Surgery of the Biliary System

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Case

Patient:

42 year-old female (BMI 34) is admitted for pain in the upper right abdominal quadrant, started 8 hours ago

Pain is increased by meals, and it is irradiated do the right shoulder

The pt does not refer fever

The physical exam shows that inspiration is stopped by pain in the right upper quadrant

What would be the next step?

Case

Blood test:

Tot. Bilirubin: 2 mg/dl

BUN: 16 mg/dl

AST: 54 U/L

ALT: 60 U/L

Creatinine: 1.05 mg/dl

WBC: 7000

Case

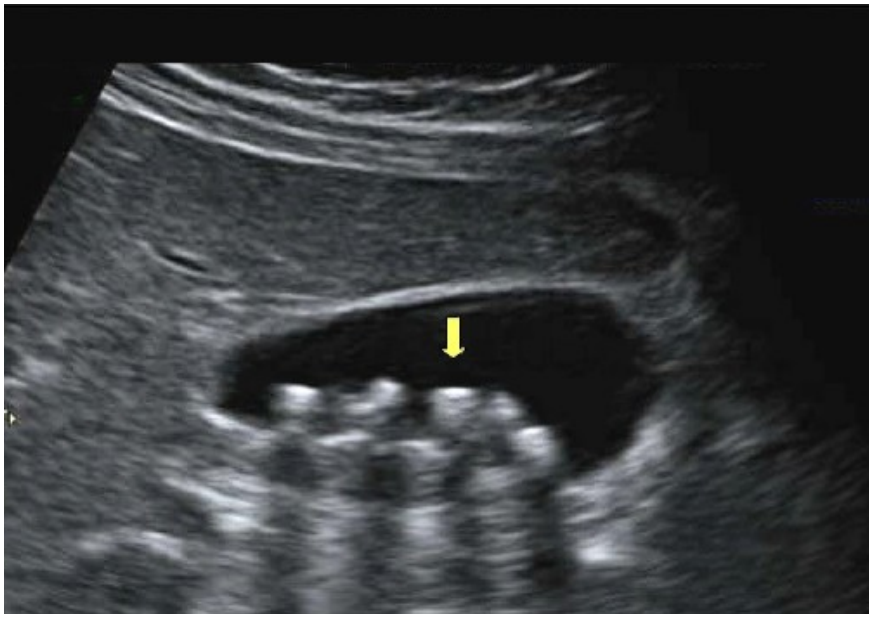
Differential diagnosis???

- Biliary cholic
- Acute cholecistytis
- Cholangitis
- Hepatitis
- Pancreatitis
- Peptic ulcer
- Pneumonia

Case

What to do?

Case



Ultrasound shows “Multiple stones in the gallbladder, mobile while the pt changes her position. Dilatation of the CBD.

Case

Hypothesis #1:

biliary cholic, cholecistytis or CBD stones?

- The duration (8 hrs) and CBD dilatation suggest CBD stones, instead of a plain biliary cholic.
- The lack of inflammatory markes (increase WBC, CRP) leave out the possibility of cholecystits and cholangitis

Case

The other hypotheses?

- **Pancreatitis**: in 40-60% of cases follows the presence of gallbladder stones in the CBD
- **Hepatitis:** jaundice, fever, pain in the upper right abdominal quadrant, nausea and vomiting
- **Peptic ulcer:** post-prandial epigastric pain
- **Pielonefritis:** localized at the flank, ask for issues related to diuresis
- **Pneumonia:** don't forget to think above the diaphragm!!

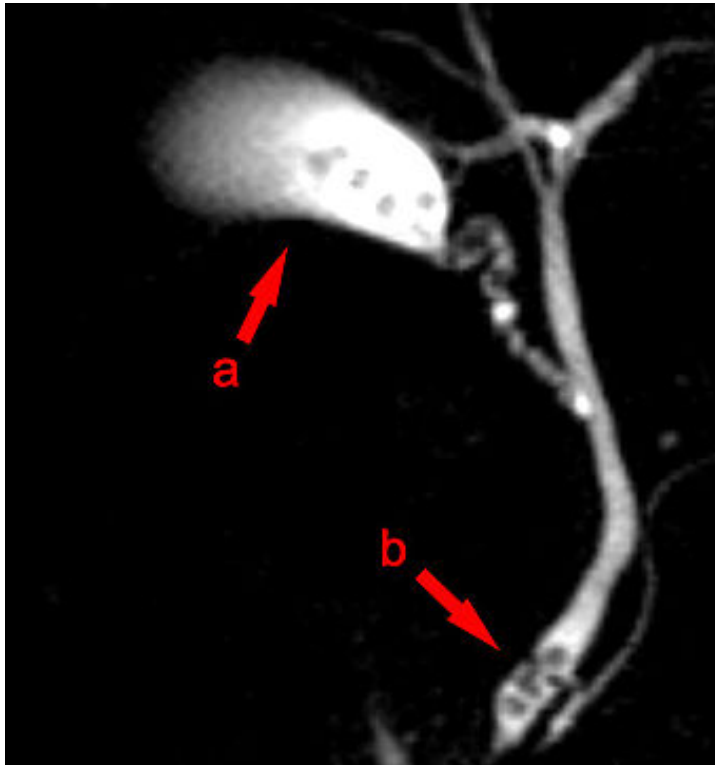
ZEBRA-ZONE:

- Fitz-Hugh-Curtis Syndrome: pain in RUQ in case of PID
- Hepatic congestion: following heart failure
- Appendicites with retrocecal appendix

What is the next step?

Case

MRI cholangiograpy:



Case

Ultimate DIAGNOSIS:

Gallbladder stones with CBD stone

Case

And now?

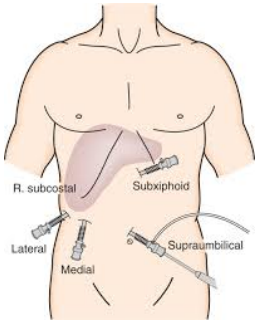
Case

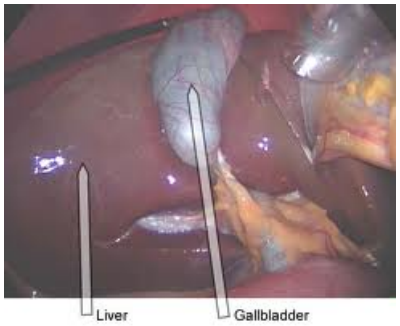
Treatment:

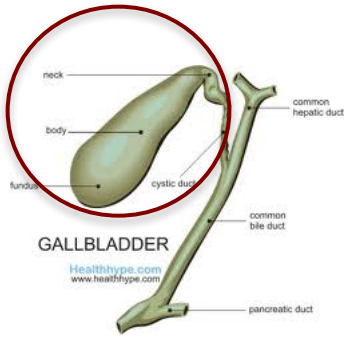
ERCP and removal of the impacted stone/stones and laparoscopic cholecystectomy

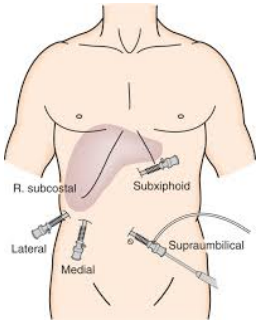
ERCP:

