Body CT

UNC Radiology Residency Educational Scholarship

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Learning objectives

By the end of this activity, participants will be able to:

I. Describe basic of CT to include common indications for body CT
II. Identify basic abdominal CT anatomy
III. Recognize classic CT cases
Outline

1. Think Back

2. Basics & Indications

3. Abdominal CT Anatomy

4. Cases

5. Wrap Up/Questions
Think Back Q1

When you suspect acute cholecystitis, what imaging test should you order?

Correct! GB ultrasound
Think Back Q2

Supine

What is the diagnosis?

Correct! Small bowel obstruction

Erect
Think Back Q3

When would you order MRI as the first line study for abdominal pain?

Correct! Suspected Appendicitis in a pregnant woman!
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Ionizing radiation (x-rays)

Basically CT is an x-ray tube that rotates around the patient with detectors on opposite side.
CT Basics

Multidetector
- 8, 16, 64, 128, 320 rows of detectors
- 64-slice scanner = 64 detector arrays in 40 mm width = 0.6 mm slice thickness
- Faster scans than single row
- More detectors helpful for breath hold studies, non-cooperative patients, and cardiac imaging

Pros: Fast and High detail

Cons: Radiation, Contrast reactions, and Expensive
CT Basics - Contrast

Types of CT Scans

• CT with Contrast
  • IV and PO Contrast (More Later!)
• CT without contrast
• CT Angiography (CTA)

Pearl: Never order a CT with and without: limited indications to do so. Plus, we must then call you / you will be interrupted in your daily tasks
CT Basics - Contrast

WHAT IS CONTRAST?
- IV and PO administered and used to highlight organs
- Allows better visualization, differentiates structures
- CT contrast is iodine based
  - Ex: omnipaque 350

ORAL CONTRAST OMNIPAQUE 240
- Water soluble, safe in case of bowel perf
- Include oral contrast in nearly all standard CT AP exams
  - Exceptions: retroperitoneal and vascular studies
CT Basics - Contrast

ALLERGIES

Contrast allergies
- Hives/rash
- Laryngeal edema
- Bronchospasm
- Vasovagal (not really an allergy)
- True anaphylaxis

Note: True anaphylaxis from prior contrast is CONTRAINDICATION to EVER receiving contrast again!

PREMEDS

Contrast allergy premedication

At UNC:
- 50 mg po prednisone 13, 7, 1 hour prior to study
- 25-50 mg po benadryl 1 hour prior

Reasons to premedicate:
- Severe hives
- Edema
- Bronchospasm

Contrast Myths

Shellfish Allergy is not a contrast allergy!
‘Iodine allergy’ or topical iodine
Iodine is an essential substance
Present in thyroid hormone
CT Basics - Anatomy

3 Planes may be included: Axial (or transverse), Coronal, and Sagittal. For body work, axial and coronal are today’s scan hallmarks (prev axial)
CT Basics - HU and Window-Level

HOUNSFIELD UNITS

Water = 0 HU
All other densities relative to water
  Air -1000
  Lung -600 to -400
  Fat -100 to – 40
  Soft tissue 40 to 80
  Bone 400 to 1000

WINDOW & LEVEL

Window and Level: allow for tissue contrast

Window width = width of values
  • Depends on the area of interest on the scan (lung and bone are not the same!)
  • Ex: bone windows: 3000

Level = set point
  Ex: bone level: 500
CT Basics - Window Settings

Soft tissue/Vascular

Lung

Bone
CT Basics - Densities

- Soft tissue
- Fat
- Contrast
- Bone
- Air
- Fluid
CT Basics - Radiation Dose

Annual background radiation
3 mSv

CT Effective Doses
10 mSv for AP (3 years background)
5-6 mSv for chest only (1.5-2 years background)
1.5 mSv CT chest lung cancer screening
12 mSv coronary CTA (4 years background)
CT Basics - Indications

Trauma
Pain
Mass
Cancer staging & surveillance
Pre & post operative
Complications

AND SO MANY MORE . . .
Think back to our Emergency Radiology and Abd Pain Lectures!
CT Basics - Order Entry

How to order in EPIC
- CT abdomen and pelvis W contrast
- CT abdomen and pelvis WO contrast
- CT chest WO contrast
- CT chest W contrast
- CTA chest W contrast
- CT abdomen and pelvis WO contrast renal colic
- CT urogram
- CT renal mass
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CT Basics - Axial Anatomy

By convention, CT displayed as if you are standing at the foot of the supine pt – with pt right on left side of screen and pt left on right side of screen.

