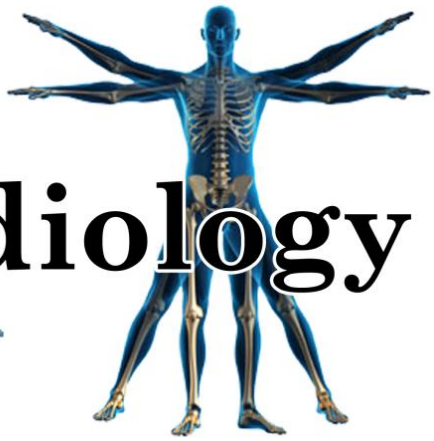


432 Radiology Team

(2): Contrast Media and Safety in Radiology

* Many thanks to 431 team for their helpful notes *

Done By:
Deema Al-Turki

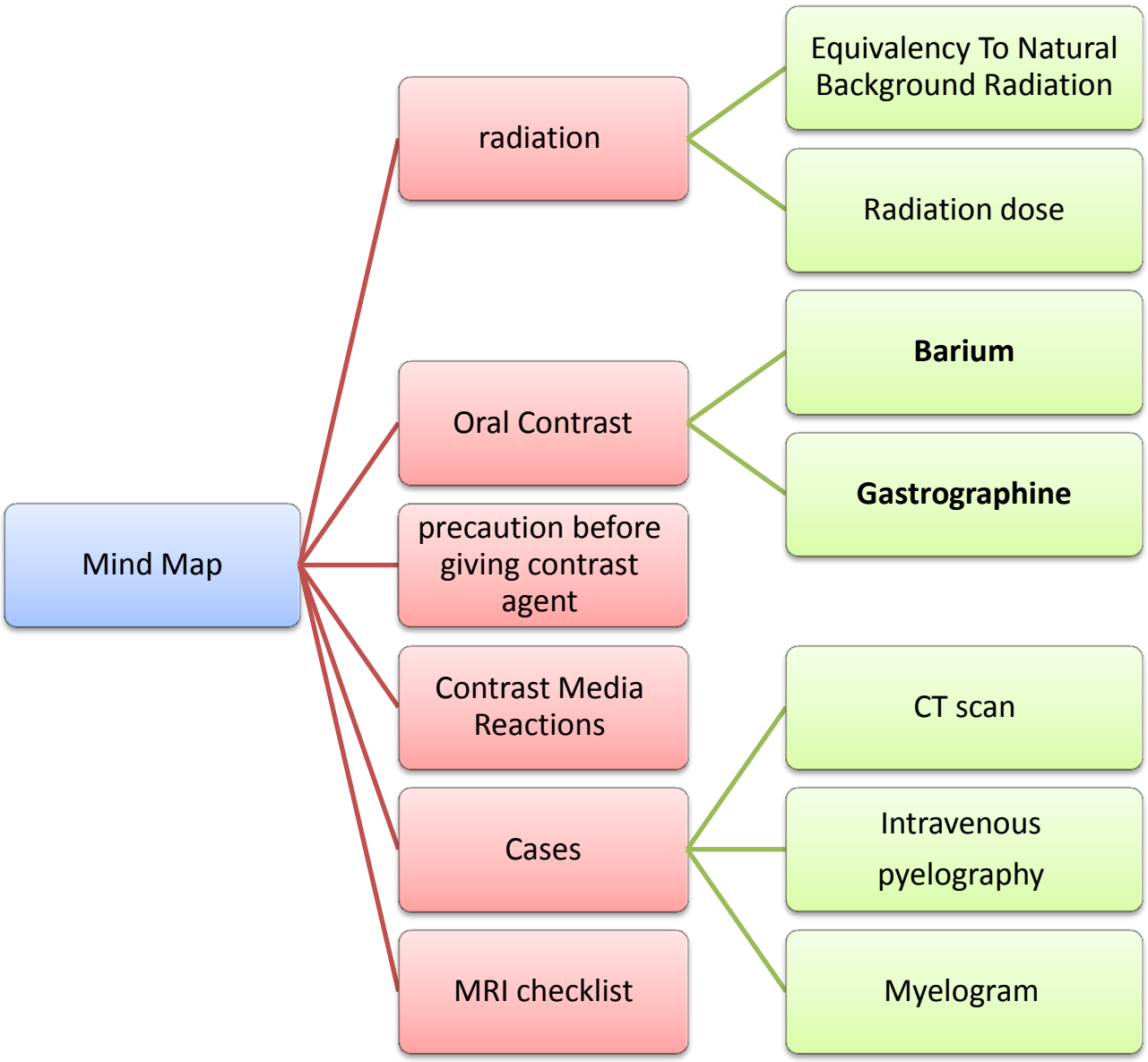
Reviewed By:
Basil AlSuwaine

جامعة الملك سعود
King Saud University

COLOR GUIDE: • Females' Notes • Males' Notes • Important • Additional • 431 team

Objectives

1. Radiation safety.
2. Contrast agent.



"The 1st page and half of the 2nd weren't mentioned in the female slides"