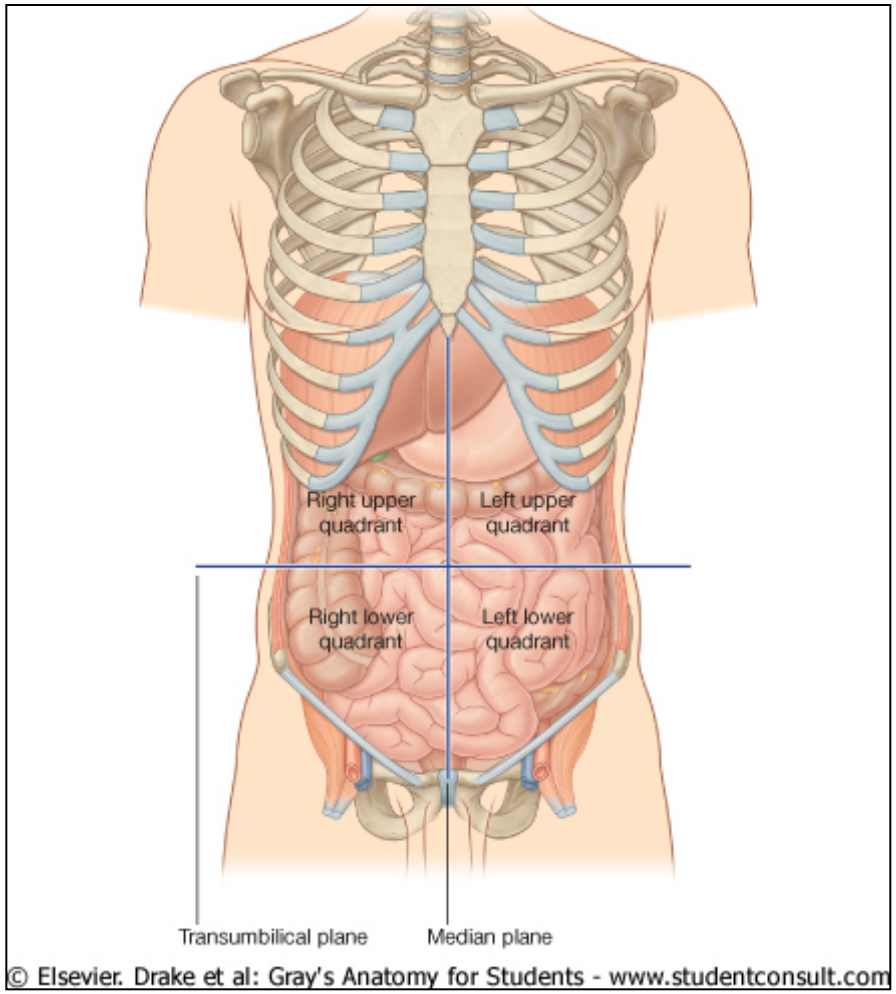
LAPAROSCOPIC CHOLECISTECTOMY

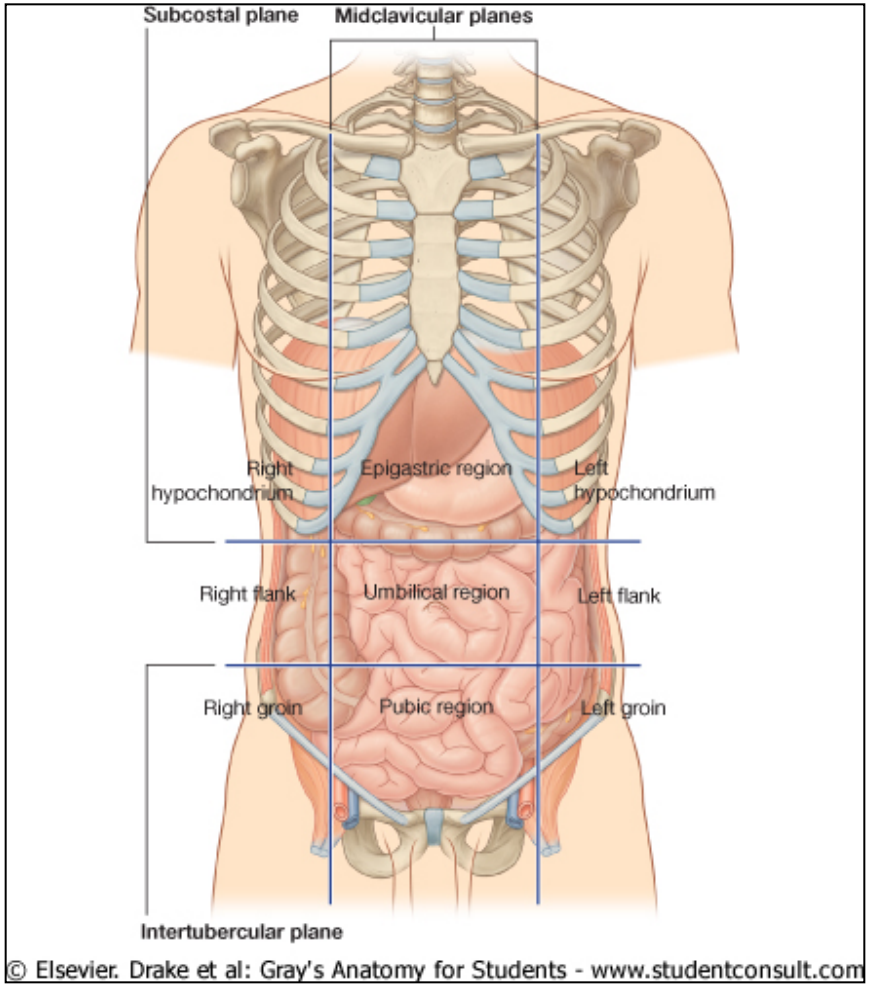


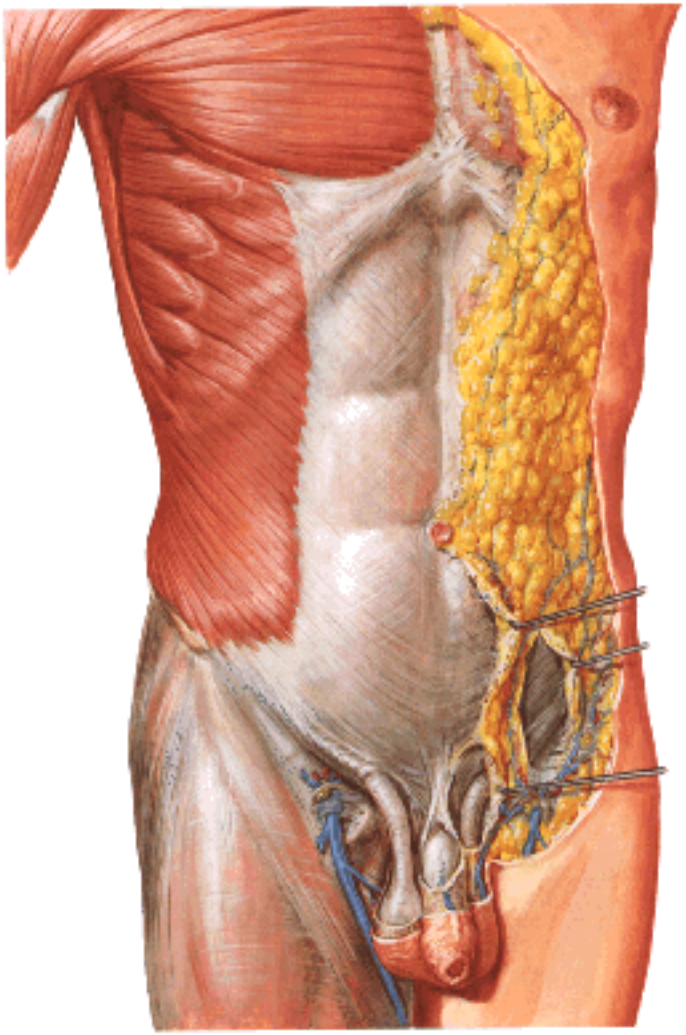


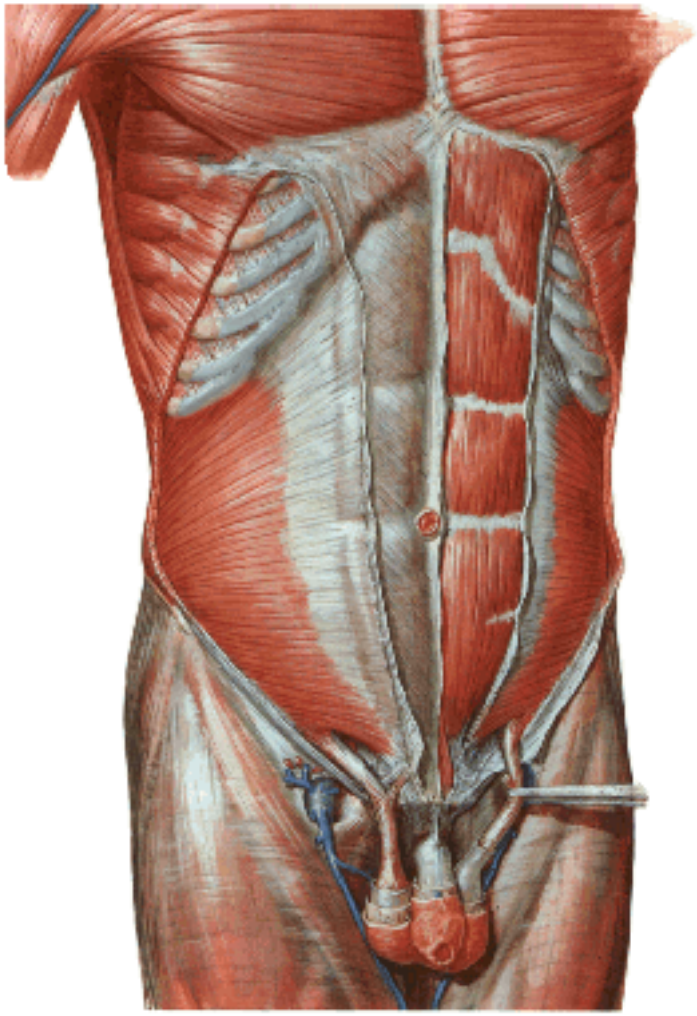


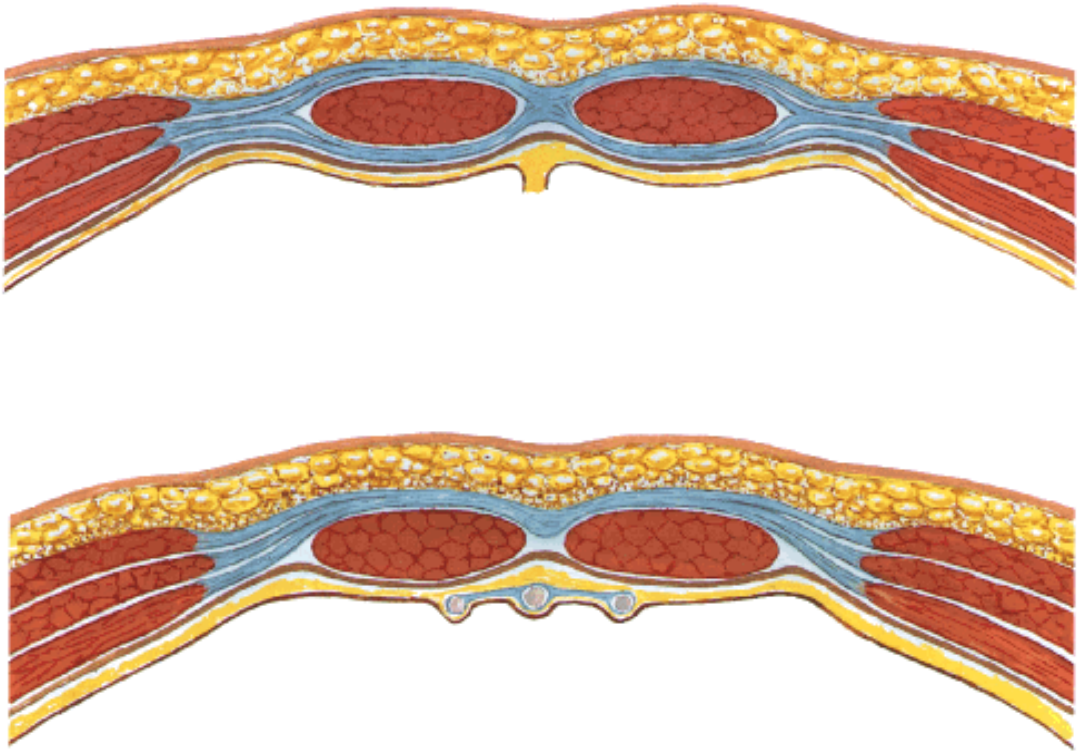


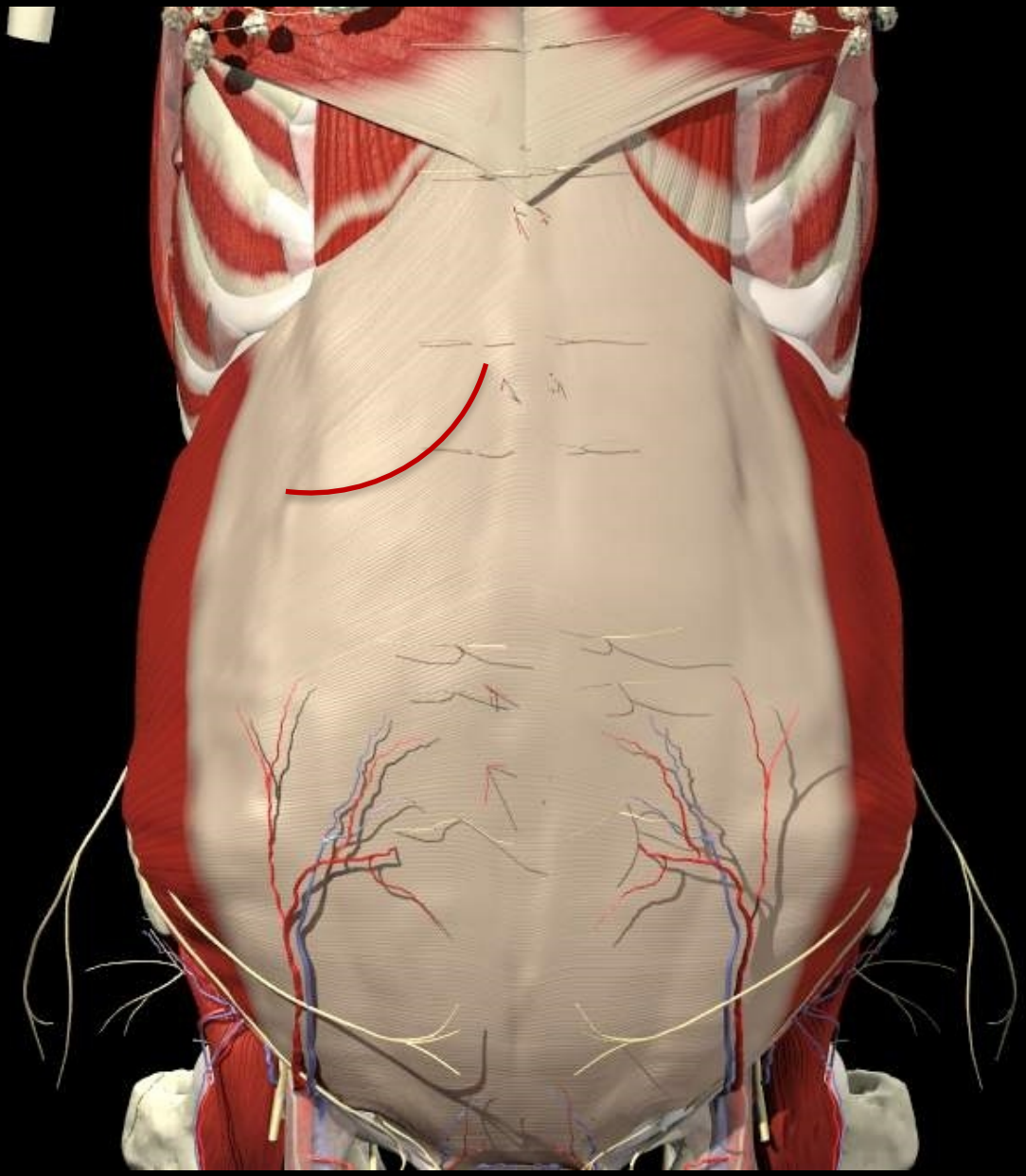


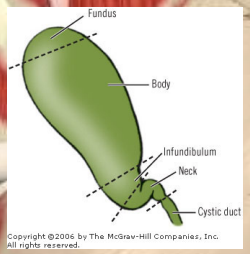


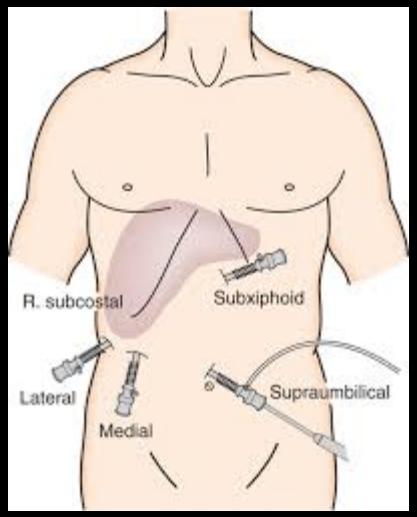


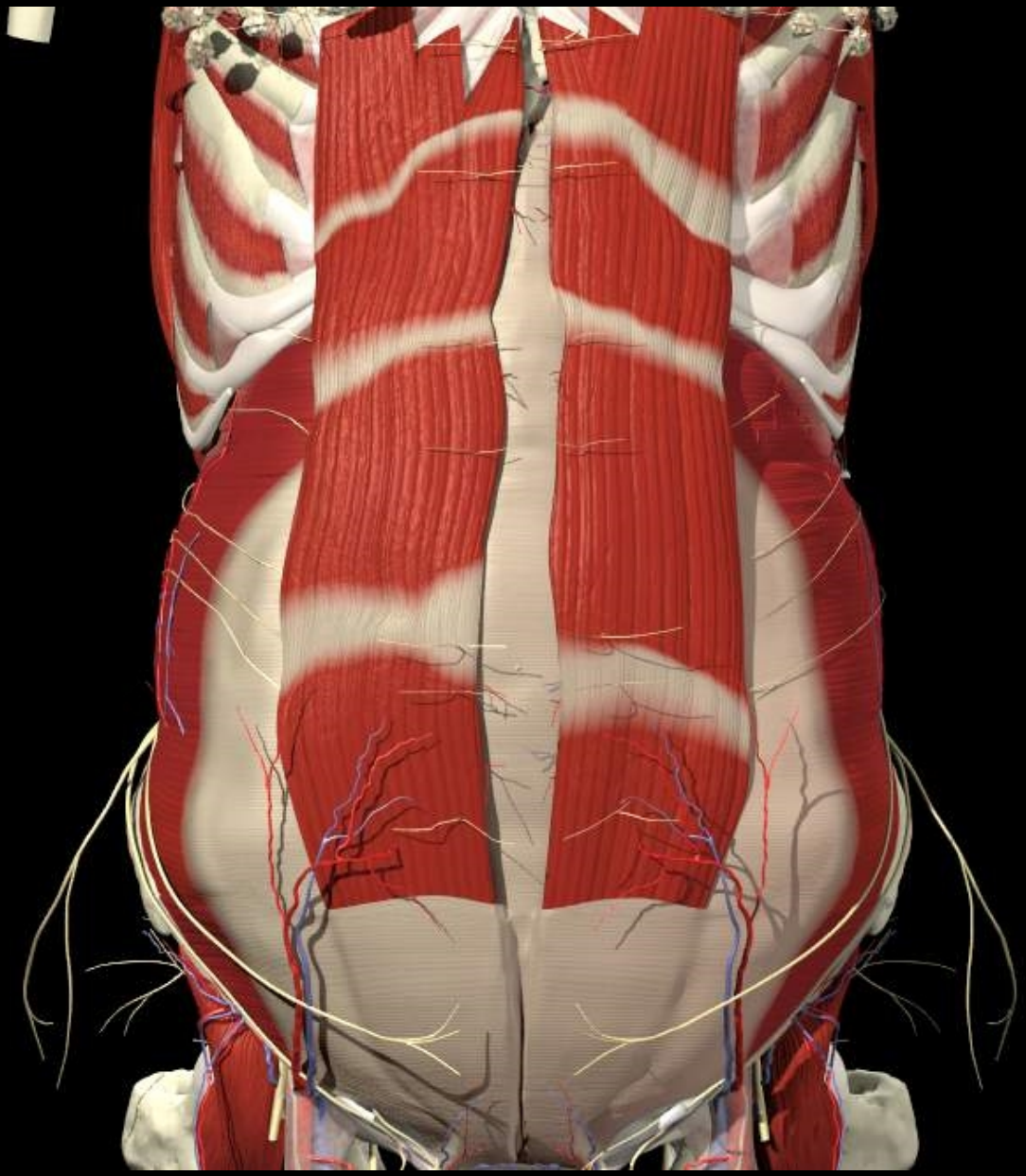


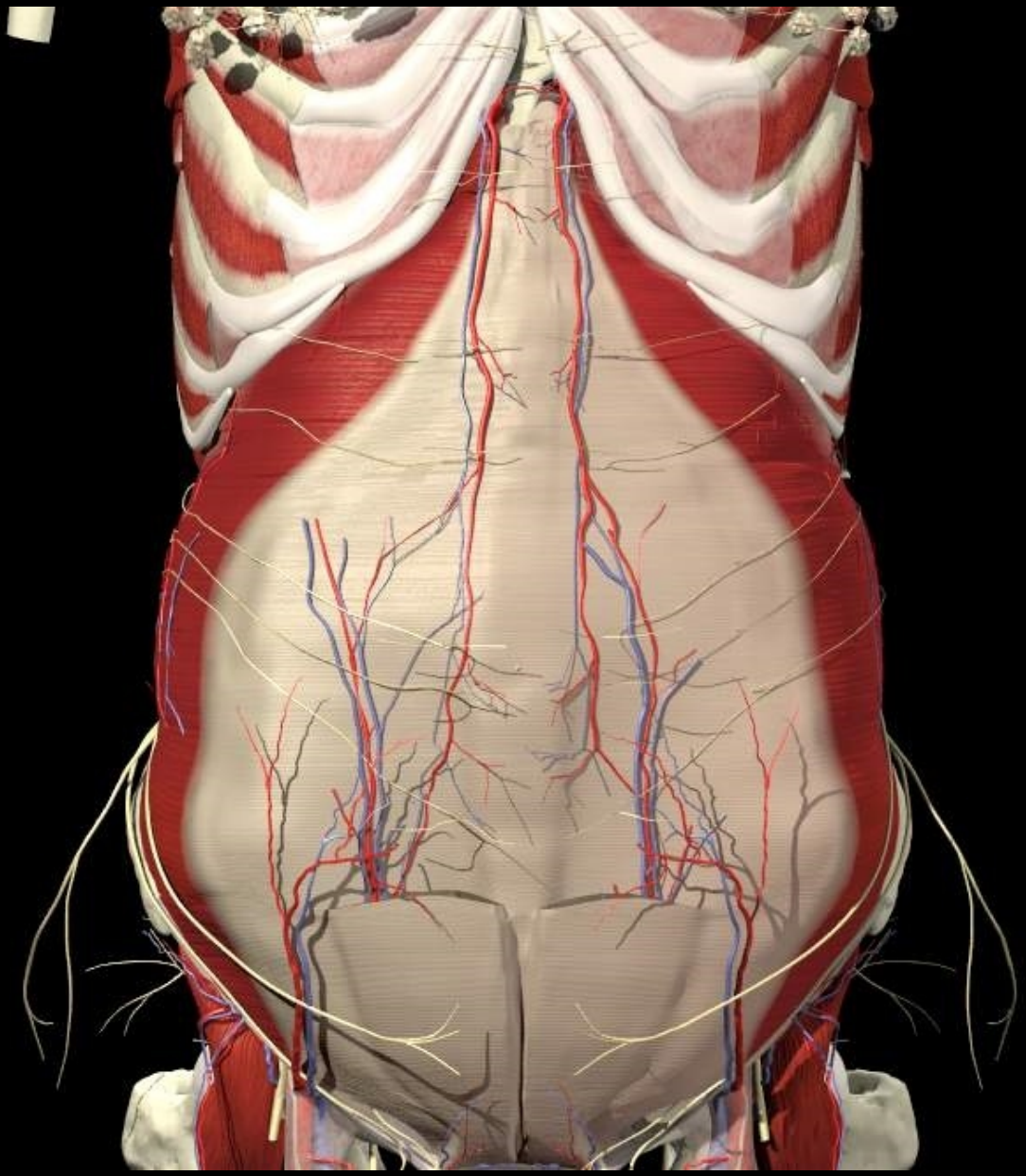


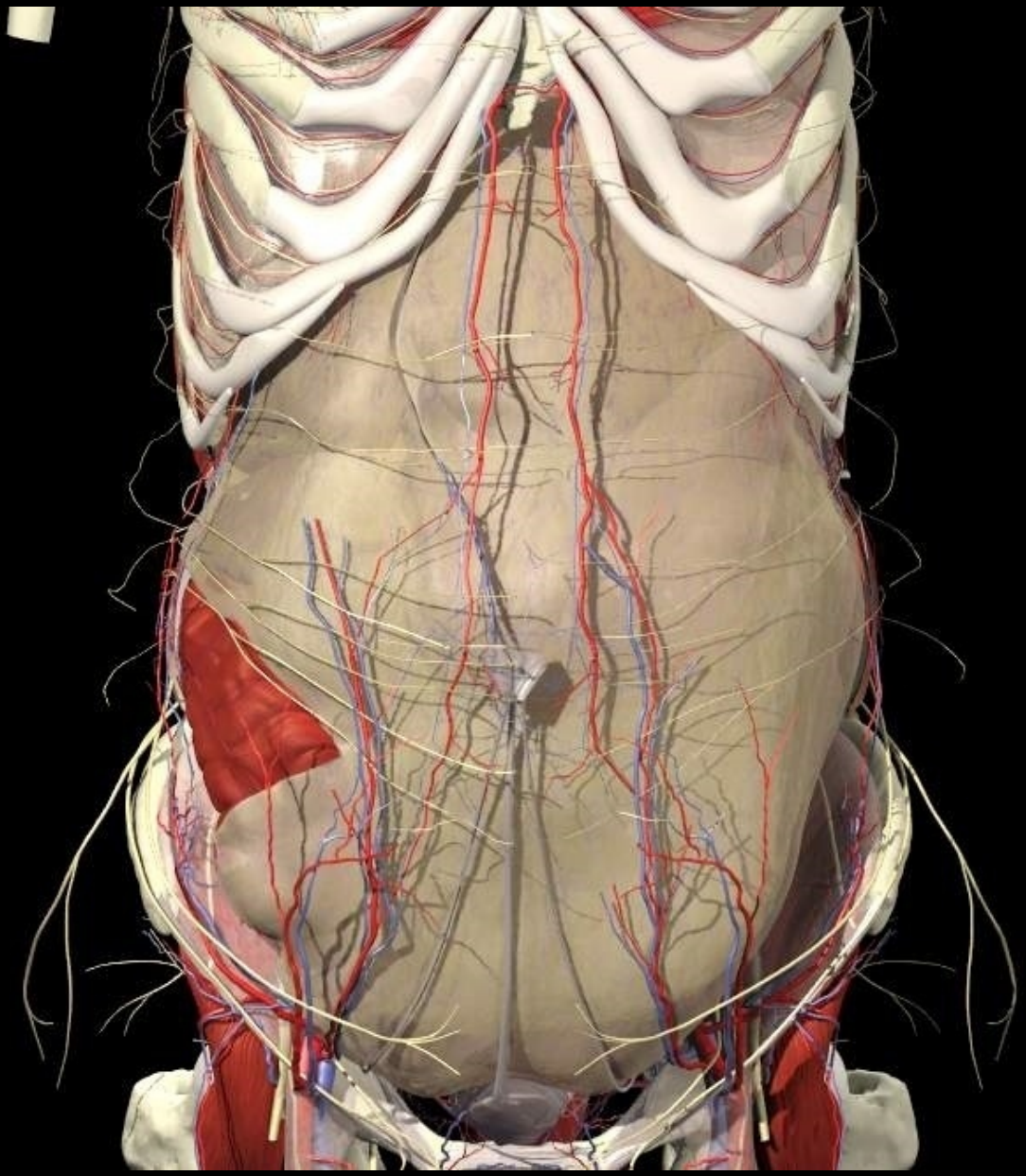


