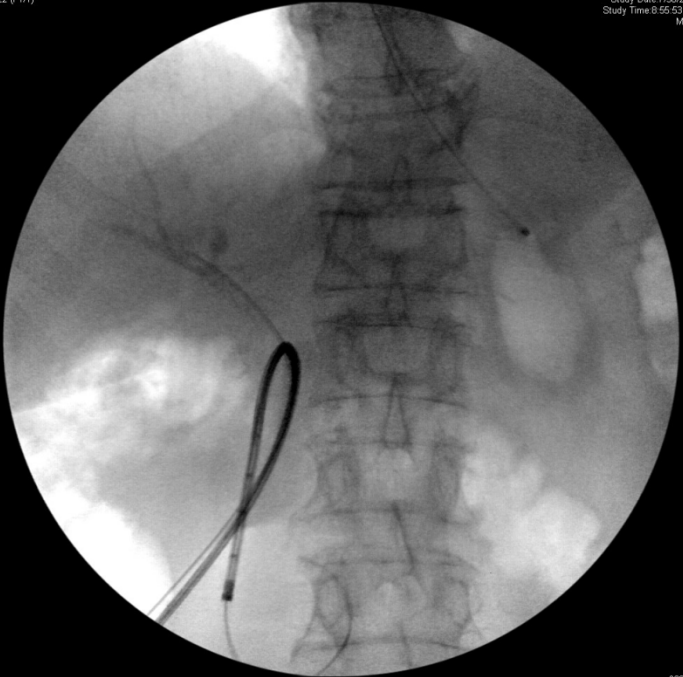
# Operative films



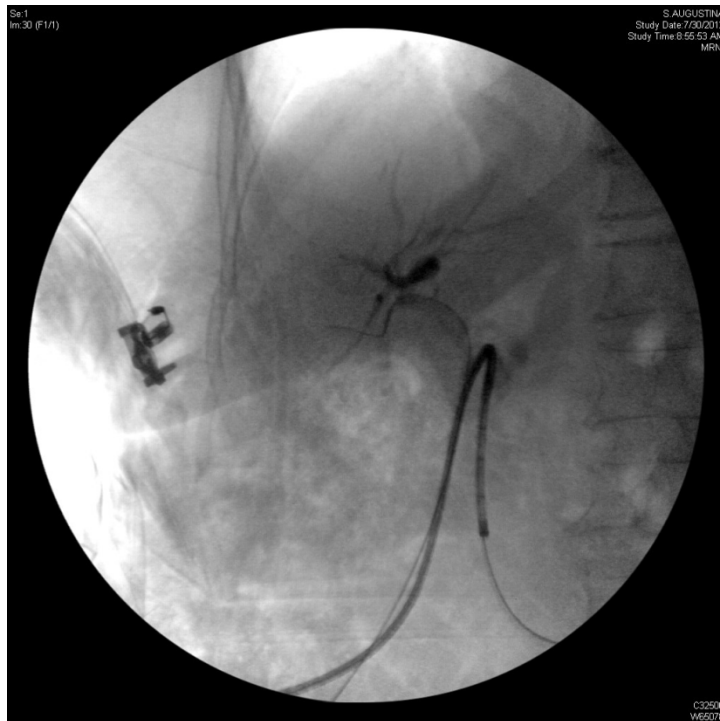
C32768  
W65536

S AUGUSTINA  
Study Date 7/30/2012  
Study Time 0:55:53 AM  
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Se1  
Im.22 (F1/1)



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Se1  
Im.30 (F1/1)

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Study Date 7/30/2012  
Study Time 0:55:53 AM  
MRN

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## But...



