MRAD 254: Fluoroscopic Imaging

Outcome: 4

Biliary Imaging

MRT Program

Objectives

4.1) Describe the gross anatomy, relational anatomy, and physiology of the biliary system

4.2) Determine the positioning for biliary procedures and examinations

4.3) Describe the radiographic procedures that are used to image the gallbladder and biliary ducts

4.4) Indicate the contrast media used in procedures of the biliary system

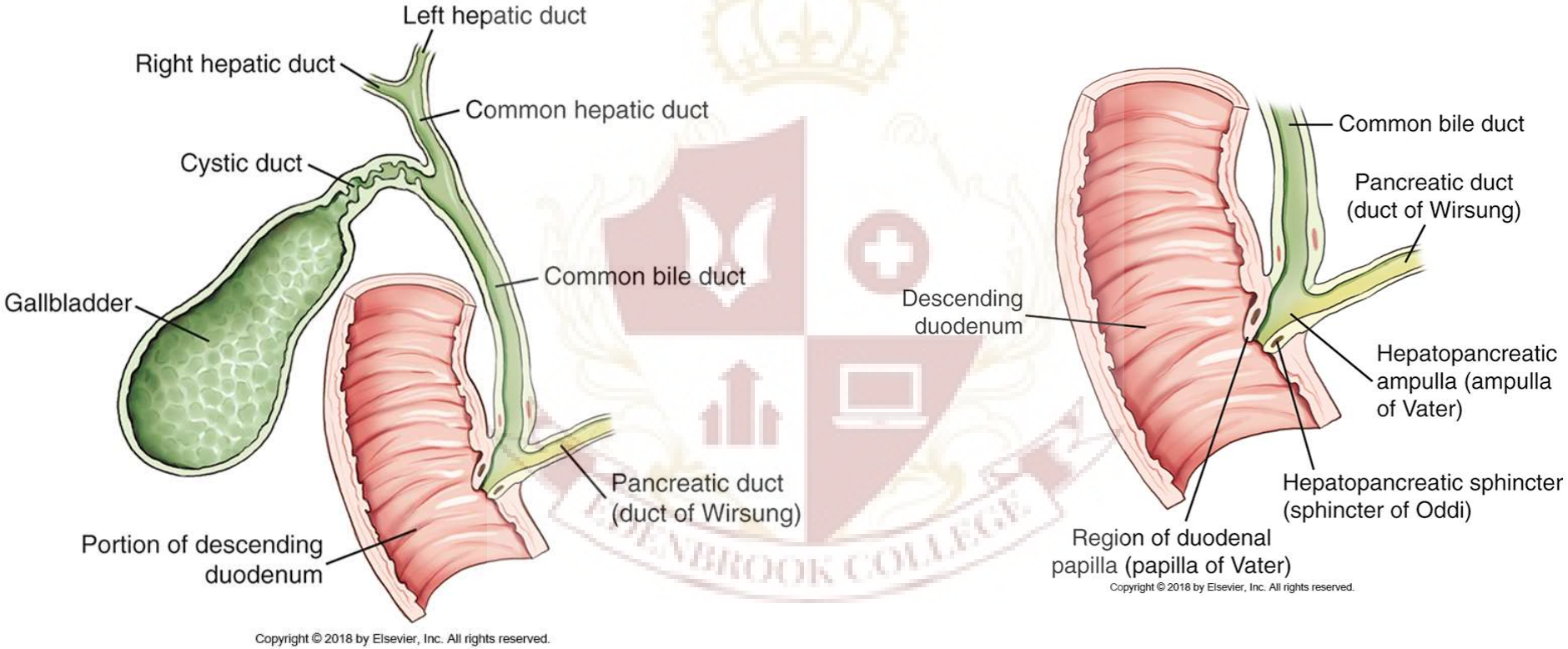
4.5) State the patient preparation and post procedural care for biliary procedures

4.6) Identify radiographic images associated with individual procedures of the biliary system

4.7) Explain the purpose and value of alternate modalities and procedures for gallbladder and biliary duct imaging

4.8) Indicate the common anatomical structures presented on images of the biliary system

Biliary Anatomy



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Biliary Physiology

- Liver creates bile and send it to the gallbladder to storage
  - R and L hepatic ducts → common hepatic duct
- Gallbladder stores the bile until you eat
  - Cystic duct → gallbladder
- Bile is expressed to aid digestion of fats and oils
  - Common bile duct → Ampulla of Vater and Sphincter of Oddi to descending duodenum
  - Major duodenal papilla