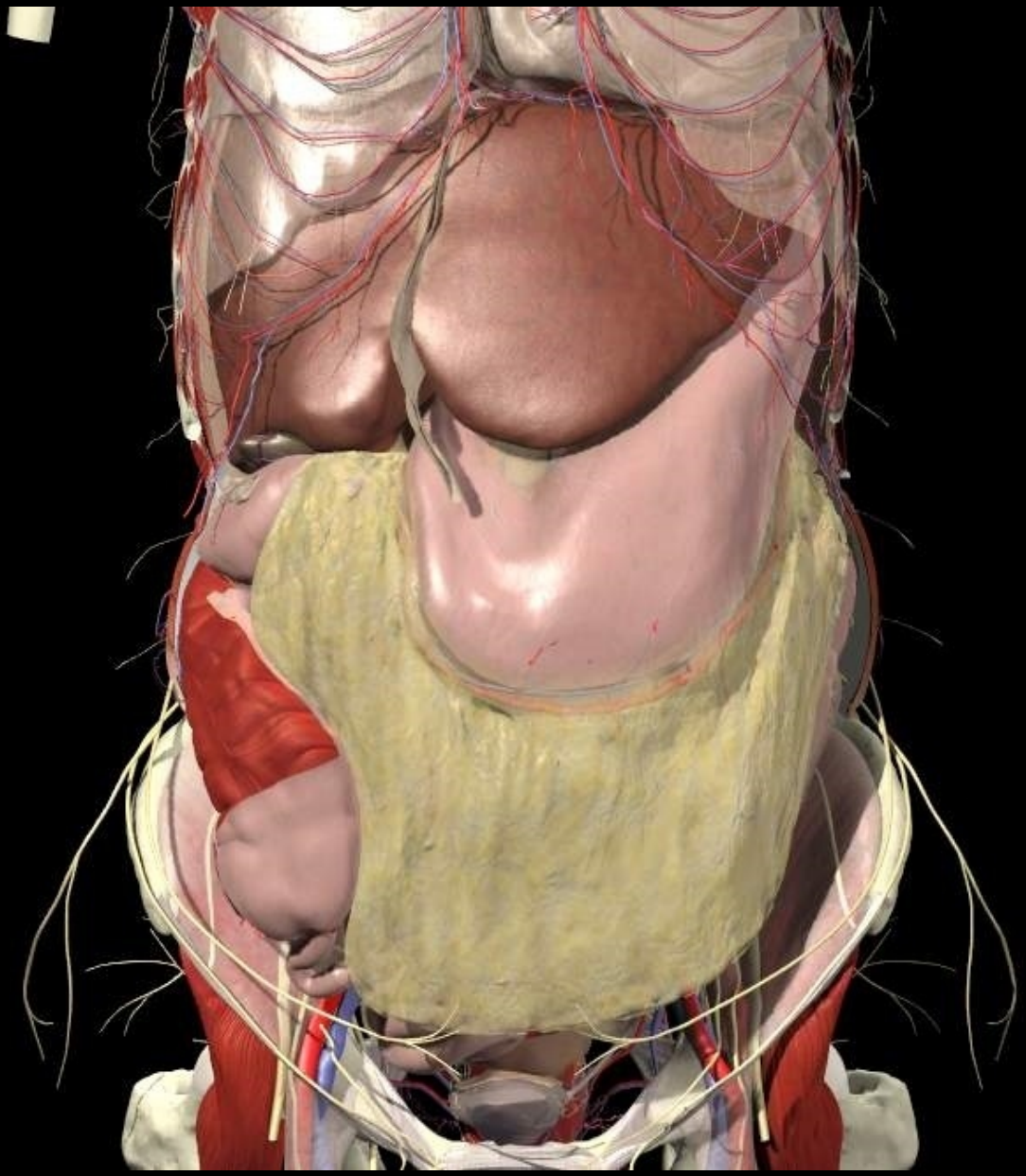


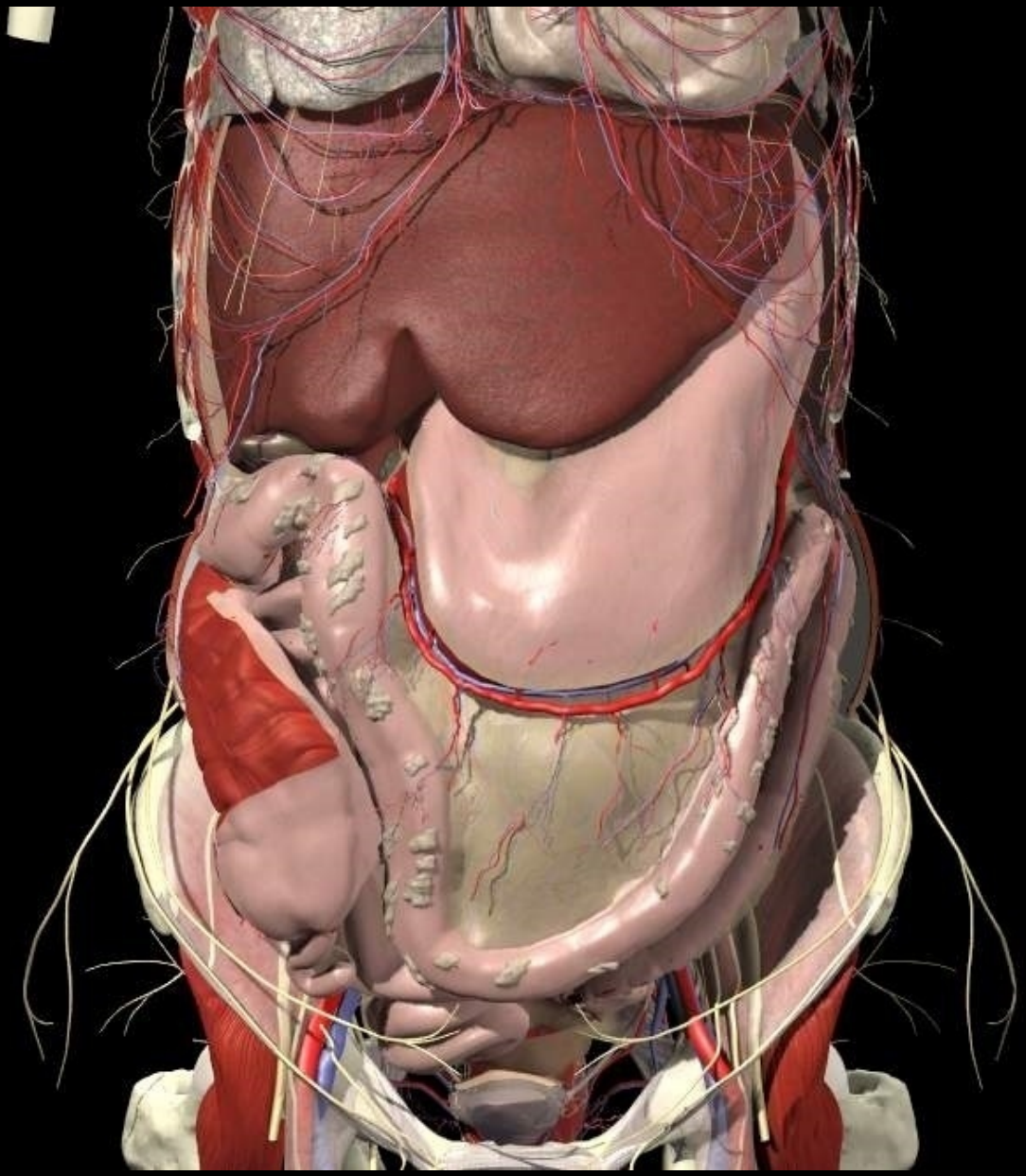


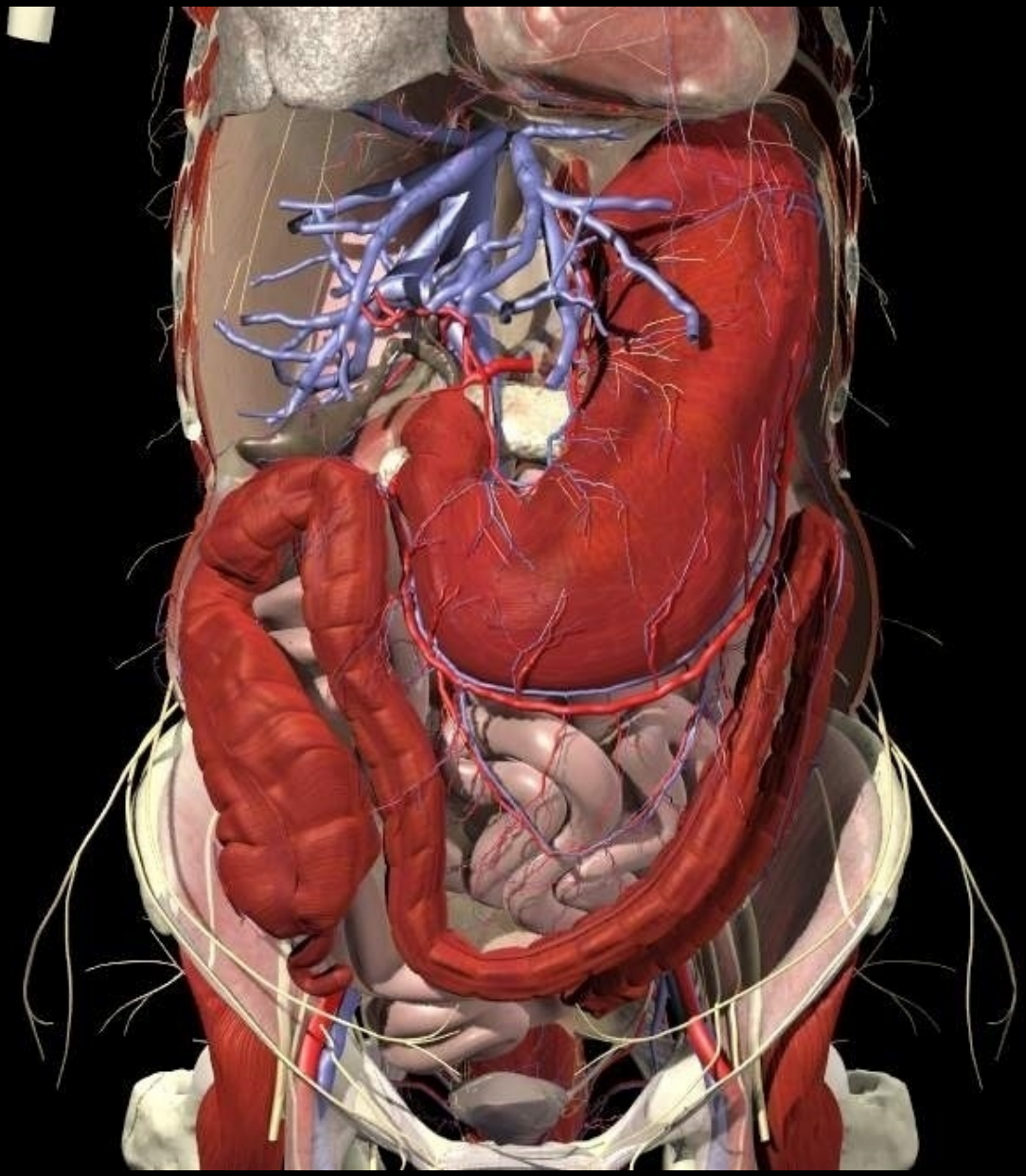




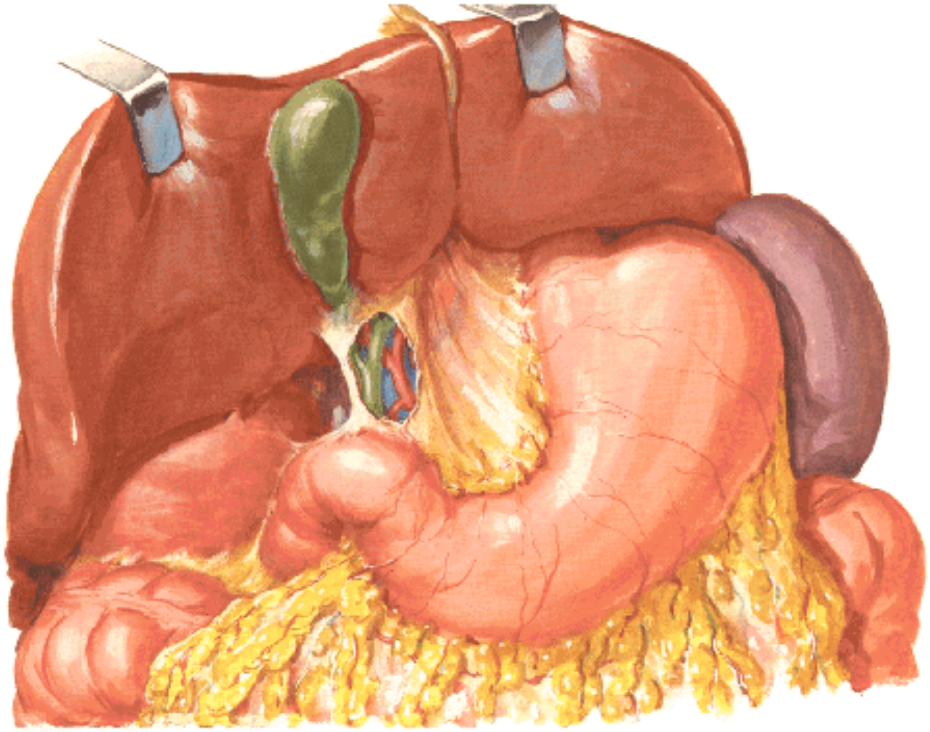






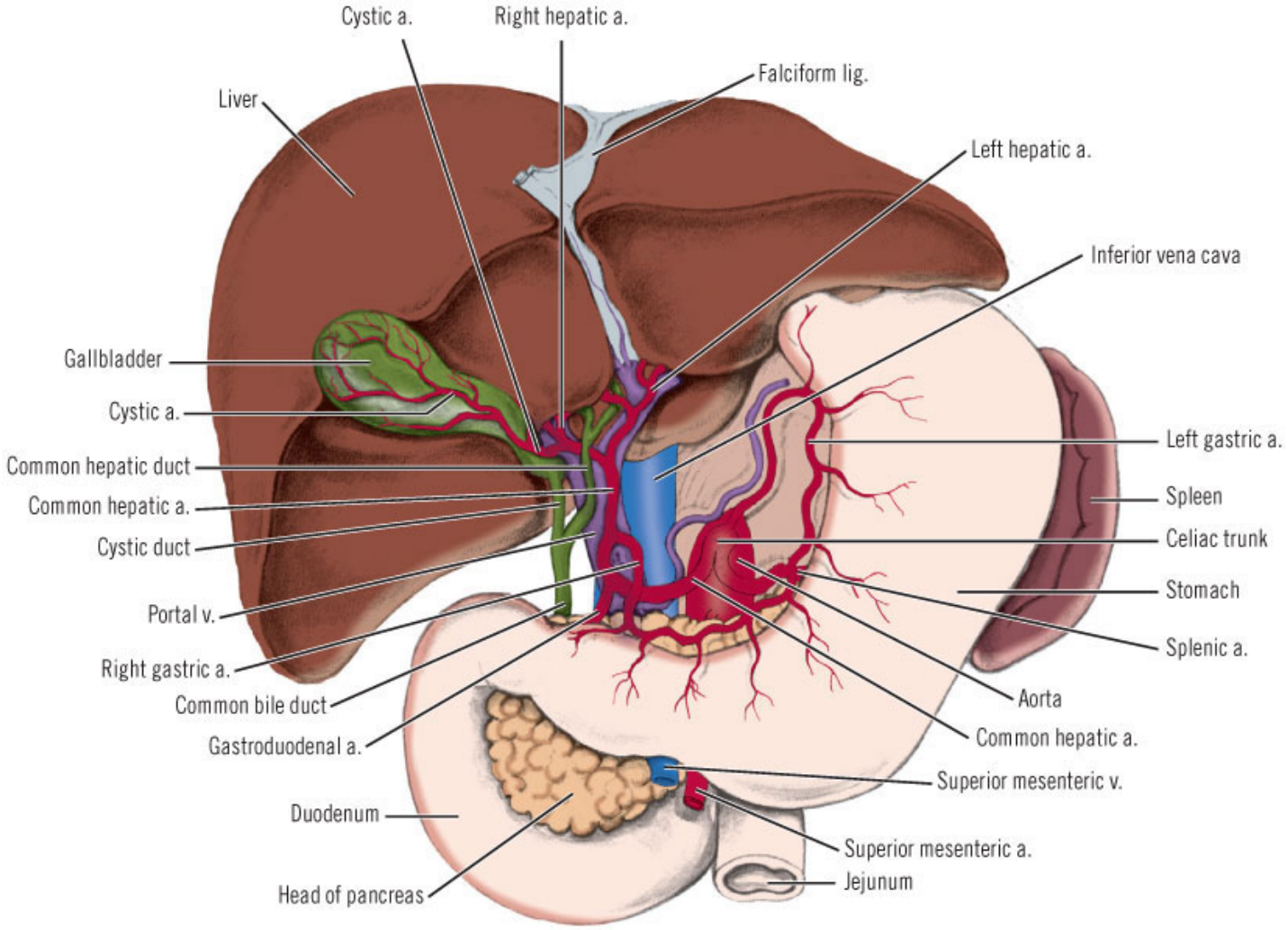


LAPAROSCOPIC CHOLECISTECTOMY



Zoellinger's Atlas of Surgical Operations, 9th ed.

LAPAROSCOPIC CHOLECISTECTOMY



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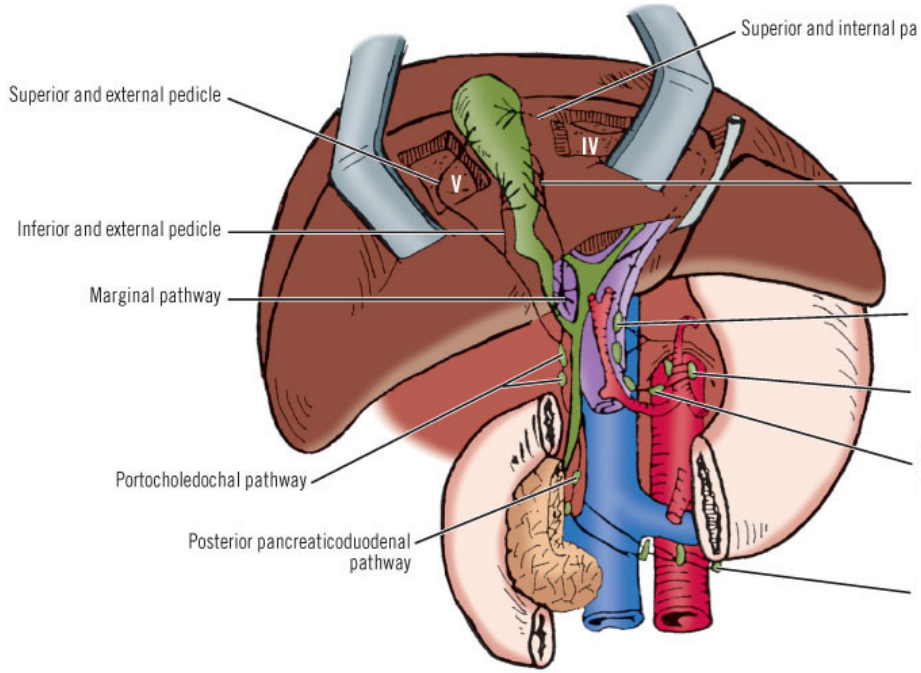
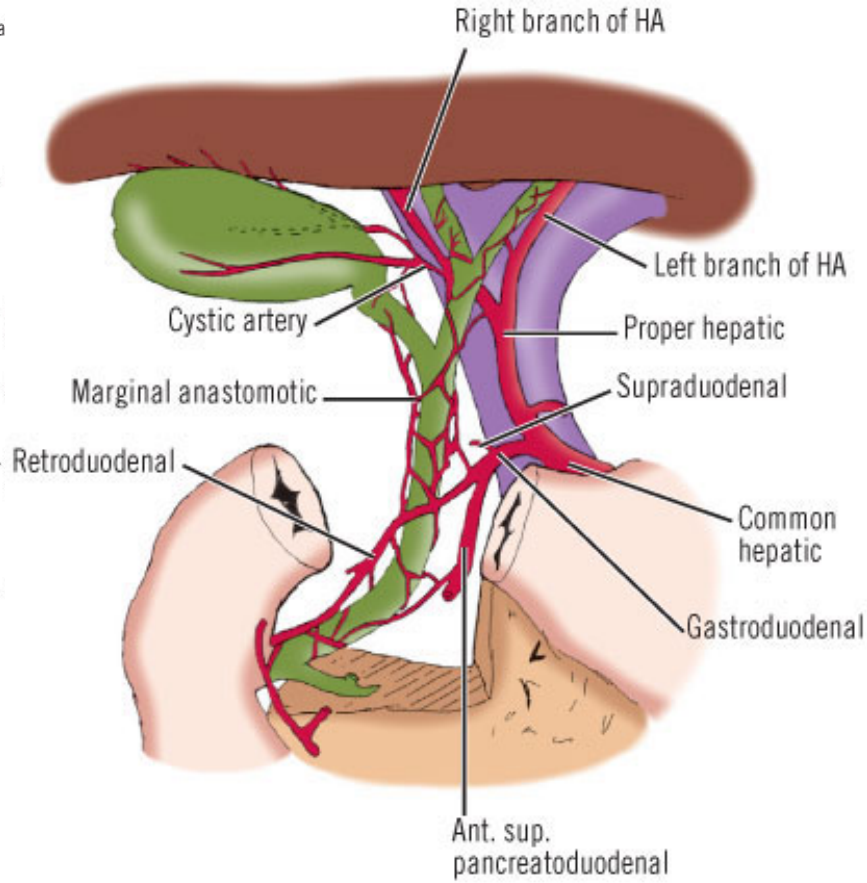
