Introduction to Abdominal Imaging

David Marker, PGYII
dmarker@jhmi.edu
I'm Dr. M. Welcome to Abdominal Imaging 101!

And I'm Dr. T.
Lecture Outline

• Objectives
• Relevance of material
• Imaging modalities
• Clinical Approach to Abdominal Anatomy
  – 4 Quadrants
  – Retroperitoneal
• Summary
Objectives

• Learn the basic modalities for imaging the abdomen
• Learn the organs found in each of the four abdominal quadrants
• Learn retroperitoneal organs
• Exposure to the presentation of common abdominal pathologies
Relevance

- Clinical use
  - 5% of visits to the ER are for abdominal pain
  - 1/8 ER patients get a CT scan
- Radiologist or Consulting With One
- USMLE Step 1
  - Some questions use radiology
- Gross anatomy exam
What are the 4 imaging modalities commonly utilized for the abdomen?
Hmm… the four main modalities used in abdominal imaging are:

1. Conventional x-ray
2. Ultrasonography
3. Computed tomography
4. Magnetic resonance
Conventional x-ray

- **Use**
  - Traditionally used for screening

- **Advantages**
  - Availability and lower cost ($50)
  - Well tolerated

- **Disadvantages**
  - Lower sensitivity
  - Ionizing radiation
Ultrasonography

- **Use**
  - Gallbladder, biliary tree, and female pelvis
  - *Aortic aneurysm* screening
  - Detection of free fluid

- **Advantages**
  - Availability and lower cost ($200)
  - No ionizing radiation, well tolerated
  - Can image in any plane

- **Disadvantages**
  - Operator dependent
  - More difficult to interpret
  - Cannot penetrate gas-filled structures

[Link to Pure Form Diagnostics media](http://www.pureformdiagnostics.com/media)
Computed Tomography

• Use
  • Imaging of choice for most abdominal abnormalities

• Advantages
  • High *spatial resolution*
  • Can see most structures simultaneously
  • Can reconstruct images in other planes

• Disadvantages
  • Cost ($500)
  • Higher ionizing radiation dose than x-ray
  • Contrast reactions
Computed Tomography

• Axial perspective (looking through the feet)

• You view one slice at a time

• Slice thickness can vary, but is generally 5 mm
Let's see, How to make an axial perspective...
Axial CT Perspective
Like looking through the feet! One slice at a time. Good to remember!
Cross-Sectional Anatomy

- Gall Bladder
- Duodenum
- L Lobe of Liver
- Stomach
- Pancreas
- Liver
- IVC
- Aorta
- R Kidney
Cross-Sectional Imaging

- Gall Bladder
- Duodenum
- Stomach
- Pancreas
- Liver
- Spleen
- Common Bile Duct
- IVC
- Right Kidney
- Left Adrenal Gland
- Aorta
Magnetic Resonance

• Use
  • Difficult diagnoses
  • Cancer staging
  • Vascular anatomy

• Advantages
  • Soft tissue contrast
  • No ionizing radiation
  • No *iodinated contrast*

• Disadvantages
  • Cost and availability ($800)
  • Scans take much longer
  • Implanted devices can make imaging difficult
The Abdominal Quadrants

Right upper quadrant

Left upper quadrant

Right lower quadrant

Left lower quadrant

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http://www.highlands.edu/subwebs/shenderson/API/lab_manual/body_quads.jpg
Right Upper Quadrant

- Gallbladder
- Liver
- Duodenum
- Pancreas
- Colon
- Right kidney & adrenal gland
Right Upper Quadrant

- RUQ Organs
- Gallbladder & biliary system
- Liver (right lobe)
- Duodenem (1/2/3 parts)
- Pancreas (head)
- Colon (Hepatic flexure/transverse)
- Right kidney & adrenal gland
Case 1

A 20 year old woman presents to the ED with the complaint of RUQ pain with nausea and vomiting after eating a cheeseburger for dinner.

On exam, she has moderate RUQ tenderness with palpation. Her WBC count is high and she has a fever.

What imaging test would you request?
RUQ Ultrasound

Normal gallbladder

Gallstone

Left Upper Quadrant

The organs in the LUQ are:

- Spleen
- Stomach
- Liver
- Pancreas
- Colon
- Jejunum/ileum
- Left kidney & adrenal

http://www.anatomyatlases.org/HumanAnatomy/5Section/
Left Upper Quadrant

- LUQ Organs
  - Spleen
  - Stomach
  - Liver (left lobe)
  - Pancreas (body/tail)
  - Left kidney/adrenal
  - Colon (transverse/splenic flexure)
  - Jejunum/ileum
Case 2

A 45 year old man comes in to the ED after being involved in high speed MVA. He has emergency surgery and a week later he has a fever and severe LUQ pain.

What do you think has happened to him?
Case 3

A 41 year old man presents to the ED complaining of fever, vague LUQ pain, and SOB for two days.

The patient's abdominal exam reveals left upper quadrant tenderness.

You request an abdominal x-ray.
The organs in the RLQ are:

- Ascending colon
- Cecum/ileum
- Appendix
- Right ovary, fallopian tube, & uterus
- Right ureter
Right Lower Quadrant

- **RLQ Organs**
  - Ascending colon
  - Cecum/ileum
  - Appendix
  - Right ovary/fallopian tube/uterus
  - Right ureter
Right Lower Quadrant

- RLQ Organs
- Ascending colon
- Cecum/ileum
- Appendix
- Right ovary/fallopian tube/uterus
- Right ureter
Case 4

A 28 year old female presents to the ED complaining of abdominal pain that was initially in the periumbilical area and then moved to the RLQ. She has also had nausea and vomiting.

The patient's abdominal exam reveals right lower quadrant rebound tenderness as well as guarding. She has a fever and WBC count is high. Her pregnancy test is negative.

What do you suspect?
Left Lower Quadrant

The organs in the LLQ are:

- Descending & sigmoid colon
- Left ureter
- Left ovary, fallopian tube, & uterus

http://www.anatomyatlases.org/HumanAnatomy/5Section/
Left Lower Quadrant

• LLQ Organs
  • Descending/sigmoid colon
  • Left ureter
  • Left ovary/fallopian tube/uterus
Left Lower Quadrant

- **LLQ Organs**
  - Descending/sigmoid colon
  - Left ureter
  - Left ovary/fallopian tube/uterus
Case 5

A 58 year old man presents to the ED complaining of lower abdominal pain and fever.

On physical examination, he has moderate LLQ and suprapubic tenderness. His WBC count is high and he has a fever.

What organ do you think may be involved?
Retroperitoneum
What organs are Retroperitoneal?

- Retroperitoneal Organs:
  - Kidneys
  - Pancreas
  - Duodenum
  - Ascending Colon
  - Descending Colon
  - Rectum

http://classes.kumc.edu/som/radanatomy
Case 6 & 7

• Where would you expect to find blood from liver trauma?

The liver is a peritoneal organ, so blood is commonly seen in the paracolic gutters. Here there is blood in Morrison’s pouch (between liver and right kidney).

• Where would you expect to find blood from kidney trauma?

A patient injured in a motor vehicle crash with renal lacerations. There is hemorrhage that is loculated by the retroperitoneal septa.
Summary

• The main imaging modalities for the abdomen are x-ray, ultrasound, CT, and MRI.
• The abdomen can be divided into four quadrants, each containing specific visceral organs.
• Abdominal organs can also be categorized as to whether are retroperitoneal.
• An understanding of the quadrant anatomy allows you to identify relevant pathology.
THANK YOU!