- POD#1: formal T-tube cholangiogram
  - large impacted stone in the distal CBD just proximal to the ampulla of Vater

# Case Presentation

- Returned to the OR
  - Percutaneous endoscopic biliary exploration, holmium laser lithotripsy, stone extraction
  - on table IOC normal
- Postop course
  - Discharged 2 days later
  - f/u t-tube cholangiogram (8/8) was normal

# Goals

- History
- Classifying stones
- The problem
- Preoperative, Intraoperative, and Postoperative identification of CBD stones and approaches in management
- Complications in management
- Tailoring decision making to patient's circumstances





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**History**

- 1889 Abbe – Choledochotomy
- 1890 Ludwig Courvoisier – CBD exploration
- 1932 Mirizzi – Intraoperative cholangiography
- 1941 McIver – Rigid choledochoscopy
- 1968 McCune – ERCP
- 1972 Burhenne- removal of retained common duct stones through a T-tube tract
- 1974 Kawai- Endoscopic sphincterotomy
- 1983 Staritz - Papillary endoscopic balloon dilatation

# Describing stones

- Primary stones (usually brown pigment stones), which form in the bile ducts
- Secondary stones (usually cholesterol), which form in the gallbladder but migrate to the bile ducts
- Residual stones, which are missed at the time of cholecystectomy (evident < 3 yr later)
- Recurrent stones, which develop in the ducts > 3 yr after surgery

# The problem

- Choledocholithiasis occurs in 15–20% of patients with cholelithiasis
- After biliary tract surgery, 2–5% of patients present with residual biliary stones
- 5.2%-12% asymptomatic

## Etiology

- ↑ Na<sup>+</sup> transport → bile concentrates
- ▲ in Ca<sup>2+</sup> & cholesterol
- ↓ Gallbladder motility
  - Biliary stasis
  - Biliary tract infection
- Cholangitis and gallstone pancreatitis.

# Preoperative Diagnosis

- Blood tests (elevated LFT's)
- Abdominal U/S
  - 15-30% sensitivity, If CBD >10mm → 90%
- EUS
  - Sensitivity and specificity 92-100%
- MRCP
  - 90% sensitive, 100% specificity
- **ERCP**

Diagnostic and therapeutic

Endoscope into 2<sup>nd</sup> portion of duodenum

Papilla visualized & cannulated

- Radioopaque dye injected under fluroscopy
- Stones appear as filling defects

Performed in conjunction with sphincterotomy and stone extraction

Stats: 99% success rate, 6% morbidity, 0.2% mortality

# Complications

- Pancreatitis (3.5%)
  - Cholangitis (<1%)
- } Contrast related
- Duodenal perforation (0.1 to 0.6%)
  - Bleeding (1.3%)

3-10% not suitable for ERCP

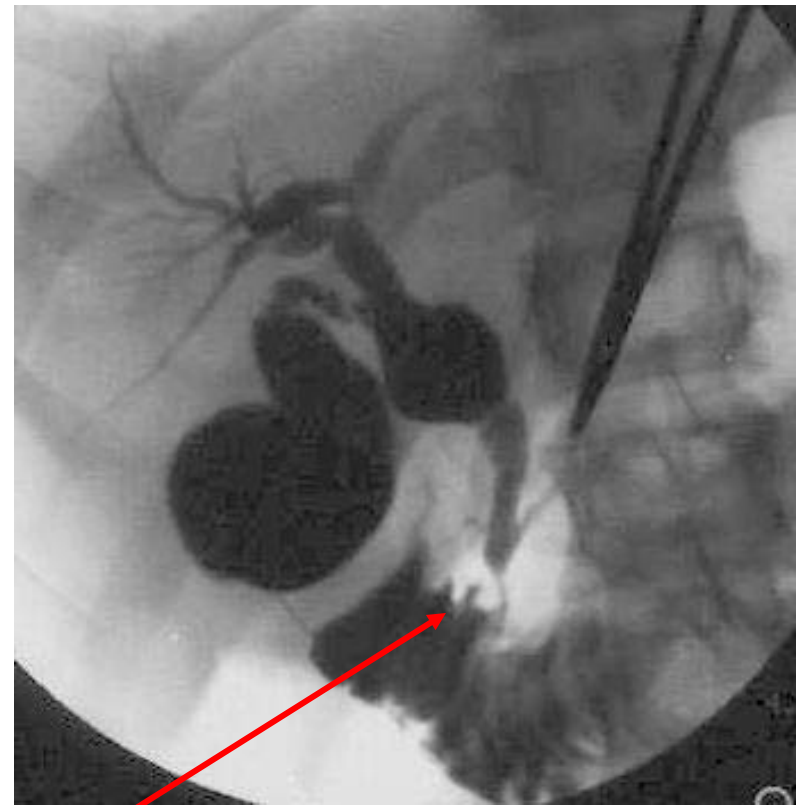
# Localizing stones intraoperatively

- Intraoperative cholangiogram (IOC)
- Intraoperative ultrasound
- Common bile duct exploration