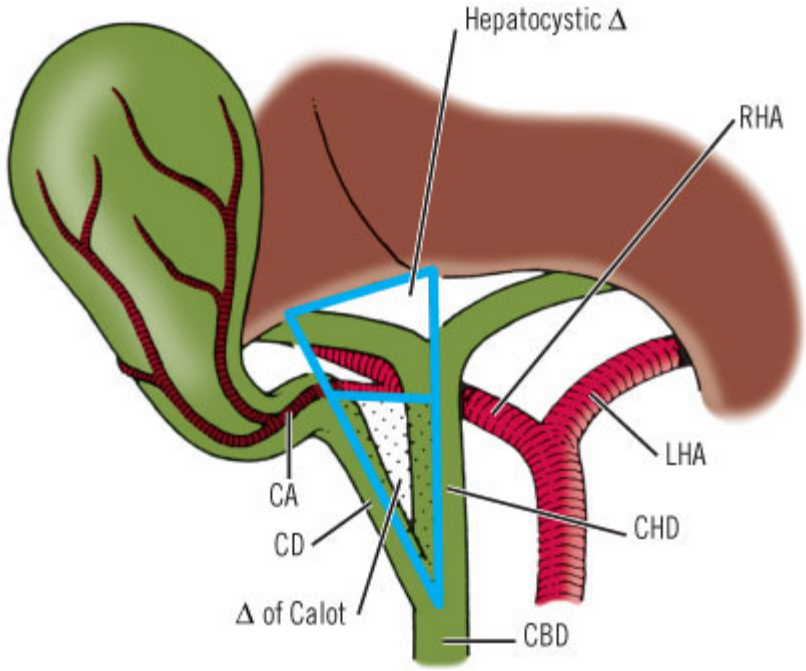




LAPAROSCOPIC CHOLECISTECTOMY

VIDEO

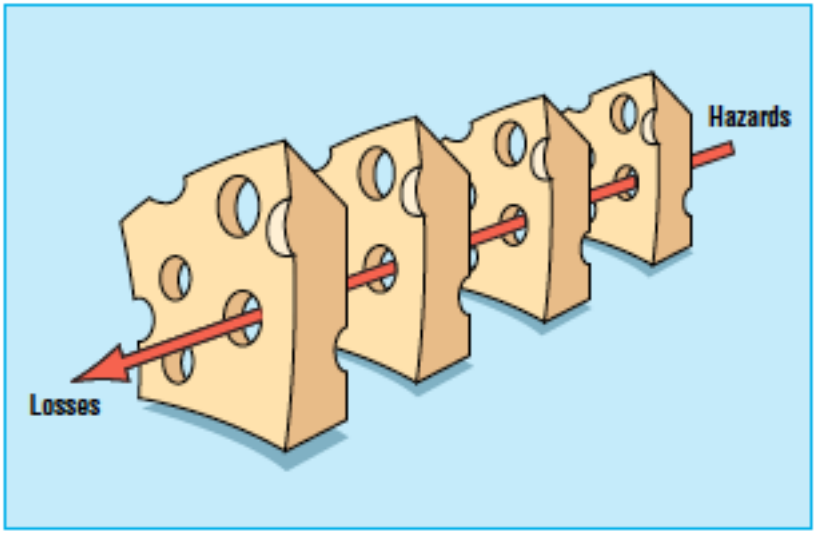


LAPAROSCOPIC CHOLECISTECTOMY

VIDEO

Laparoscopic cholecistectomy

The Swiss cheese model



Anatomic anomalies, grade of inflammation,
experience of the surgeon, instrumentation influence surgery outcomes

br med j 2000;320:768-70

LAPAROSCOPIC CHOLECISTECTOMY

Coplications after cholecistectomy

Anatomic risk factors:

- Accessory biliary ducts
- Anomalies of cystic duct