Shielding:

Lead apron

Thyroid collar

- Operators view the target through a leaded glass screen, or if they must remain in the same room as the target, wear lead aprons and thyroid collar. Almost any material can act as a shield from gamma or x-rays if used in sufficient amounts.
- (All health care workers exposed to radiation must take these precautions, like surgeons, gastroenterologist and cardiologists, not just radiologists; Mostly in fluoroscopy and interventional radiology procedures.)
- Standard 0.5mm lead apron
- Protect you from 95% from radiation exposure

Factors That Control The Amount, Or Dose Source:

1. **Time**: ↓ the time of an exposure → ↓ the effective dose .
   An example of reducing radiation doses by reducing the time of exposures might be improving operator training to reduce the time they take to handle a source. (Surgeon – cardiologist)
2. **Distance**: ↑distance (between the patient and the x-ray machine) → ↓ dose
   due to the (inverse square law). Distance can be as simple as handling a source with forceps rather than fingers.

Radiation Risk:

	stochastic effect	deterministic effect
Related to	Accumulative amount of exposure "The more the exposure, the higher the risk. i.e. no specific dose to cause the effect"	Thresholds level "Certain amount of exposure would cause the effect"
Possible side effects	- Genetic effect - Carcinogenic effect .	- Finding - Cataract - Bone Marrow Failure - Erythema - Lung Fibrosis

Deterministic Effect:

- LEVEL >2-3 GRAY RANG (Gray is unit of exposure of radiation)
- ONE CHEST X RAY 0.15 mGRAY = 10000 chest x ray = 100 CT abdomen = 30 mins to 1 hr fluoroscopy exposure

(Fluoroscopy has the highest exposure) (This is just to compare exposure in different modalities)

ALARA rule: = (As Low As Reasonably Achievable)

- As low as reasonably achievable
- Reduce number of exam (Usually, there's a 48---hour interval between 2 procedures, unless the case is an emergency).
- Reduce time of exam
- Use alternaive (US/MRI if possible)
- US vs MRI

BACKGROUN RADIATION = (Radiation in the universe)

- NATURAL RADIATION
- FROM OUTER SPACE
- FROM RADON GAS
- (average annual dose)
- 3.2 milli-sievert Sievert is effective dose (absorbed dose)

Average annual dose

- Radiolgsit :
- 0.7 milliSievert
- Technolgist :
- 0.95 milliSievert

Equivalency To Natural Background Radiation: *(not imp)*

Equivalency To Natural Background Radiation	
Abdominal region	
Computed Tomography (CT) Abdomen	3 years
Computed Tomography (CT) Body	3 years
Intravenous Pyelogram (IVP)	6 months
Radiography-Lower GI Tract	16 months
Radiography-Upper GI Tract	8 months

Radiation Dose:

INVESTIGATION	RISK/ PA CHEST X RAY (0.03 m SV)
LUMBAR SPINE	100
ABDOMINE	50
IVU	150
CT HEAD	100
CT CHEST	300
CT ABDOMEN	400

Note(s):

The body takes a minimal amount of the ionization or radiation from nature. A single dose of CT body = 3 times what the body takes from nature

-If a patient presented to the ER with trauma, we'd do a skull CT to detect a fracture, not x-ray. Although radiation is higher in CT, we'd get a clear Image from the first time. However, if we order an x-ray, we might need to do it again or order a CT, which means double exposure. Also, other finding such as hematoma can't be detected by x---ray.