# Intraoperative Cholangiogram (IOC)



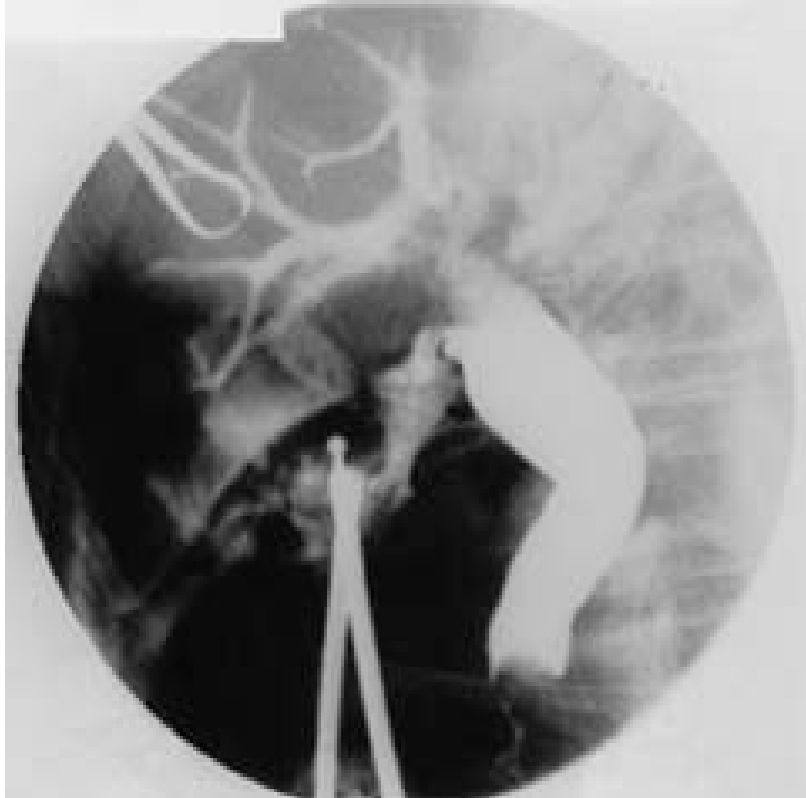
**STATIC**



**DYNAMIC**

filling defect



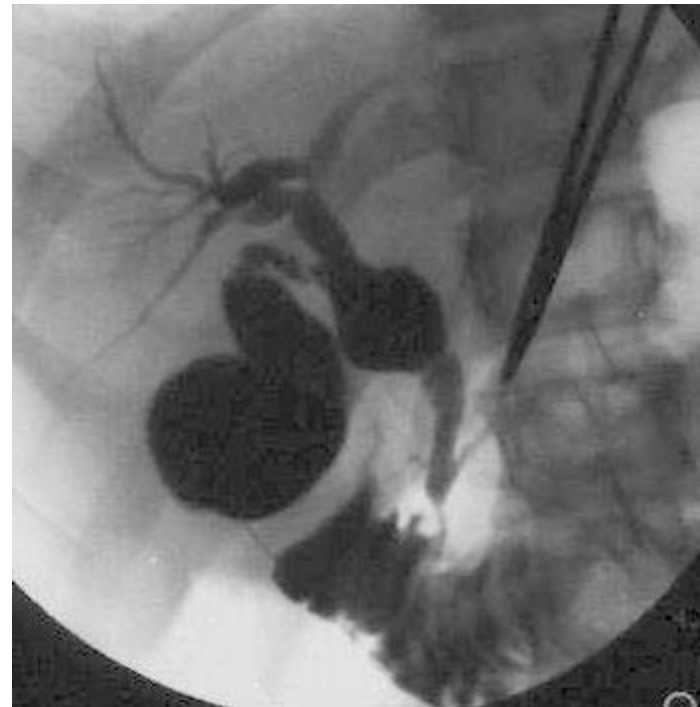


**STATIC**

- Time consuming (>16 min)
- Film often inadequate
- Lower success rate (47%)
- Visualization of anatomy more difficult
- Difficulty in differentiation between stones and air bubbles