- Anomalies of extra-hepatic bile duct

Anatomic variation of the extrahepatic bile duct

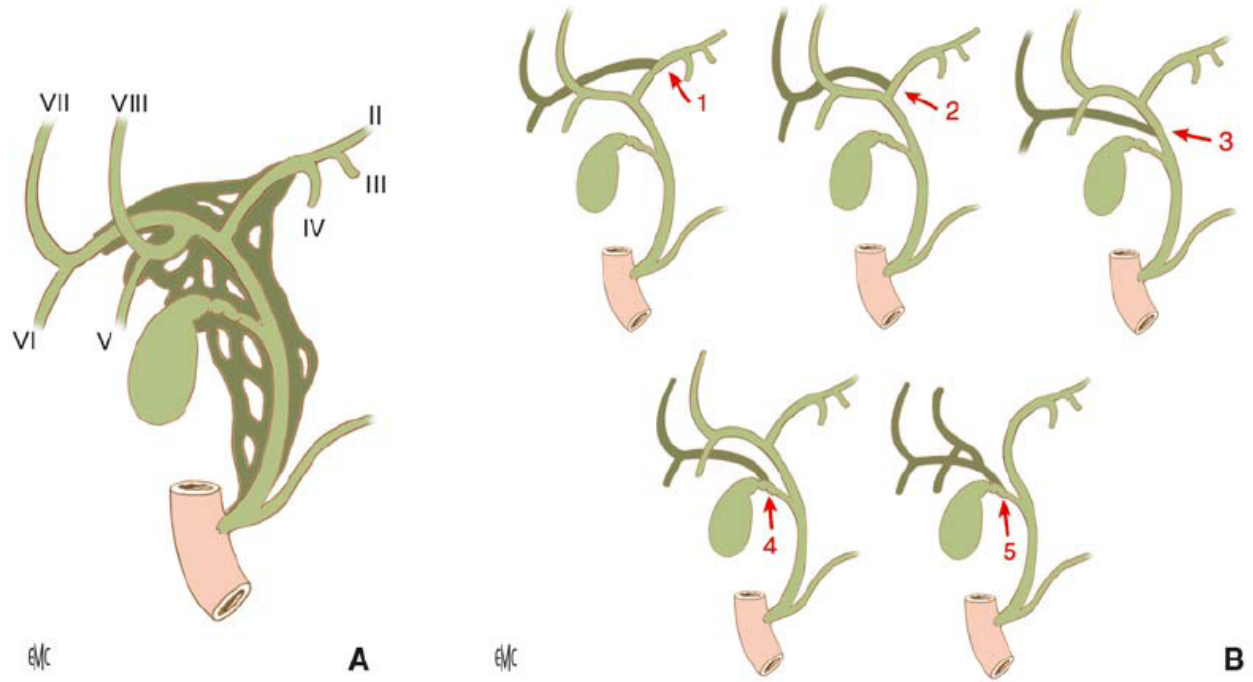


Figure 1. Variations anatomiques des voies biliaires extrahépatiques : glissements et conduits cystohépatiques (Champetier).
A. Voies biliaires extrahépatiques lors de leur développement embryonnaire.
B. Variations par glissement. 1 à 4. Glissements du conduit latéral droit ; 5. glissement du conduit hépatique droit ; 4 et 5 constituent un conduit cystohépatique.