- Another example. CT abdomen is preferred over IVU in some cases. Because after ordering IVU, you might still need to order a CT abdomen (150+400=550). However if you only order CT, the exposure will be less (400)

Oral Contrast

Barium

Barium meal, swallow and enema.
(Not water soluble)
Indication: GI study
Contraindicated if there's: Perforation or toxic mega colon.
(The possible complication is chemical peritonitis or toxic mega colon)

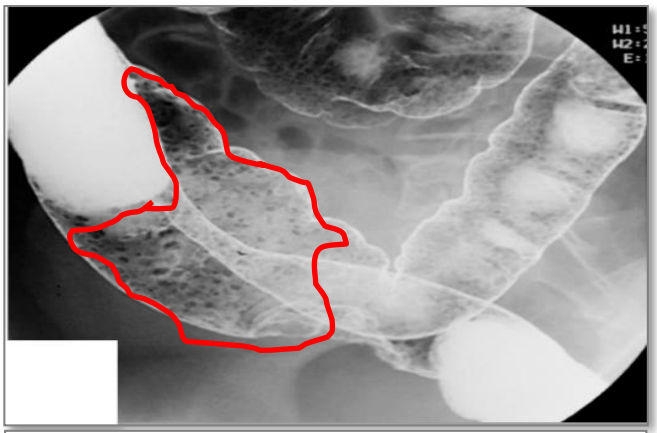
Gastrographine

In CT study (diluted gastrographine) (water soluble) (Iodine is used because it absorbs xray)
Main indication: bowel perforation.
Contraindication: If there is a risk of aspiration or fistula between the esophagus and the trachea
(The possible complication is chemical pneumonitis)

Note(s):

How to know if there's bowel perforation: X-rays of the chest or abdomen will show air in the abdominal cavity, called free air.

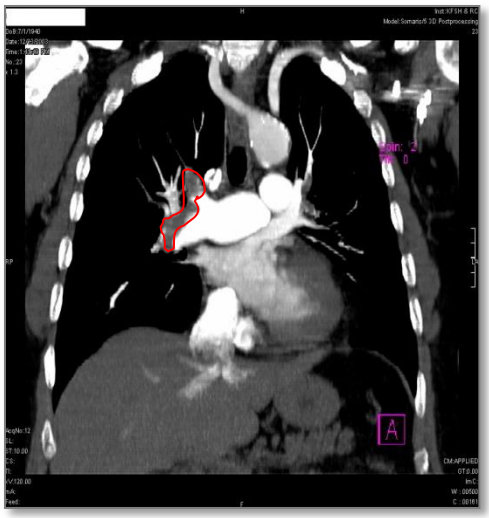
Double contrast (Contrast +air) Used to see: The lumen
In cases such as: Ulcerative colitis and crohn's disease.

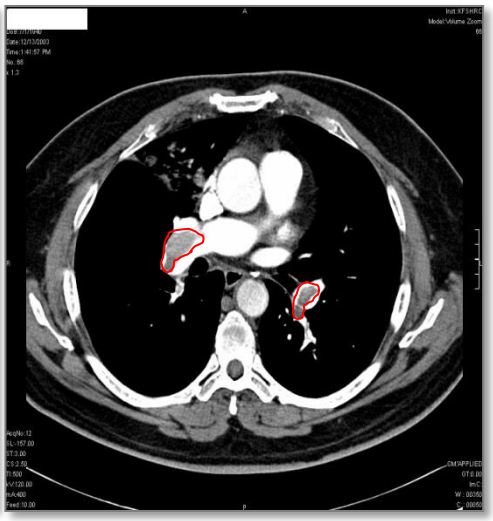


Polyposis

CT Scan:

Without contrast





CT Angiography: There is a filling defect in the vessels indicating pulmonary embolism.

Precaution Before Giving Contrast Agent:

1. previous reaction
2. asthmatic patient (e.g. in an asthmatic)
3. renal impairment
4. diabetes mellitus
5. atopic dermatitis
6. pregnant
7. sickle cell anemia
8. multiple myeloma

Note(s):

To detect pulmonary embolism, IV contrast. Must be given rapidly. However, doing that In addition to not allocating the IV access properly would result in contrast extravasation. (a leakage Of contrast material Into the fatty tissue around a vein).
Necrosis is a possible complication.
Management: Elevating the affected extremity above the heart and applying cold compresses topically.

Contrast Media Reaction: (very imp)

Type of reaction	symptoms	Treatment
MILD	- Nausea & vomiting.	Observe
MODERATE	- Skin reaction - bronchospasm.	- Anti-histamine - epinephrine
SEVER	- Hypotension - tachycardia	- Anti-histamine - epinephrine - atropine

Note(s):

- *Hemodialysis after CTA in case of renal impairment*
- *Cortisone before in case of an asthmatic patient*

Case 1:

A 45 year old patient had the following symptoms and signs after diphasic CT of the liver:

RR= 30/min (tachypnea)

BP= 80/40 mmHg (hypotension)

Pulse rate= 125/min (tachycardia)

Answer: sever → Anti-histamine, epinephrine, atropine.