# IOC

- Less time consuming (<5 min)
- Better quality and higher resolution
- **In real time**, higher success rate (96%)
- Possibility of interaction with the findings
- Required for transcystic exploration of CBD
- +/- issues w/availability

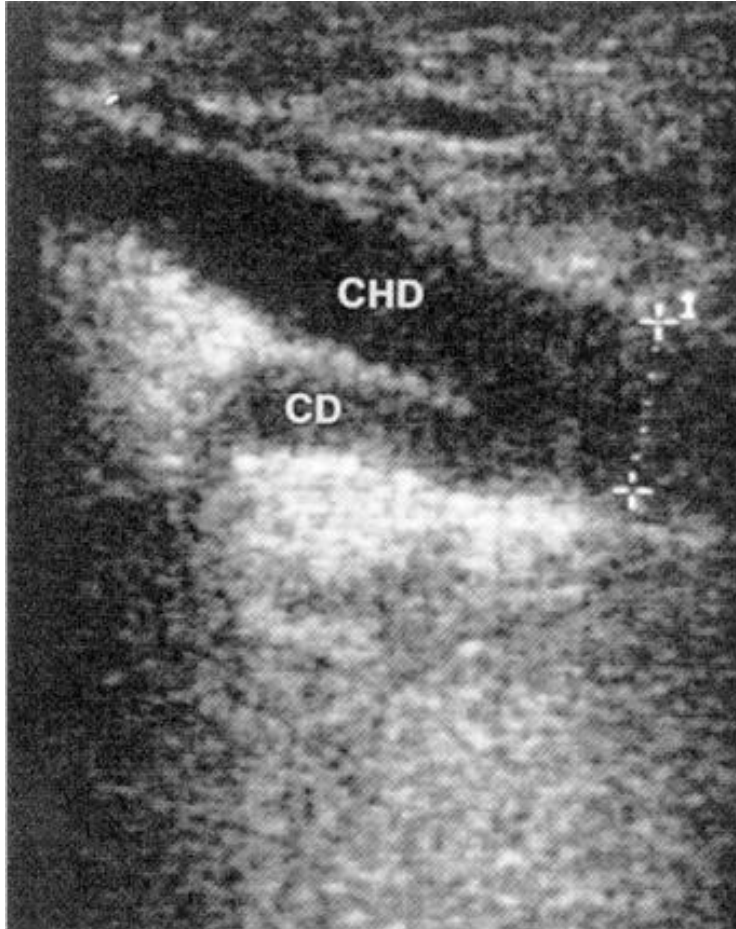


**DYNAMIC**

# IOC complications

- Bleeding
- Infection
- Pancreatitis
- Damage to the common bile duct

# Intraoperative U/S



- Success rate ~90%
- High sensitivity and specificity (~94%)
- Safer
- Procedure time <10 min
- Low resolution
- Operator dependent

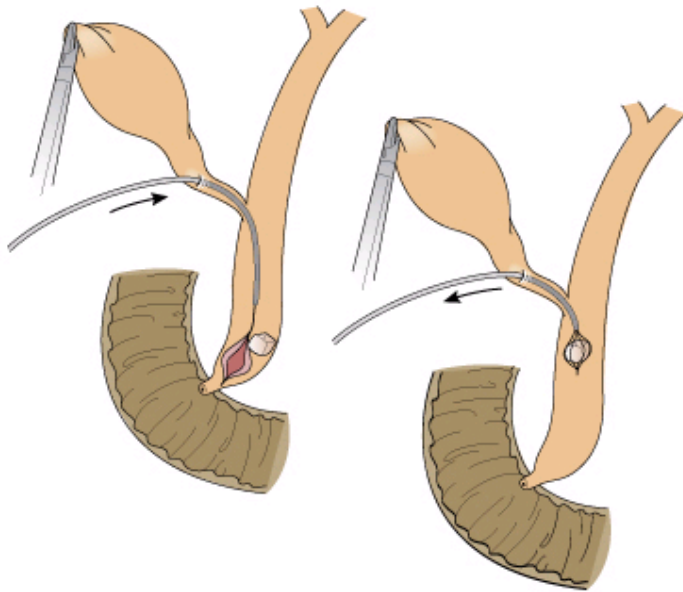
# CBD exploration (CBDE)