Cholelithiasis

- Gallstones
- Bile is compressed and solidifies
- Often seen inside the gallbladder
  - Can be anywhere along the biliary tree
- Very commonly asymptomatic
  - Usually not treated if not causing problems
- 15-20% can be seen on plain radiographs

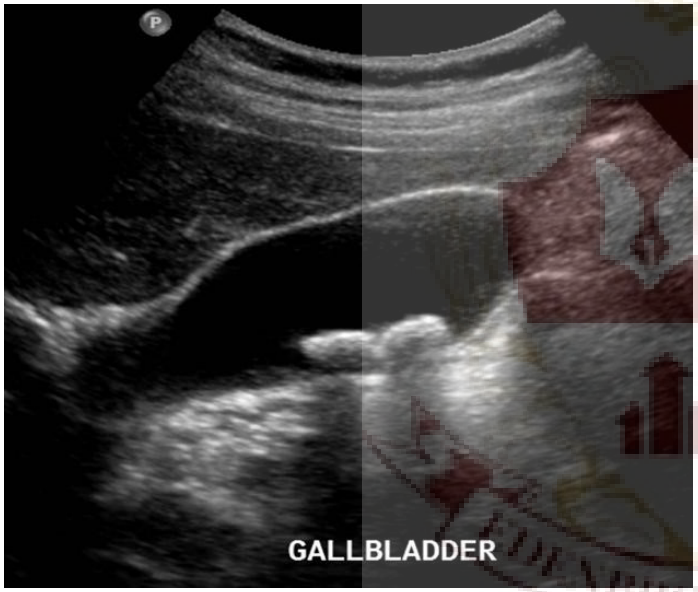


https://radiopaedia.org/articles/gallstones-1

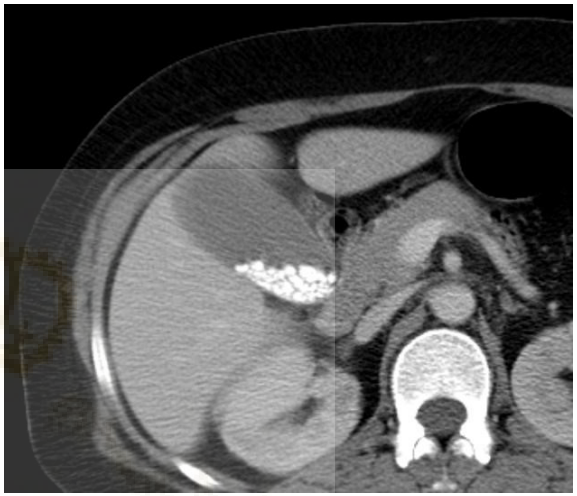
Visualizing Gallstones

- Can be seen on CT if very calcified
- Can also be seen on MR
  - Expensive with long wait times
- Gold standard is ultrasound
  - See very small and radiolucent stones
  - Watch stones roll around in real time
  - Measure thickness of gallbladder wall
  - Detect extra fluid

Gallstones



https://radiopaedia.org/articles/gallstones-1





Cholecystitis

- Inflammation of the gallbladder
- Almost always caused by gallstones obstructing the neck of the gallbladder
  - Bile salts cause inflammation of mucosa
  - Increased pressure and pain
- Often leads to secondary bacterial infection
- Diagnosis by ultrasound the most common
  - CT also used to see other areas at the same time
- Gallbladder must be removed

Imaging the Biliary Tree

- Want to image to whole biliary tree
- Localize obstructing stones
- Find strictures
- Ensure no stones remaining after gallbladder removal
- Contrast fluoroscopy most common
  - Used to be mobile X-ray, but now C-arm is almost exclusively used

Contrast Media

- Single contrast exam
- Non-ionic, iodinated
  - Ultravist is common
- Diluted to prevent obscuring very small stones
  - Sometimes all you see is a very small filling defect

Methods of Administration

- Intravenous
  - CT cholangiogram
  - You'll learn about these in CT 1 & 2
- Direct Injection
  - Injected directly into the biliary ducts during cholecystectomy
  - Injected via the common bile duct in an ERCP
- Indwelling catheter
  - Catheter left in the body after a cholecystectomy

Contraindications

- Contraindications to the contrast, not the procedure
- Known sensitivity to contrast
  - Back to ultrasound for further imaging
- Acute infection of the biliary system
- Elevated creatinine or blood urea nitrogen (BUN)
  - Indicates poorly functioning kidneys
- Pancreatic pseudocysts
  - Sometimes arise from the pancreatic duct
  - If filled with contrast they may burst and cause infection

Procedures - ERCP

- Endoscopic Retrograde Cholangiopancreatogram
  - Performed by a gastroenterologist with the help of an anesthetist and nursing staff
- Endoscopic
  - Thin, flexible camera tube inserted through mouth to duodenum
  - Catheter passed down tube and into duodenal papilla
- Retrograde
  - When contrast is injected, it flows backwards along normal path of bile
  - Common bile duct → Cystic and Hepatic ducts
- Cholangiopancreatogram
  - Can investigate gallbladder and pancreas

ERCP cont.