Case2:

Status: Lethargic.

RR: 28/min (tachypnea)

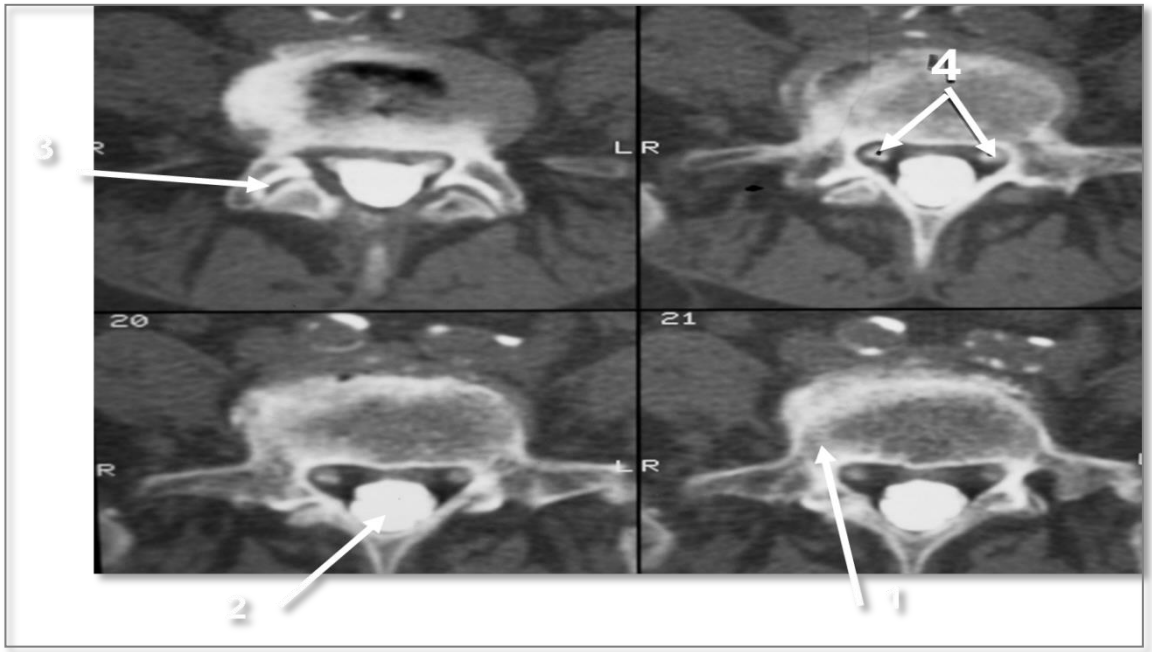
BP: 70/40 mmHg (hypotension)

Pulse: 130/min (tachycardia)

Chest: Some expiratory wheezes

Answer: sever → Anti-histamine, epinephrine, atropine.

Myelogram (study of spinal cord):



We can see the nerve root

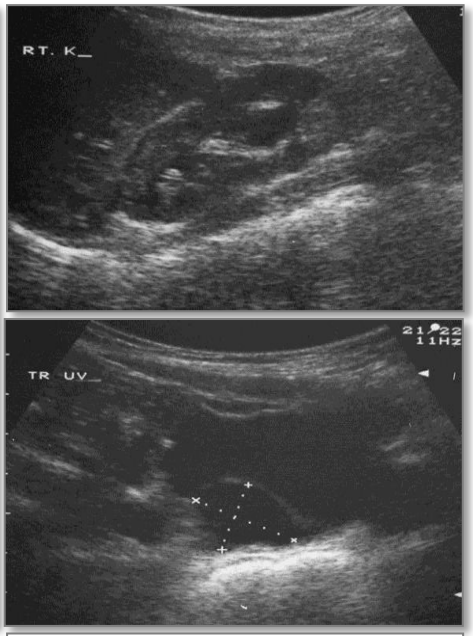
Note(s):

A Myelogram uses X-rays and a special dye called contrast material to make pictures of the bones and the fluid-filled space (subarachnoid space) between the bones in your spine (spinal canal). A Myelogram may be done to find a tumor, an infection, problems with the spine such as a herniated disc, or narrowing of the spinal canal caused by arthritis.

In some cases we should use a combination of different modalities (when we have many deferential diagnoses). "E.g. the patient in the pictures below, we performed Intravenous pyelography which revealed that he has a filling defect. It could be a tumor (solid) or ureterocele (cystic lesion) so we performed US to differentiate:

Case3:

Intravenous pyelography (intravenous urography: Has filling defect could be tumor.