- Laparoscopic vs. Open
  - Lap: Transcystic vs. transductal approach
  - Open
- Surgeon's comfort

# Laparoscopic CBD Exploration

## Laparoscopic transcystic bile duct exploration

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## Transcystic:

- Stone < 6 mm
- Cystic duct > 4 mm
- CBD < 6 mm
- Stone location distal to the cystic duct/CBD Junction
- Fewer than 6 to 8 stones within the CBD

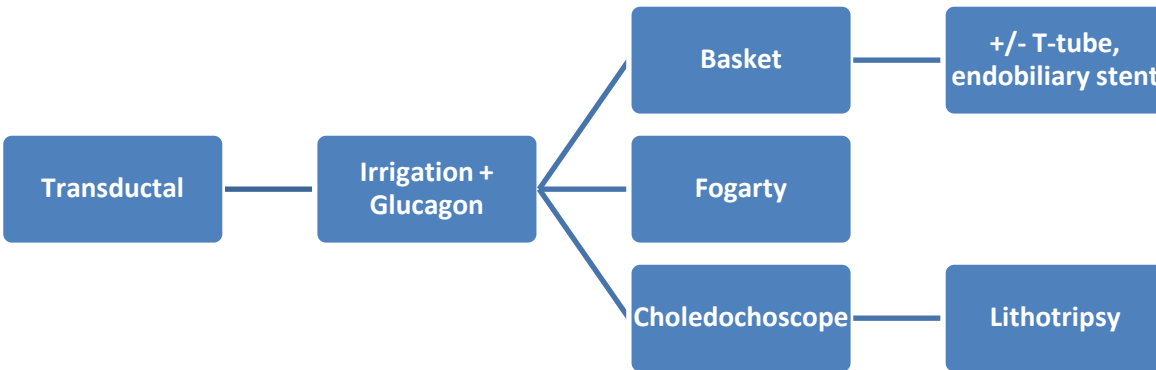
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Laparoscopic transcystic bile duct exploration.

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# Laparoscopic CBD Exploration



## Transductal:

- Failed laparoscopic transcystic exploration or preoperative endoscopic stone extraction
- Stone > 6 mm
- Cystic duct < 4 mm
- CBD > 6 mm
- Multiple stones
- Stone location proximal to the cystic duct/CBD junction



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Society of American Gastrointestinal and  
Endoscopic Surgeons (SAGES), 1994

- Multiple centers  
(19, n=226)
- 8.5% preop ERCP w/  
sphincterotomy
  - < ½ cases w/  
successful extraction
- 83% removed  
transcystically ,17%  
transductal
- Conversion to open: 5%  
Transcystic, 19%  
transductal
- 7% morbidity
- Retained stones seen in  
2.6% of cases
- Complications
  - bile duct leak (2-6%)
  - subhepatic abscess  
(0.7 %)
  - Retained stone





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## Level 2 evidence

- **Transcystic common bile duct exploration in the management of patients with choledocholithiasis.** *J Gastrointest Surg.* 2003 May-Jun;7(4):492-6.  
Rojas-Ortega S, Arizpe-Bravo D, Marín López ER, Cesin-Sánchez R, Roman GR, Gómez C.
- **All-comers policy for laparoscopic exploration of the common bile duct.** *Br J Surg.* 2002 Dec;89(12):1608-12.  
Thompson MH, Tranter SE.
- **Laparoscopic exploration of common bile duct in difficult choledocholithiasis.** *Surg Endosc.* 2004 Jun;18(6):910-4. Epub 2004 Apr 21.  
Tai CK, Tang CN, Ha JP, Chau CH, Siu WT, Li MK.
- **National analysis of in-hospital resource utilization in choledocholithiasis management using propensity scores.** *Surg Endosc.* 2006 Feb;20(2):186-90. Epub 2005 Dec 9.  
Poulose BK, Arbogast PG, Holzman MD.