Chiche L, EMC-Techniques chirurgicales, 2011

Anatomic variation of the hepatic artery

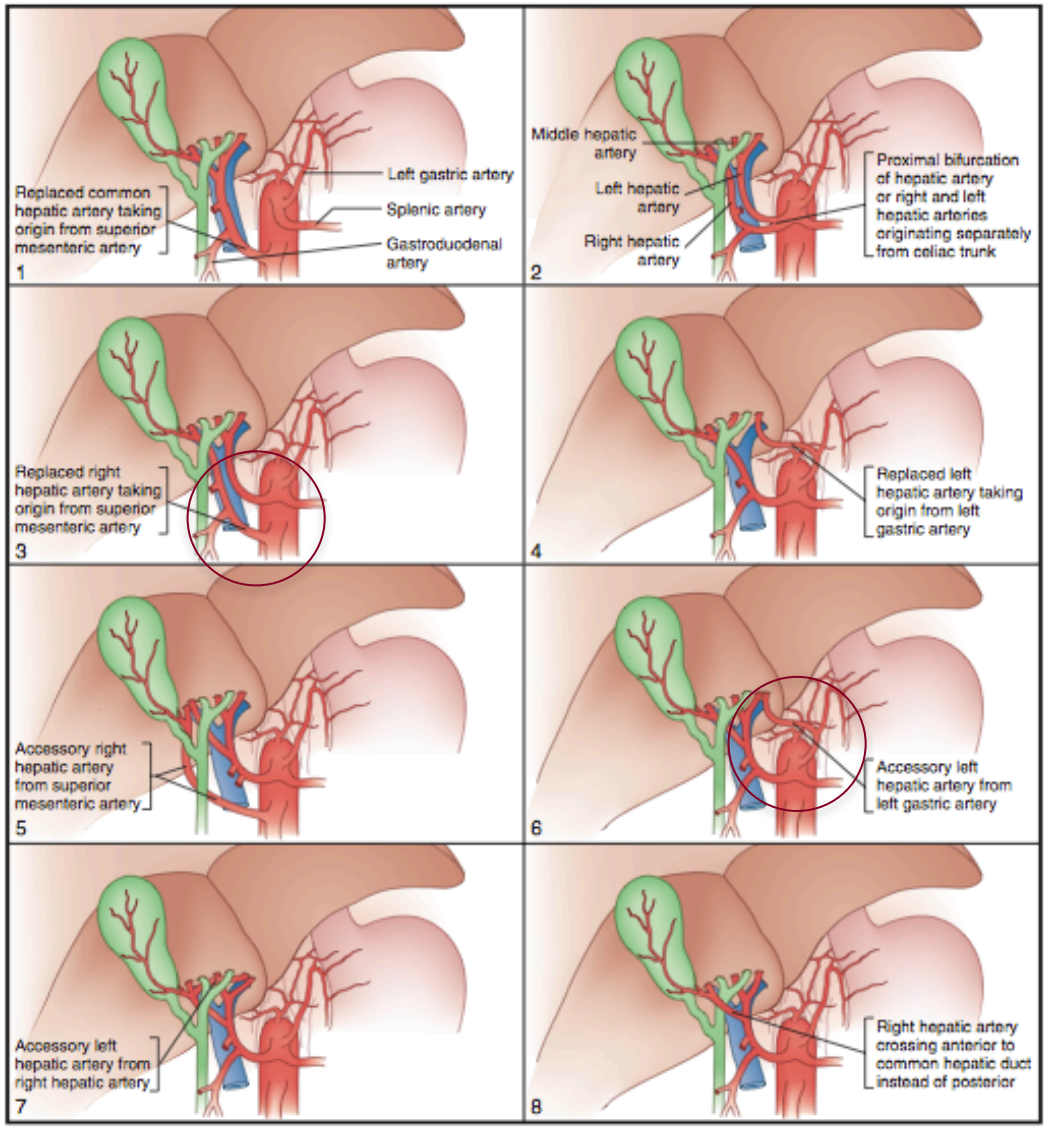


FIGURE 54-11 Variable anatomy of the hepatic artery. The common hepatic artery can originate off the superior mesenteric artery instead of the celiac axis. A replaced or accessory right hepatic artery comes off the superior mesenteric artery and runs posterior to the head of the pancreas, to the right of the portal vein and behind the common bile duct into the hilum. A replaced or accessory left hepatic artery originates off the left gastric artery and runs through the lesser omentum into the umbilical fissure. (Netter illustration from www.netterimages.com.

Sabiston, Textbook of Surgery, 19th ed., ch 54

Anomalies of the cystic artery

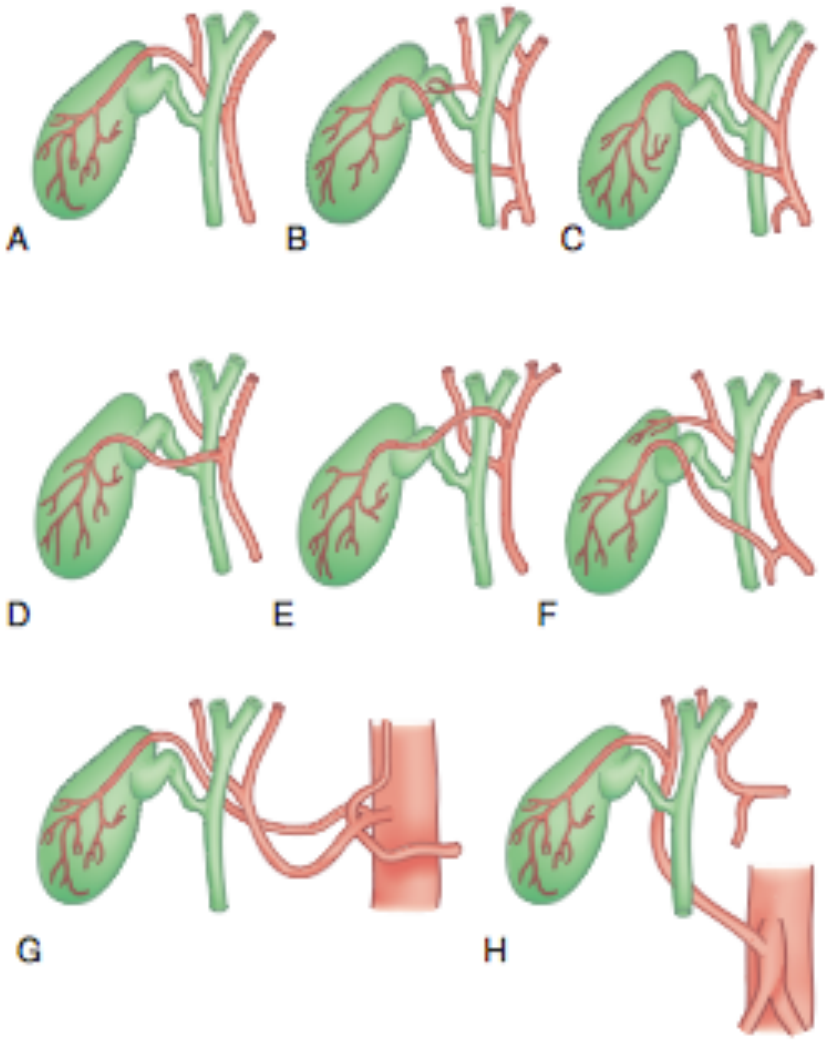


FIGURE 54-12 Variations in the anatomy of the cystic artery. **A,** Most common anatomy. **B,** Double cystic artery, one off the proper hepatic artery. **C,** Origin off the proper hepatic artery and coursing anterior to the bile duct. **D,** Originating off the right hepatic artery and coursing anterior to the bile duct. **E,** Originating from the left hepatic artery and coursing anterior to the bile duct. **F,** originating off the gastroduodenal artery. **G,** Originating off the celiac axis. **H,** Originating from a replaced right hepatic artery. (From Blumgart LH, Hann LE: Surgical and radiologic anatomy of the liver and biliary tract. In Blumgart LH, Fong Y [eds]: Surgery of the liver and biliary tract, London, 2000, WB Saunders, pp 3–34.)

Sabiston, Textbook of Surgery, 19th ed., ch 54

Laparoscopic cholecistectomy

Changes in operative risk of biliary lesion in different time frames

’80s – Open cholecistectomy:
Biliary lesions: 0.15%-0.5%

’90s – Laparoscopic cholecistectomy – the beginning
Biliary lesions: 0-2% (mean 0.37%)

2000s – Laparoscopic cholecistectomy:
Biliary lesions: 0.3-0.6%

Bismuth H., Lazorthes F.: Monographie de l'association francaise de chirurgie: traitement des plaies iatrogenes des voies biliaires. Paris: Masson; 1981

Henry ML, Carey LC. Complications of cholecystectomy. Surg Clin North Am. 1983 Dec;63(6):1191-204

Iatrogenic lesions

Biliary complications after lap chole

Mechanisms of lesions:

- Error in duct ligation or necrosis of the duct
- Non-recognition of an accessory biliary duct on gallbladder bed
- Bad recognition of the biliary tree

Algorithm after lap chole:

pz with pain, fever or dynamic ileo

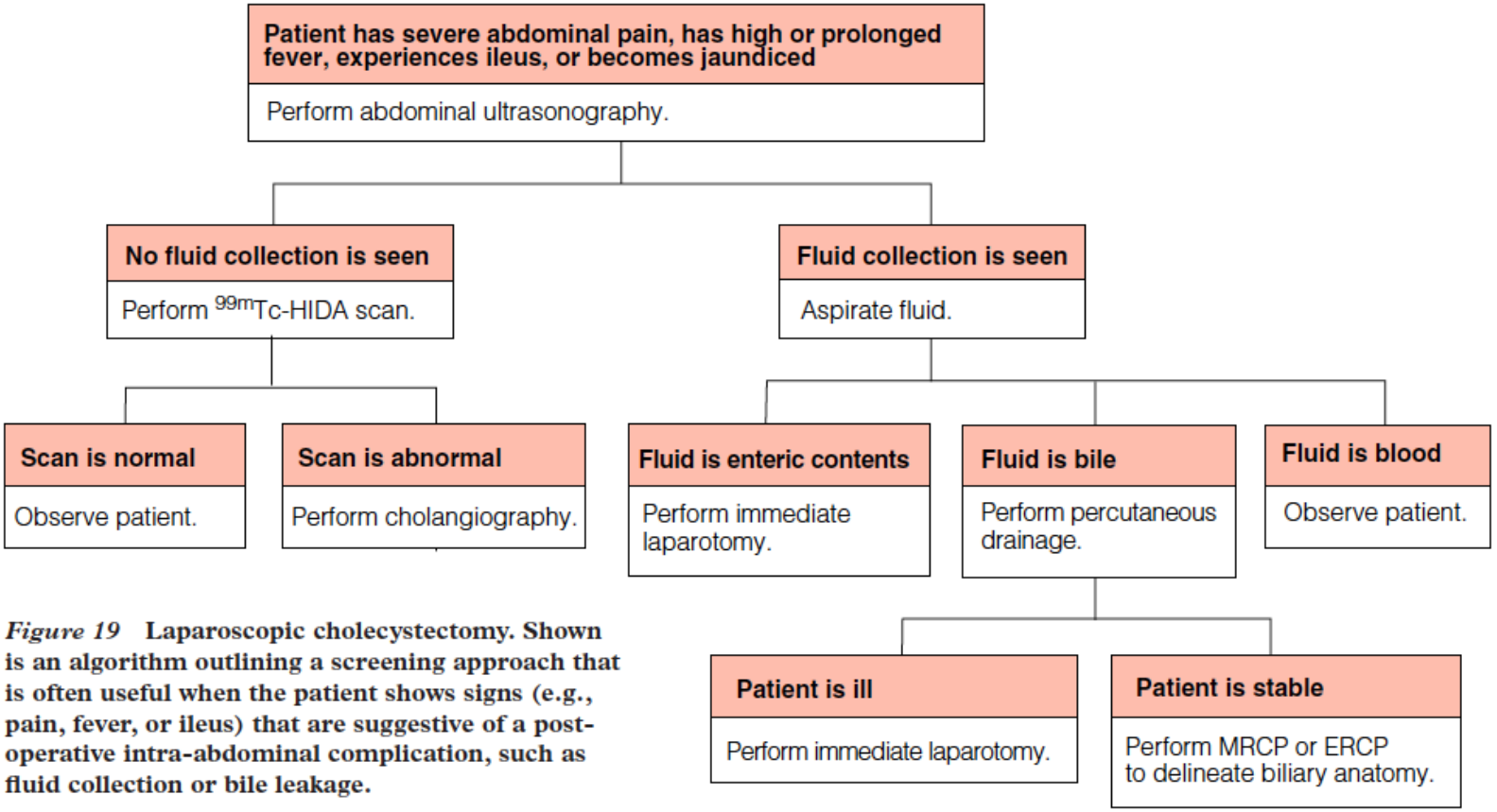
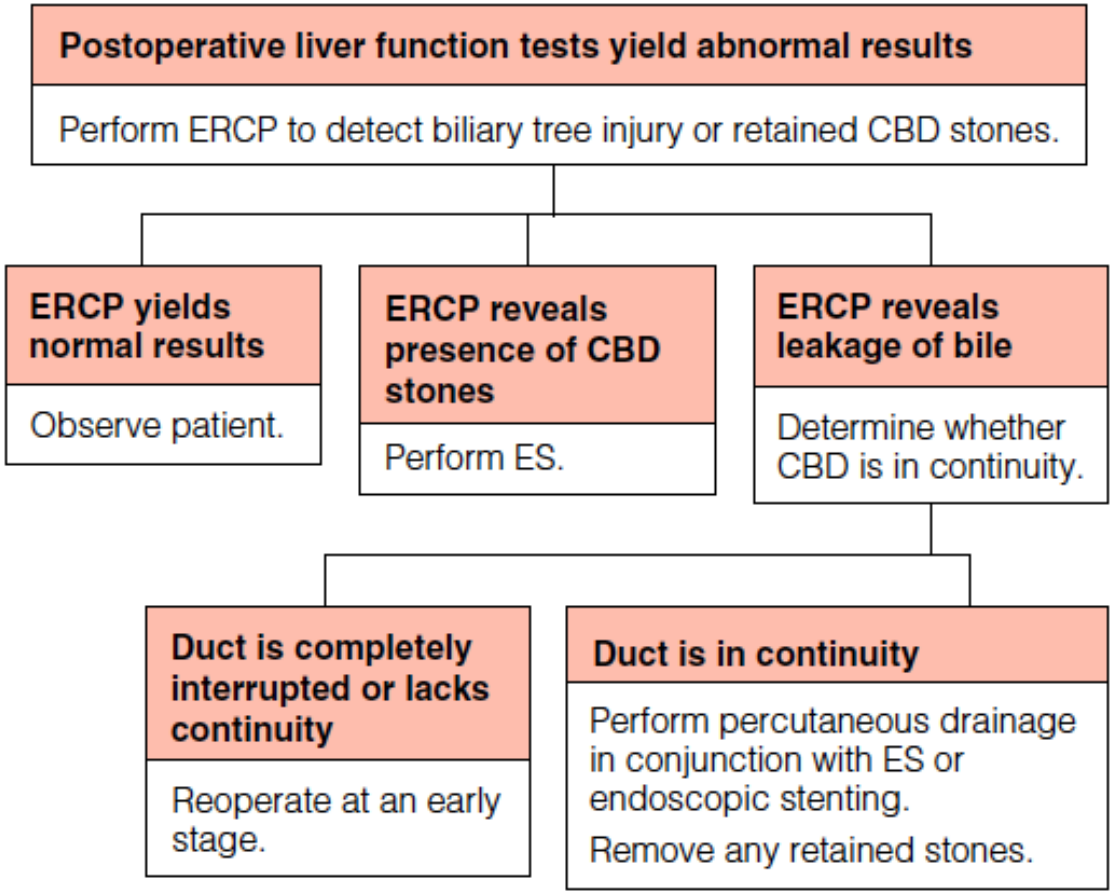


Figure 19 **Laparoscopic cholecystectomy. Shown is an algorithm outlining a screening approach that is often useful when the patient shows signs (e.g., pain, fever, or ileus) that are suggestive of a post-operative intra-abdominal complication, such as fluid collection or bile leakage.**

ACS Surgery: Principles and Practice, 2005

Algorithm after lap chole:

changes in serologic hepatic tests



ACS Surgery: Principles and Practice, 2005

Iatrogenic lesions

Biliary complications after lap chole

Diagnosis:

•10-30% of the lesions are identified intra-operatively

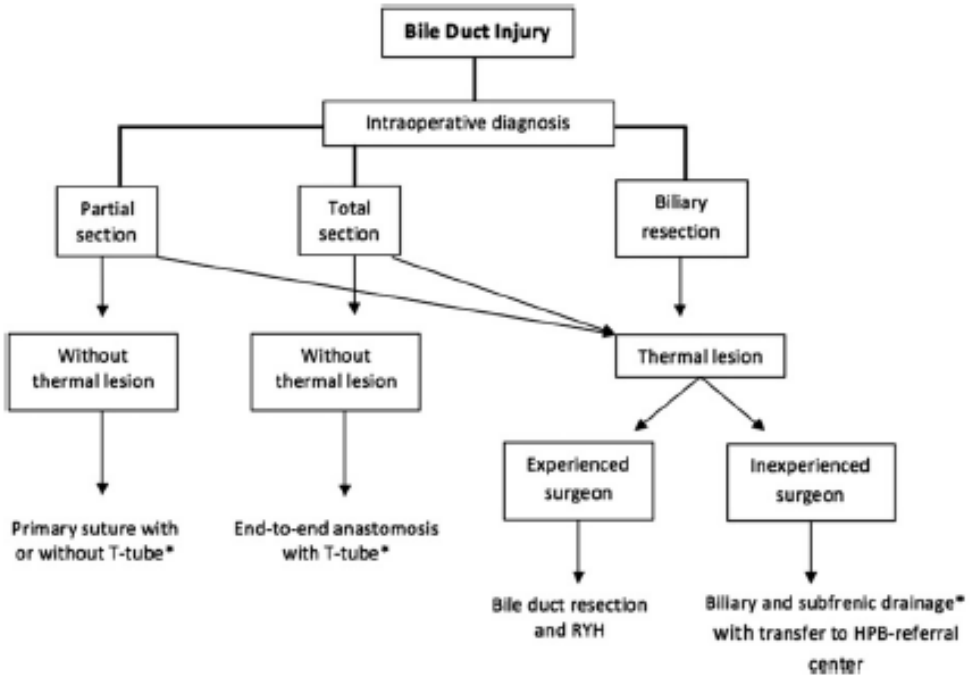
• Complex lesions have to be sent to an high-volume hepatobiliary surgery center

• Delay in transfer increases rate of complications and mortality by 1.5%

•Success rate of biliary reconstruction by expert hepatobiliary surgeon is 79% compared to 27% of general surgeon

Wu YV, Linehan DC, Sur Clin N Am 90(2010);787-802

Algorithm: intra-op biliary lesion



Pekolij et. Al. Intraoperative repair of bile duct injuries. JACS 2013, 216(5)

Iatrogenic lesions

Intra-op management:

•Repair should be performed by an expert hepatobiliary surgeon

•For un-experienced surgeons, it is suggested to place sub-liver drains and eventually a T tube

•The patient should be transferred to a high-volume hepatobiliary center

Lau WY et al. ANZ J Surg. 2010 Jan;80(1-2):75-81

Iatrogenic lesions

Delayed repair:

•It is suggested in case of complex lesions, sinchronous vascular damage and collection

•It is suggested a delayed repair after 2-3 months

•All the biliary lesions in discontinuiti with the intestine must be repaired

Wu YV, Linehan DC, Sur Clin N Am 90(2010);787-802

Strasberg's classification of the biliary lesions

Bile Duct Injury Type	Definition
A	Bile leak from a minor duct still in continuity with the common bile duct
B	Occlusion of part of biliary tree
C	Bile leak from duct not in communication with common bile duct
D	Lateral injury to extrahepatic bile ducts
E	Circumferential injury of major bile ducts (Bismuth class 1 to 5)

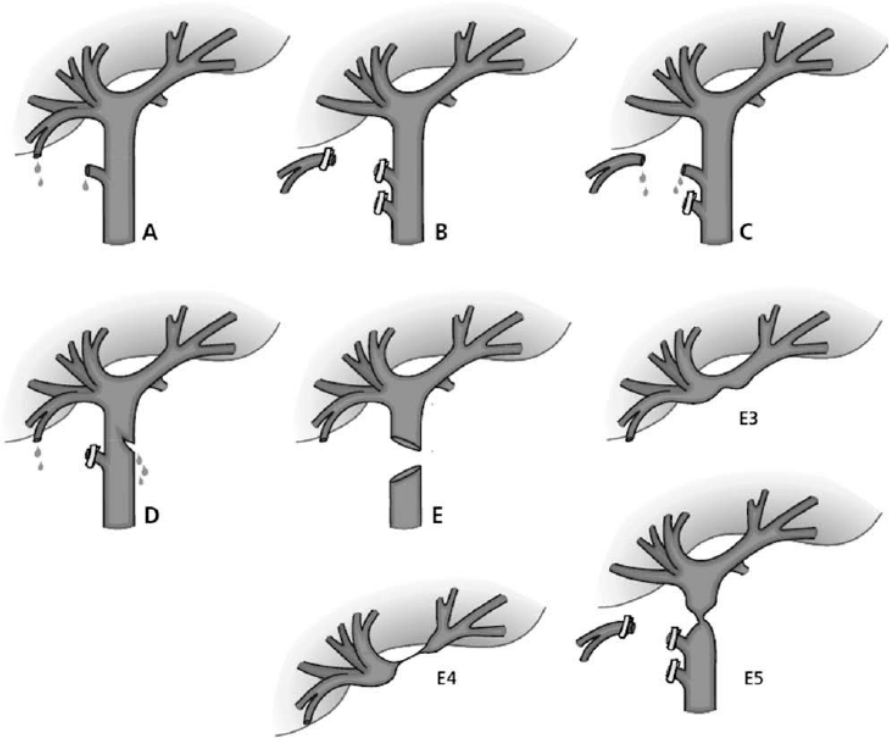
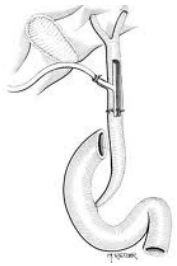


Fig. 1. Classification of the bile duct injury (published with the permission, Ref. 37).
Classification of bile duct injuries according to Strasberg et al (16, 37). Type A refers to leak from cystic duct stump or leak from gallbladder bed. Type B occlusion of segmental or sectoral bile duct. Type C same as B but with bile leak from the duct. Type D common duct injury with leak. Type E disruption of the continuity of the main bile duct below bifurcation E1 (over 2 cm), E2 (under 2 cm), at the bifurcation E3, without communication between left and right main ducts E4, and lesion at the main duct with concomitant lesion of right sectoral or segmental duct E5.