- R Lung
- Heart, LV
- RA
- IVC
- Pulmonary vessels, RLL
- Azygous vein
- Esophagus
- Aorta, descending
CT Basics - Axial Anatomy

Lung windows for basilar pulmonary findings

Heart, LV

RA

Pulmonary vessels, RLL

Azygous vein

Esophagus

Aorta, descending
CT Basics - Axial Anatomy

- Liver
- Stomach
- Hepatic Veins
- IVC
- Spleen
- Aorta

Without IV, PO contrast
Now on to (axial) Anatomy!

CT Basics - Axial Anatomy

- Liver
- Portal Veins
- IVC
- Diaphragm
- Stomach w/ PO contrast
- Spleen
- Aorta

With IV, PO contrast
CT Basics - Axial Anatomy

- Stomach, body w/ PO contrast
- Spleen
- Liver
- Pancreas
- IVC
- Diaphragm
- Aorta
- L Adrenal
- L Kidney upper pole
CT Basics - Axial Anatomy

Colon
- hepatic flexure

Liver
- inferior tip

IVC

R Kidney

Aorta

Small Bowel

Colon
- descending

Splenic vein

L Kidney
CT Basics - Axial Anatomy

Mesenteric fat
Colon cecum
R gonadal vessels

Umbilicus
Small Bowel
Colon descending
L Psoas
L Iliac wing
Iliac bifurcation
CT Basics - Axial Anatomy

- Colon
  - Cecum
- Small Bowel
  - Ileum
- Colon
  - Descending
- L Iliac wing
- L Psoas
- Iliac vessels
- Sacrum
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Case #1 - 45 yo MVA
Case #1 - 45 yo MVA
What do you see?

Axial CT with contrast: free fluid around liver, splenic lac with active extravasation

Free Fluid

Gallbladder

Active contrast extravasation

Laceration, Spleen
Case #2 - 67 yo with dull abdominal pain and a palpable mass
Case #2 - 67 yo with dull abdominal pain and a palpable mass

Axial CT without contrast: aortic aneurysm with active retroperitoneal extravasation = ruptured AAA. Call Surgery!!
Case #3 - Flank Pain and a Bladder Mass
Case #3 - Flank Pain and a Bladder Mass – Findings?

CT Axial, delayed phase. Two right ureters. Two left ureters, one opacified, one dilated and not opacified.

CT axial w/ contrast. Left hydronephrosis

[Image of CT scan showing left hydronephrosis and delayed phase findings.]
Case #3 - Flank Pain and a Bladder Mass – Findings?

Coronal CT, delayed phase. Duplicated collecting systems, dilated left upper pole moiety. Left ureterocele.

**Weigert Meyer Rule:**
- For duplex kidneys with complete ureteral duplication, the upper renal ureter will have an ectopic insertion that is located medially and inferiorly to the lower pole ureter.
- The upper renal ureter will often form a ureterocele.
- The lower renal ureter will have an insertion located laterally and superiorly, and will often be subject to reflux.
Case #4 - RLQ Pain
Case #4 - RLQ Pain

Findings: Dilated tubular structure in the right lower quadrant attached to the cecum. Few high density round structures at the appendix base - Could be appendicoliths. Diagnosis: Appendicitis
For CT protocols, think of indication before ordering study
Renal colic - order non contrast
Routine - order IV and PO contrast

Wrap Up

• CTA is arterial phase study to evaluate arteries, trauma
• Contrast allergies: shellfish is NOT contraindication
• Contrast allergy premeds: prednisone & Benadryl
• Contrast serum creatinine <1.8, but dialysis pt ok (if they don’t make urine!)
• Radiation effective dose of CT AP
  10 mSv ~3 years background radiation

Questions???
More at [www.rads.web.unc.edu](http://www.rads.web.unc.edu) [www.msrads.web.unc.edu](http://www.msrads.web.unc.edu) and @UNCRadRes

Thank you!