- **Stone clearance rates ranging from 85% to 95%,**

- **Morbidity rate of 4%–16% ,**

- **Mortality rate of around 0%–2%**

- **vs. ERCP, less cost, <LOS**

- **CBD laceration, stricture,  
bile leak**



# Summary of randomized trials comparing endoscopic common duct clearance plus surgery against surgery alone

Reference (year)	Treatment	n	Successful duct clearance	Mortality	Morbidity (Total)	Morbidity (Major)	Additional procedures required	Median hospital stay (days)
<b>Neoptolemos</b>	ES	55	50	2	18	9	1	9
(1987)	S	59	54	1	13	5	0	11
<b>Stain</b>	ES	26	17	0	4	1	n.a.	5
(1991)	S	26	23	0	7	1	n.a.	6
<b>Stigmann</b>	ES	16	5	0	3	0	1	n.a.
(1992)	S	18	6	0	3	0	0	n.a.
<b>Hammarstrom</b>	ES	39	35	0	7	3	4	n.a.
(1995)	S	41	37	0	9	4	4	n.a.
<b>Targarona</b>	ES	50	44	3	8	5	n.a.	5
(1996)	S	48	45	2	11	4	n.a.	11
<b>Kapoor</b>	ES	16	11	0	5	4	2	10.6
(1996)	S	17	13	0	5	3	3	11.3
<b>Suc</b>	ES	97	67	3	13	13	28	12
(1998)	S	105	75	1	13	5	8	16
<b>Rhodes</b>	ES	40	37	0	6	4	10	3.5
(1998)	S	40	30	0	7	2	10	1
<b>Cuschieri</b>	ES	133	82	2	17	9	17	9
(1999)	S	133	92	1	21	9	17	6
<b>Sgourakis</b>	ES	42	27	1	6	3	5	9
(2002)	S	36	24	1	5	2	4	7.4
<b>Nathanson</b>	ES	45	43	0	11	6	3	7.7
(2005)	S	41	40	0	12	7	3	6.4
<b>Hong</b>	ES	93	85	0	8	1	1	4.2
(2006)	S	141	126	0	22	1	3	
<b>Total</b>	ES	652	503 (77.1%)	11 (1.69%)	106 (16.25%)	58 (8.89%)	72 (12.5%)	4.6
	S	705	565 (80.1%)	6 (0.85%)	128 (18.15%)	43 (6.1%)	52 (8.2%)	