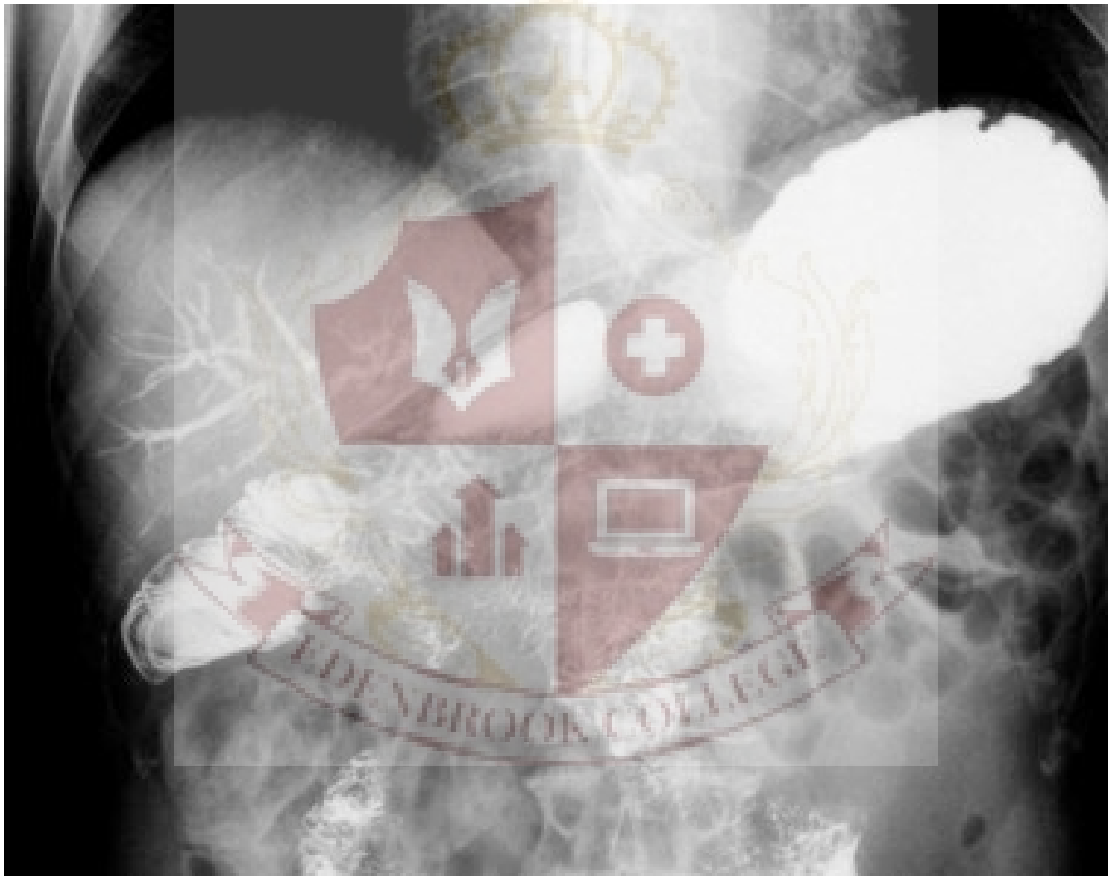
- Contrast highlights stones or strictures
- Brush out ducts or use a basket to remove stones
- Sphincterotomy to allow stone to pass
- Barium may reflux up biliary tree during UGI



NCircle® Nitinol Tipless Stone Extractor | **NCompass®** Nitinol Stone Extractor | **NForce®** Nitinol Helical Stone Extractor | **NGage®** Nitinol Stone Extractor | **NTrap®** Stone Entrapment and Extraction Device

https://darshanavnadkarni.wordpress.com/tag/nitinol-devices-and-components/

Barium Reflux into Biliary Tree



https://clinicalgate.com/biliary-fistulae/

Patient Preparation & Post Care

- NPO 8 hours
- Patient will be heavily sedated for this procedure
- Remain NPO until topical anesthetic sprayed on throat wears off
  - Prevents aspiration
  - 1-2 hours
- You will have almost nothing to do with these parts of the exam