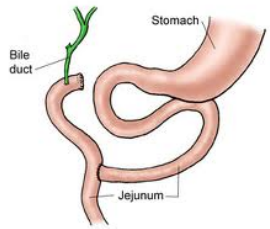
Joseph et al. Ann Surg 2012;256:1–6

Classification of biliary lesions

Surgical management:

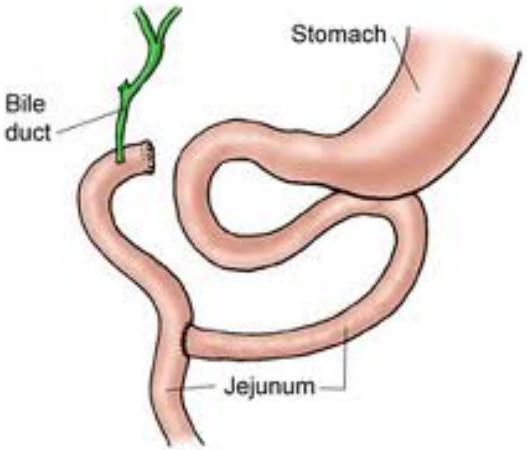


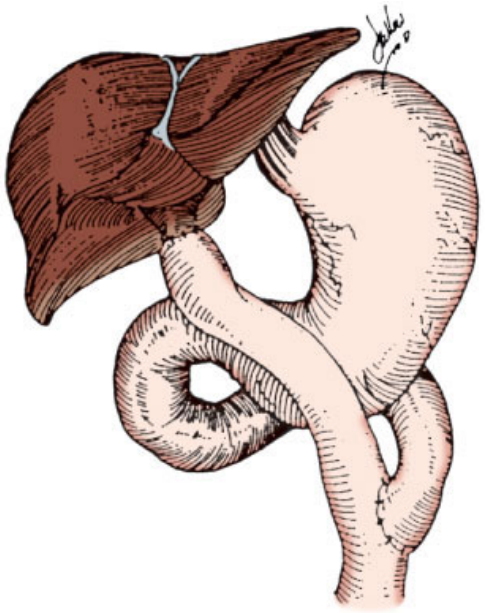
- Strasberg A: Oversewing or ligation
- Strasberg B: No intervention is needed in most of the cases
- Strasberg C: Suture or hepatic-jejunal anastomosis
- Strasberg D: Suture on T tube (Kehr tube)
- Strasberg E: Hepatic-jejunal anastomosis

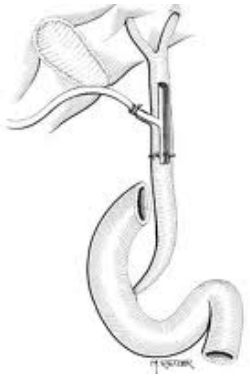


Nordin et al., Scandavinian Journal of Surgery 2011

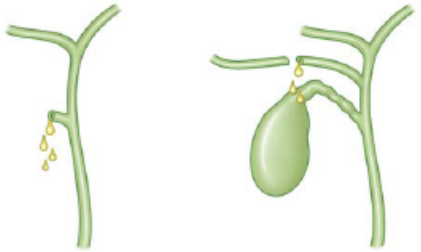
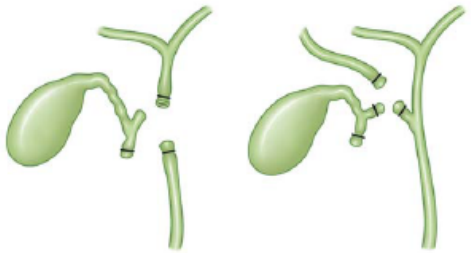
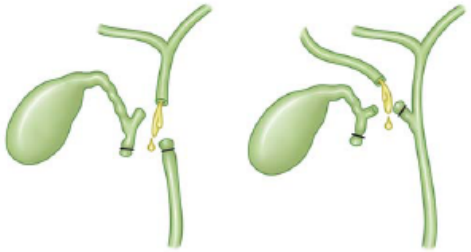
Classification of biliary lesions







Nordin et al., Scandavinian Journal of Surgery 2011

Type A	Fuite du canal cystique	
Type B	Fuite sur la VBP	
Type C	Sténose ou ligature de la VBP	
Type D	Transsection de la VBP ou d'un canal principal	

Classification of biliary lesions

: Amsterdam classification

Endoscopic management:

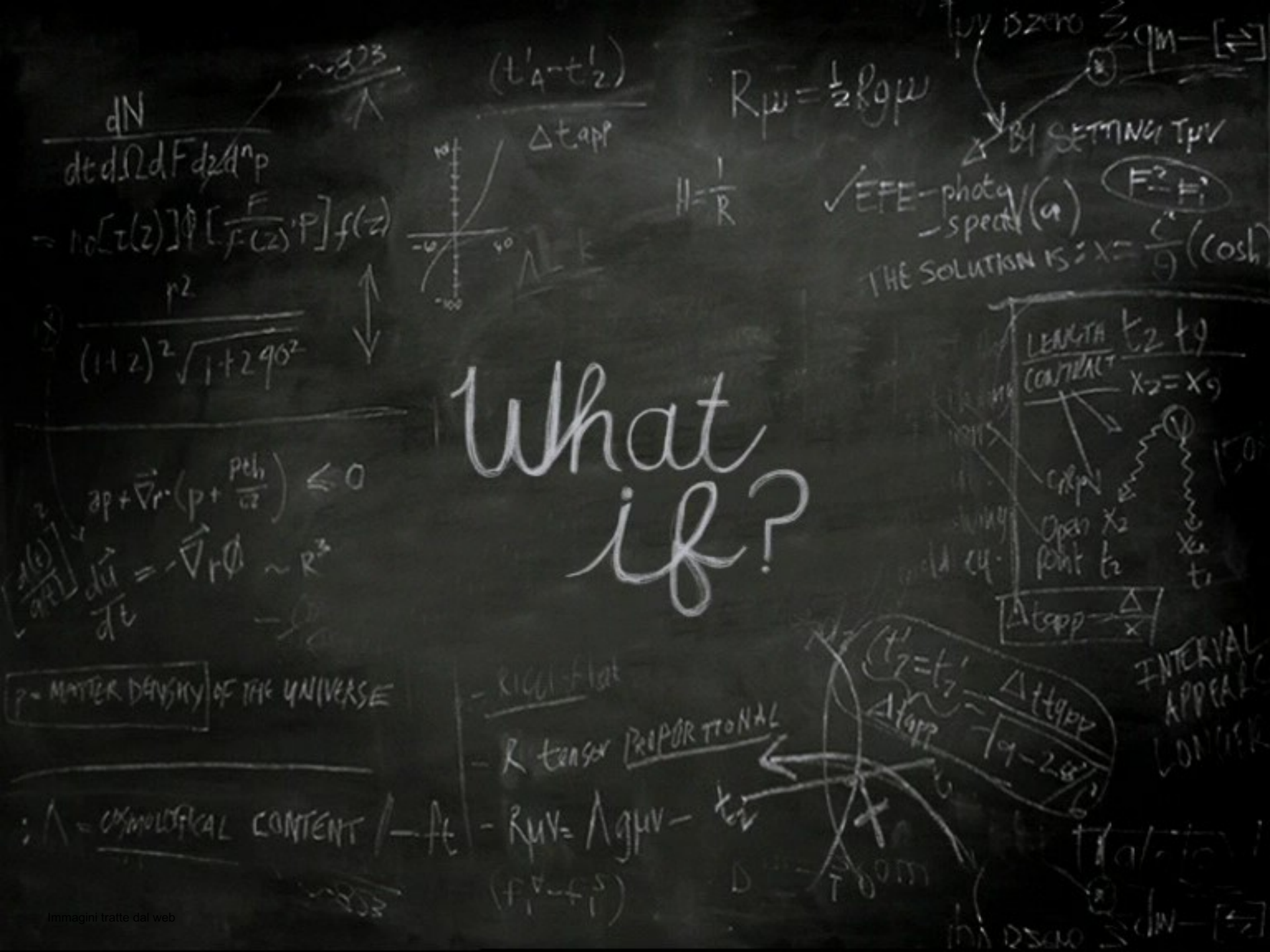
- Amsterdam A: Sfinterotomy, biliary stent and eventually percutaneous drainage
- Amsterdam B: percutaneous drainage, sfinterotomy, biliary stent, eventually surgical treatment
- Amsterdam C: radiologic/endoscopic Rendez-vous
- Amsterdam D: Surgical treatment

De Reuver PR, Ann Surg 2007;245:763-70

Laparoscopic cholecystectomy

Take-home messages

- Laparoscopic cholecistectomy cannot be considered an «ordinary» operation
- Damage to the patient can be catastrophic
- Always consider the proper indication to surgery
- Explain risks and benefits of the operation to the patients – informed consent
- Use always a laparoscopic approach, except where indicated
- In case of intra-op lesion, tranfer the patient to an hepatobiliary center



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Case

Patient:

75 year-old pt., BMI 34, is admitted for RUQ abdominal pain since 3 days

Physical exam shows alt of inspiration during deep palpation of the RUQ.
Fever is reported (38° C)

Tot. bilirubin: 1mg/dl	AST: 243 U/L
BUN: 16 mg/dl	ALT: 270 U/L
Creatinine: 1.05 mg/dl	WBC: 20.000

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Case

Ultrasound

Gallbladder stones and thikening of gallbladder wall. Fluid collection around gallbladder

Question 1

Name structures of the biliary tract (1 to 8) from top to bottom:

1) **Intrahepatic ducts**
2) **Left hepatic duct**
3) **Right hepatic duct**
4) **Common hepatic duct**
5) **Gallbladder**
6) **Cystic duct**
7) **Common bile duct**
8) **Ampulla of Vater**

Question 2

Q. What is the name of the node in Calot triangle?
A. Calot's node

Question 3

Q. What are the small ducts that drain bile directly into the gallbladder from the liver?
A. Ducts of Luschka

Question 4

Q. What artery is suceptible of injury during cholecistectomy?
A. Right hepatic artery

Question 5

Q. What is the name of valves of gallbladder?

A. Spiral valves of Heister

Question 6

Q. What is «Hartmann's pouch»
A. Gallbadder infundibulum

Question 7

Q. What are the boundaries of the triangle of Calot?

A.The 3 C's:

1. **Cystic duct**
2. **Common hepatic duct**
3. **Cystic artery**

Question 8

Q. Are you sure that the triangle of Calot includes the cystic artery and not the liver edge?
A. Yes, look up Gastroenterology 2002; 123(5): 1440

Question 9

Q. What is the source of alkaline phosphatase (AP) ?
A. Bile duct epithelium: expect AP to be elevated in bile duct obstruction

Question 10-11

Q. What is in bile?
A. Cholesterol, lechitin (phospholipid), bile acids and bilirubin

Q. What does bile do?
A. Emulsifies fats

Question 12-14

Q. What is the enterohepatic circulation?
A. Circulation of bile acids from liver to gut and back to liver

Q. Where are most of the bile acids absorbed?
A. In the terminal ileum

Q. What stimulates gallbladder empting?
A. Cholecistokinin and vagal imput

Question 12-14

Q. What is the source of cholecistokinin?
A. Duodenal mucosal cells

Q. What stimulate the release of cholecistokinin?
A. fat, protein, aminoacids, and HCL

Q. What inhibits its release?
A. Tripsin and chymotripsin

Question 15

Q. What are actions of cholecistokinin?
A. Gallbladder empting, opening of ampulla of Vater, slowing of gastric empting, pancreas acinar cell growth and release of exocrine products

Question 16-18

Q. At what level of serum total bilirubin does one start to get jaundiced?
A. >2.5 g/dl

Q. Classically, what is thought to be the anatomic location where one first finds evidence of jaundice ?
A. Under the tongue

Q. With good renal function, how high can the serum total bilirubin go?
A. Very rarely, >20 g/dl

Question 19-21

Q. What are the signs and symptoms of obstructive jaundice?
A. Jaudice, dark urine, clay-colored stools (acholic stools), pruritus (itching)

Q. What causes the itching in obstructive jaundice?
A. Bile salts in the dermis (not bilirubin)

Q. Define cholelithisasis
A. Gallstones in gallbladder

Question 22-24

Q. Define choledocolithiasis?
A. Gallstones in CBD

Q. Define cholecystitis?
A. Inflammation of gallbladder

Q. Define cholangitis
A. Infection of biliary tract

Question 25-27

Q. Define cholangiocarcinoma
A. Adenocarcinoma of bile duct

Q. Define Klatskin's tumor
A. Cholangiocarcinoma of bile duct at the juction of the right and left hepatic ducts

Q. Define biliary cholic
A. Pain from gallstones, usually from a stone at the cystic duct. The pain is located in the RUQ, epigastrium, or right subscapolar region. It usually lasts minuts to hours but eventually goes away. It is often postprandial, expecially after fatty foods

Question 28-30

Q. Define choledochojejunostomy
A. Anastomosis between CBD and jejunum

Q. Define Biloma
A. Itraperitoneal bile fluid collection

Q. Define hepaticojejunostomy
A. Anastomosis of hepatic duct or common hepatic duct to jejunum

Question 31-33

Q. What is the initial diagnostic study of choice for evaluation of biliary tract/gallbladder/cholelithiasis?
A. Ultrasound

Q. Define ERCP
A. Endoscopic retrograde cholangiopancreatography

Q. Define IOC
A. Intra operative cholangiogram

Question 34-36

Q. Define PTC?
A. Percutaneous transhepatic cholangiogram

Q. Define HIDA/PRIDA scan
A. Radioisotope study; isotope concentrated in the liver and secreted into the bile; will demonstrate cholecystitis, bile leak, or CBD obstruction

Q. How does HIDA scan reveal cholecystitis?
A. Non-opacification of the gallbladder from obstruction of the cystic duct

Question 37-39

Q. What is sfincterotomy?
A. AKA papillortomy. Cut through sphincter of Oddi to allow passage of gallstones from the common bile duct;

Q. How should postoperative biloma be treated after lap chole?
A. Percutaneous drain bile collection/ERCP with placement of biliary stent past leak

Q. What is the treatment of major CBD injury after lap chole?
A. Choledochojejunostomy

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