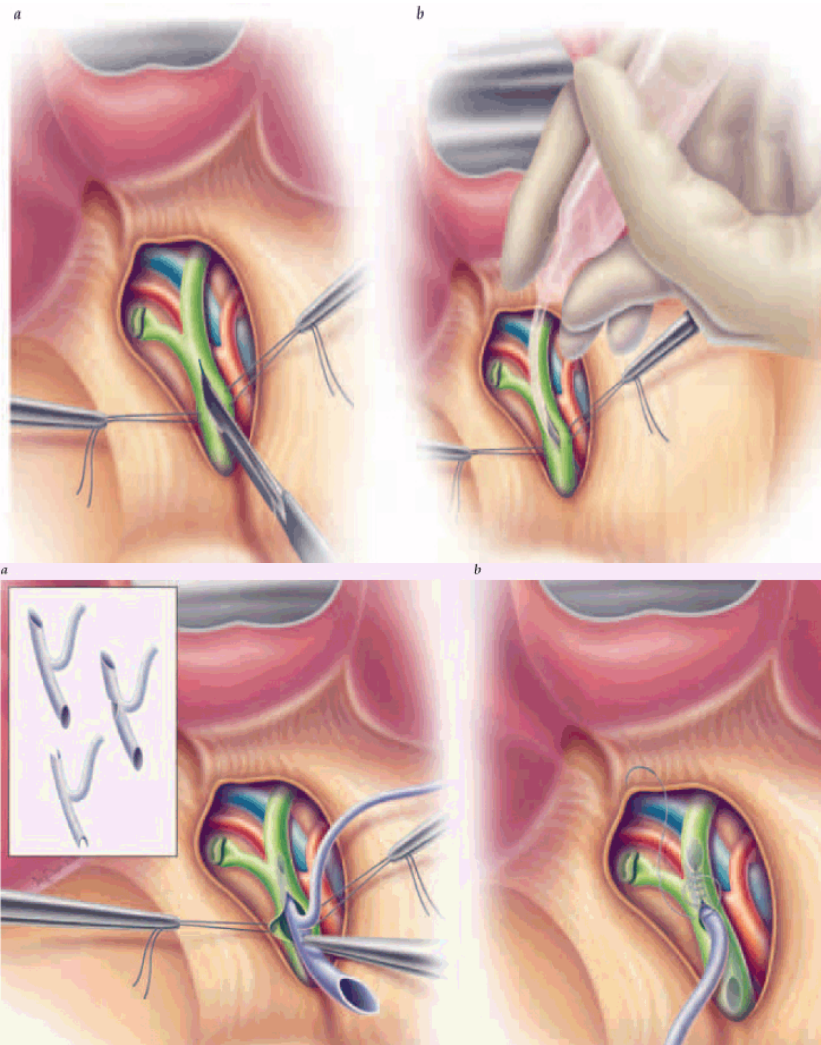
# Open CBDE

## Indications

- Patients:

- w/ CBD stones undergoing open cholecystectomy
- who failed or suffered complications from Lap CBDE
- w/ severe Triangle of Calot inflammation
- when laparoscopic equipment, experience, and/or resources are limited

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**Open CBDE**



- Anterior duct exposed
- Stay sutures laterally
- CBD opened vertically
- Catheter irrigation
- +/- Fogarty, basket, stone forceps, scope
- Place t-tube
- Close choledochotomy



# Dealing with difficult CBD stones: Open drainage procedures

## Indications:

- Multiple CBD stones
- Recurrent choledocholithiasis
- Unsuccessful sphincterotomy
- Impacted large CBD stones
- Markedly dilated CBD

## Choices:

- Transduodenal sphincteroplasty
- Choledochoduodenostomy
- Choledochojejunostomy

# Postoperative Management

- Post-op ERCP
- Dissolution
  - Ursodeoxycolic acid
  - Methyl tert-butyl ether (MTBE)
- Lithotripsy
  - Mechanical (crushing technique)
  - Extra-corporeal shock wave (electromagnetic)
  - Intra-corporeal (laser)

# Lithotripsy

- **Electrohydraulic Lithotripsy (EHL)**

- direct high voltage
- cholangioscopy or under fluoroscopy
- reserved for CBD packed with multiple stones or a large impacted stone
- Tissue damage, bleeding

- **Extracorporeal Shockwave Lithotripsy (ESWL)**

- Percutaneous sound waves
- done before ERCP
- clearance rates of 83% to 90%
- not common approach in US

# Laser lithotripsy

- amplified light energy
- under direct vision with cholangioscopy or under fluoroscopic control
- rate of duct clearance for retained CBDS using is 64-97%