US: hypoechoic → cystic lesion not solid → ureterocele

Note(s):

The Diagnosis here is ureterocele. (A cystic out-pouching of the distal ureter into the urinary bladder)

MRI:

Please Check and Indicate the following:	
	Posible Hazards Present
1.	A cardiac pacemaker
2.	Intracranial Vascular Clips
3.	Neurostimulators of any sort
4.	Intraoccular metallic foreign bodies
5.	Ossicular implantations
6.	Any metallic implants : metal plates, pins, rods, etc.
7.	Hair pieces
8.	Any prosthetic devices
9.	Heart Failure
10.	Surgical clips on the arteries & wire sutures
11.	Heart valve
12.	Pregnancy
13.	Sharpnel
14.	Metallic/Silver eye liners

Checklist before doing MRI → contraindications

Note(s):

Can we do MRI For a pregnant patient? Yes, but only after the first trimester

Major contraindication: Metallic implements

SUMMARY

1. We use Barium for GI study unless if there's Perforation or toxic mega colon. We use Gastrographine. In this case Barium can cause chemical peritonitis.
2. If there is a filling defect in the vessels In CT Angiography → pulmonary embolism.
3. Take precaution before giving contrast agent to a patient with sickle cell anemia, multiple myeloma, or a pregnant.
    - Hemodialysis after CTA in case of renal impairment
    - Cortisone before in case of an asthmatic patient
4. If a patient has nausea & vomiting after giving him a contrast → observe
   If he has hypotension → epinephrine, anti-histamine, atropine
   Other symptoms without hypotension → epinephrine, anti-histamine.
5. In some cases we should use a combination of different modalities (when we have many deferential diagnosis).
6. Uretrocele, a cystic out-pouching of the distal ureter into the urinary bladder (hypoechoic in US)

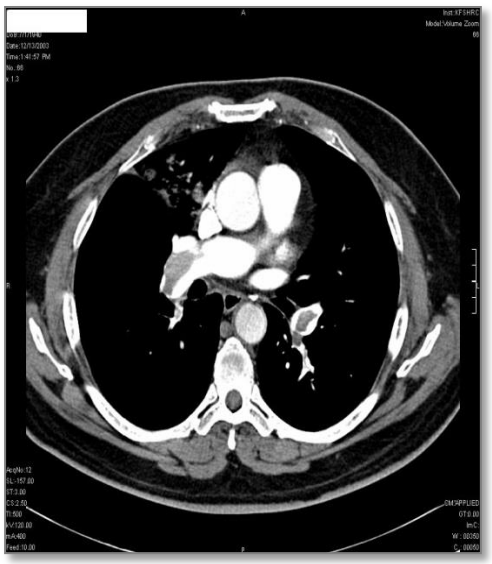
NOTE(S):

- *You should protect your body against radiation, especially these: Gonads, thyroid and cornea*
- *Radiation effects: Carcinogenic and Genetic (Accumulative amount of exposure)*
- *There is High Radiation in: High and Closed places*
- *No radiation in MRI and US*
- *More radiation in CT than X-ray*

Questions

1) A patient developed tachycardia, bronchospasm, skin rash after being given a contrast how are you going to treat him?
   A. epinephrine, anti-histamine, atropine
   B. epinephrine, anti-histamine, without atropine
   C. observe him
   D. anti-histamine

2) What is the imaging modality used here?
   A. CT Angiography
   B. MRI
   C. MYLOGRAM
   D. Intravenous pyelography



3) What is your diagnosis?
   A. Toxic mega colon
   B. Herniated disc
   C. Uretrocele
   D. Pulmonary embolism

4) An asthmatic patient needed to have a CT angiograph what are you going to do?
   A. Use iodine
   B. Give him salbutamol 1 hour before giving him the contrast.
   C. Hemodialysis immediately after CT
   D. Give him cortisone 30 min before giving him the contrast

5) A patient known to have crohn's disease for 10 years came to you with severe stomach pain (tenderness), chills, fever, nausea, vomiting and sever bleeding. What contrast should be used to assess the bowel?

A. Gastrographine
B. Iodine
C. Barium

6) What is the imaging modality used here?

A. CT Angiography
B. Intravenous pyelography
C. MRI with gadolinium
D. MYLOGRAM

432 Radiology Team Leaders

Eman AlBedaie
Emansaleh202@gmail.com

Basil AlSuwaine
Basil.als@hotmail.com

Answers:

1st Question: B
2nd Question: A
3rd Question: D
4th Question: D
5th Question: A
6th Question: B