Technologist's Role

- Largely technical
- Set up fluoro equipment
  - Often a dedicated fluoro suite
- Monitor and control fluoro use
  - Some gastroenterologists like to do this themselves
- Document fluoro time and images for the patient's chart

During the Procedure

- Pt in LAO position on table
  - Centered over lower costal region on right side
- Fluoro to ensure catheter is in correct place
- Fluoro & contrast to see blockages
- Fluoro during stone removal

ERCP Fluoroscopy



What It looks Like

- https://youtu.be/IRdA2krJ6LQ
  - Great video of an ERCP in action!



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Proc. – Laparoscopic Cholecystectomy

- Surgical removal of the gallbladder
- Done in an OR with a surgeon
- Done in conjunction with a **cholangiogram**
- Done with a C-arm
  - Textbook talks about using a mobile X-ray machine, but this is now very rare.
  - Live fluoro very helpful

Laparoscopic Cholecystectomy cont.

- Small incision made and laparoscopic camera and instruments inserted
- Gallbladder removed and cystic duct clipped off
  - Clips will be visible on plain X-ray for the rest of patient's life
- Contrast injected into biliary tree
  - Before or after removal of gallbladder
  - Ensure no stones are left
  - 6-8ml injected
- Draped C-arm brought over ROI
- Anesthesiologist suspends respirations
- Fluoro and contrast injection at the same time

Surgical Clips Seen on X-ray



Technologist's Role

- Same as any OR case
- Set up fluoro and take images
- Document fluoro time and images for patient's chart
- Images
  - AP
  - RPO and LPO
  - RPO projects biliary tree off spine in hypo and asthenic patients

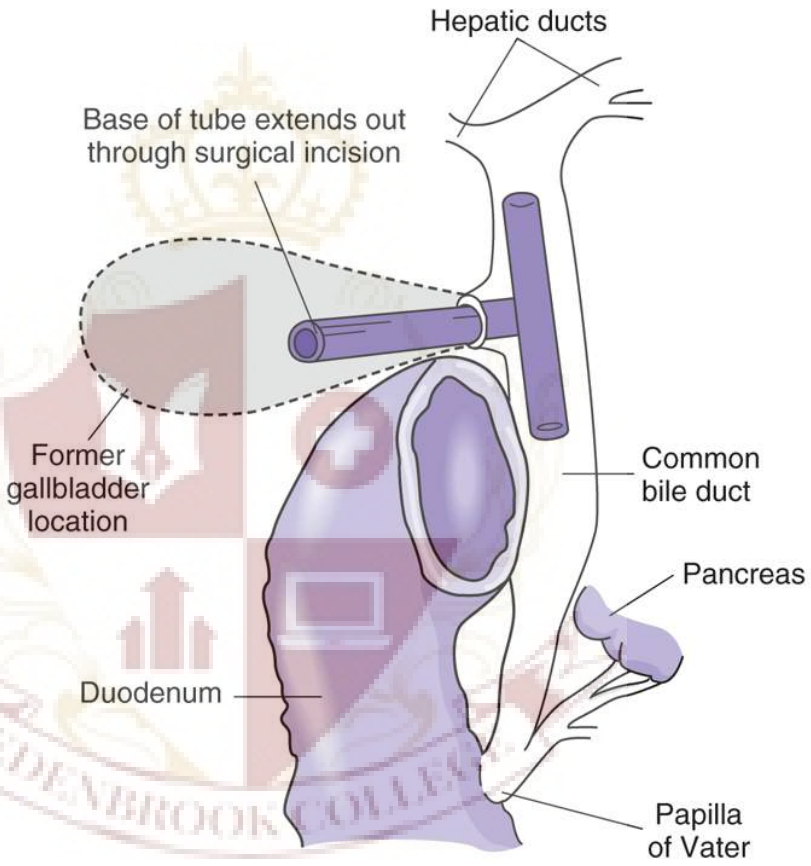
Operative Cholcystectomy/Cholangiogram

- Same as Laparoscopic, but using an open incision
- Used to be used for every case, but now only when a laparoscopic case goes wrong

T-Tube Cholangiogram

- "Delayed" cholangiogram
- Done in radiology department by radiologist and technologist
- Done when concerned about stones remaining in biliary tree after cholecystectomy
- T shaped catheter left in patient
  - Cross bar in hepatic and common bile ducts
  - Bottom sticks out of patient
  - Drains bile if there is swelling on common bile duct after surgery
  - Allows injection of contrast into biliary tree
  - Ensures patency of ducts before tube removal