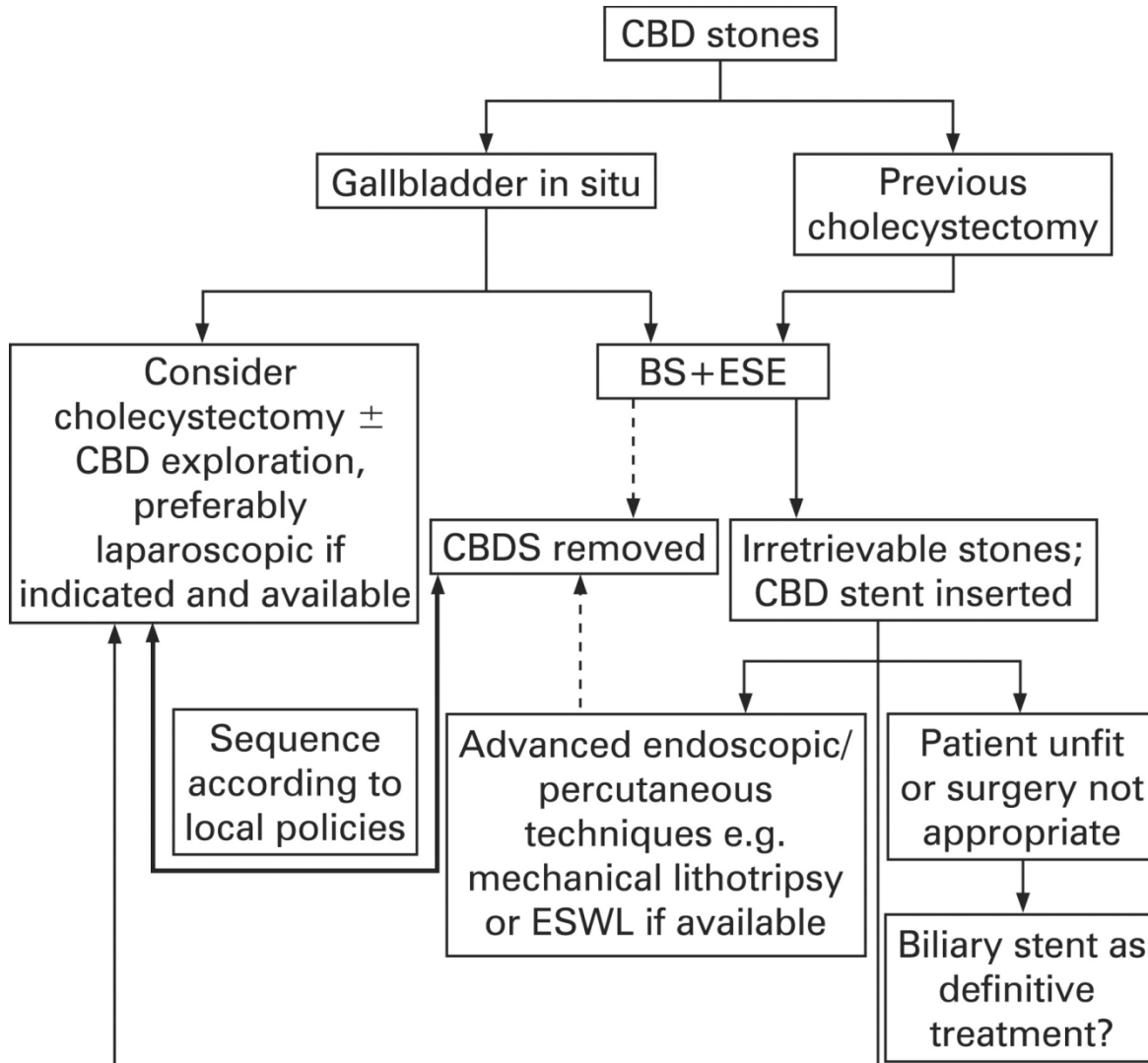


**Ten years of Swedish experience with intraductal electrohydraulic lithotripsy and laser lithotripsy for the treatment of difficult bile duct stones: an effective and safe option for octogenarians.**

Swahn F, Edlund G, Enochsson L, Svensson C, Lindberg B, Arnelo U.  
Surg Endosc. 2010 May;24(5):1011-6. Epub 2009 Oct 23.

- Retrospective study (1995-2006)
- 44 patients with a median age of 80 years underwent EHL or ILL
- Success in 34 (77%). The others required multiple attempts. All but one achieved complete clearance ( recurrent CBD stones)
- Median f/u 53 mths

# www.downstatesurgery.org CBDS Algorithm



biliary sphincterotomies (BS)  
endoscopic extraction (ESE)

# Conclusions

- All patients with symptomatic cholelithiasis must be evaluated for possible CBD stones
- Multidisciplinary approach to CBD stones
- Exploration of the CBD should be performed in all patients with CBD stones who have either failed, or are not candidates for, endoscopic therapy and who do not have medical conditions that prohibit surgical intervention
- Laparoscopic CBD exploration is safe, cost-effective and carries low morbidity and mortality rate
- Surgeon's experience, level of clinical suspicion , resources and patient factors determine:
  - Lap vs. open approach. +/- drainage procedure
  - use of other modalities

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# Question 1

The most common gallstones in the developed world are:

- A) Brown pigment
- B) Black pigment
- C) Cholesterol
- D) Quartz

## Question 2

The most common complication of ERCP is:

- A) Perforation
- B) Pancreatitis
- C) Cholangitis
- D) Bleeding

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Question 3

Which of the following statements is true?:

- A) Laparoscopic CBDE carries low morbidity and mortality rate, but is not cost effective
- B) There is potential use for lithotripsy in elderly & frail patients with CBDS w/acceptable results
- C) Surgeon's comfort means favorite OR, not resources to operate

## Question 4

Why didn't this patient undergo ERCP with sphincterotomy post-cholecystectomy?

- A) Previous h/o cholangitis
- B) Duodenal diverticulum
- C) Abnormal anatomy
- D) Age