T-tube Placement



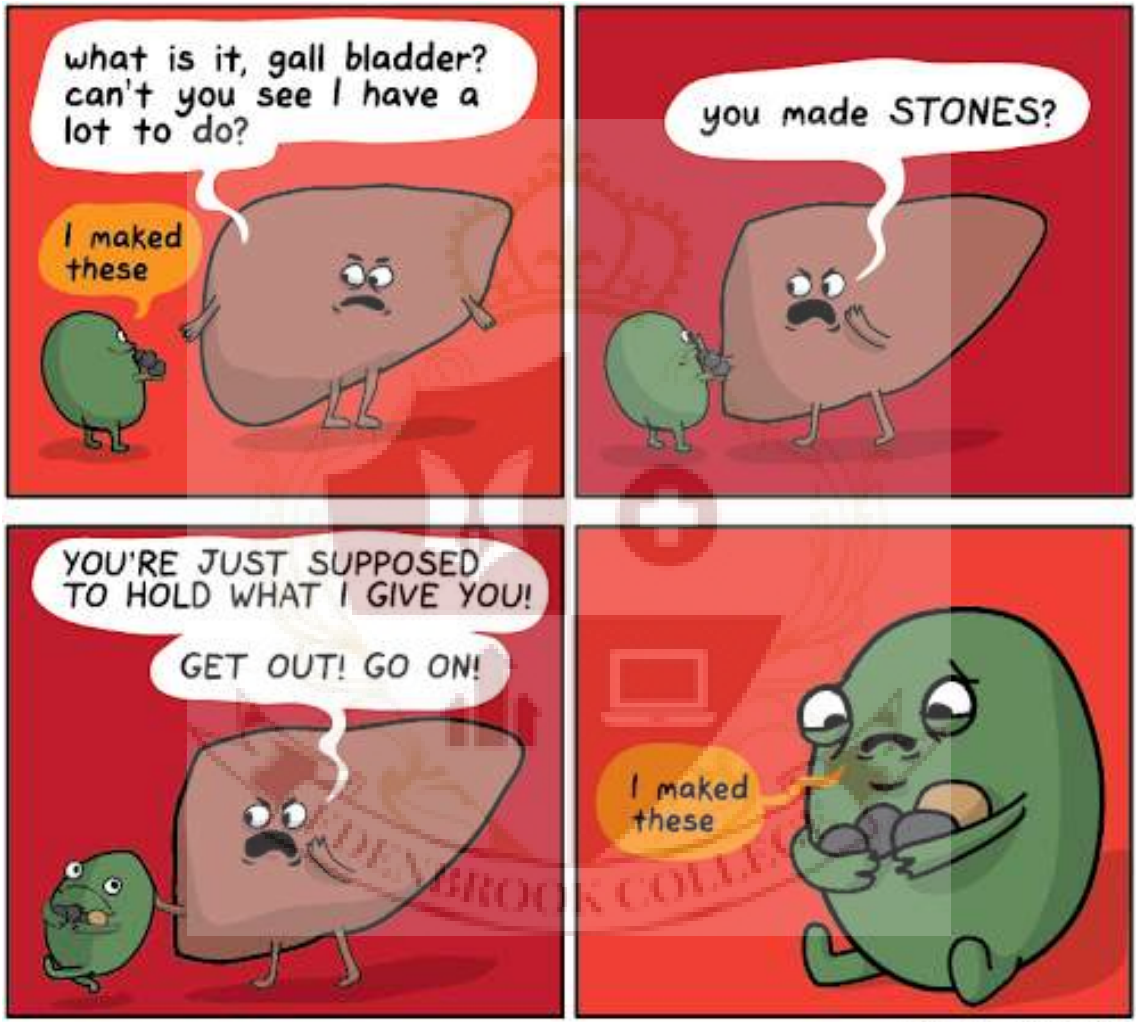
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Patient Preparation and Procedure

- Tube is clamped the night before to allow filling with bile
  - Prevents air bubbles, which can be mistaken for small stones
- NPO 8 hours
- Bile is drained
  - Have a kidney basin ready
- Contrast is injected through the tube and into biliary ducts
- If stones are found the radiologist will use a basket catheter to remove them

Normal T-tube Cholangiogram




what is it, gall bladder? can't you see I have a lot to do?
I maked these
you made STONES?
YOU'RE JUST SUPPOSED TO HOLD WHAT I GIVE YOU!
GET OUT! GO ON!
I maked these
theAwkwardYeti.com