



SPECIAL RADIOLOGICAL PROCEDURES

CONTRAST MEDIA

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قسم تقنيات الأشعة والسونار

Stage second

المرحلة الثانية

محاضرة رقم 1

الجانب النظري

Lecture No.1

Theoretical

تدريسي المادة : سهى رحيم هلال

RADIOGRAPHIC CONTRAST MEDIA



CONTRAST

- It is the difference in optical density between different parts of image.
- Any substance that make an organ or structure more visible than without it's addition .
- Any substance that allows visualization of structures that cannot be seen under normal circumstances .

REAL

BAD CONTRAST

GOOD CONTRAST

History of contrast media



1896-WALTER BRADFORD discovered contrast media.

1897- First reported GI contrast study performed using Bismuth- TOXIC!

1910- Barium Sulphate used (safer)

1920's- Sodium Iodide used which is a treatment for syphilis.

Iodine was found to be radio opaque to x-rays.

1927 - First reported IVU with iodised organic salts (**Uroselectan**)



- As you must know from physics of x ray when x ray beam hit an object (patient's body or body part) attenuation will happen to that beam with different attenuation values according to the composition of the object itself (bone , air , fluid, soft tissues) .
- Air attenuation Negligible (due to low density)
- Bone attenuation ...Significant (due to high density)
- Soft tissues ... similar to water



- Low attenuating material means it allow radiation to pass through it freely and called (radiolucence) black color on x ray film..
- High attenuating material means it inhibit the passage of radiation through it and called (radiopaque) white color on x ray film..



- If the two organs have similar densities , then it is not possible to distinguish them on a radiograph, because no natural contrast exists..
- Radiographic contrast media were developed to increase differences in the attenuation (absorption) of radiation by soft tissues.

Classification



- 1- Radiographic contrast agents ..**
- 2- MRI contrast agents ..**
- 3- Ultrasound contrast agents ..**



Radiographic contrast media are divided into positive and negative contrast agents.

- 1- The positive contrast media attenuate X-rays more than do the body soft tissues..
- 2- The Negative contrast media attenuate X-rays less than do the body soft tissues.



The positive contrast media divided into

- 1-Water-soluble iodine-based agents.
- 2- Non-water-soluble barium agents.

Which are **radiopaque** materials and appear **white** on film.

The Negative contrast media like

- 1- Air
- 2- Carbon dioxide

Which are **radiolucent** materials and appear **black** on film.

Compare Single and Double Contrast:-



	Single Contrast	Double contrast
Fundus	Supine	Erect with two views 90 degree to each other or Prone right side down.
Body	Erect or Prone	Supine with 60 degree head end elevation.
Antrum and Pylorus	Prone right side down	Supine right side up
D ₁ and C loop of duodenum	Prone right side down	Supine right side up
D ₄ of duodenum	Supine	Prone right side down.

**Image enhanced
with Positive C.M.**



**Image enhanced
with Negative C.M.**



Barium examination of GIT



- 1- Barium **swallow** (esophagus)
- 2- Barium **meal** (stomach)
- 3- Barium **meal follow through** (stomach & small intestine)
- 4- Barium **enema** (colon)

[Barium have a drink]



Contrast Media Used In Radiology



Positive contrast media



- 1- Water-soluble iodine-based agents.
- 2- Non-water-soluble barium agents.

Water-soluble contrast media

- Oral used [Gastrographin]
- IV injection [Urographin , Telrbrix]
- Intra thecal [Iohexol]

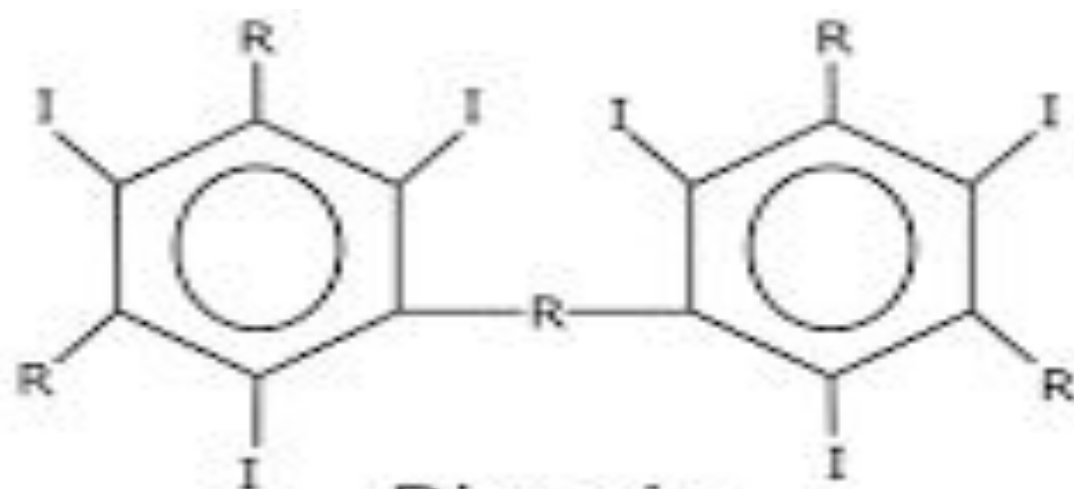


Water-soluble iodine-based agents

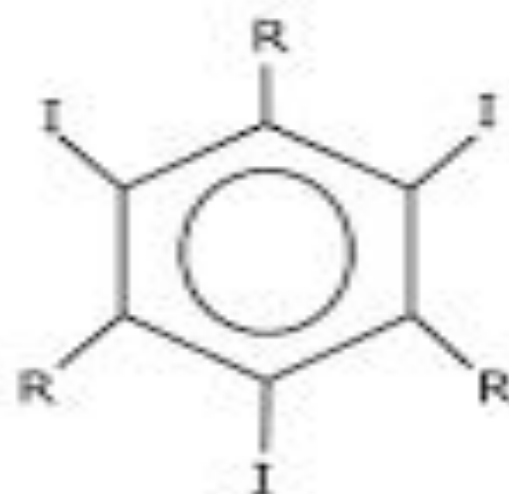


Chemical composition :- are based on a benzene ring to which three iodine atoms (I) are attached.

- 1- A monomer contains one benzene ring tri-iodinated
- 2- A dimer contains two benzene rings tri-iodinated



Dimeric



Monomeric



- Iodine is radiopaque material so , it is used in composition of contrast media ,
- when there is more iodine give more contrast so, dimers (have 6 iodine atoms) are better than monomers (have 3 iodine atoms) as a more powerful contrast ability..
- Iodine-based contrast agents can be divided into two groups,
ionic and non-ionic,based on their water solubility



NON -IONIC CM	IONIC CM
Low osmolality	High osmolality
Lower risk	Higher risk
High cost \$	Low cost \$
No electrical charge(that is why called Non ionic)	electrical charged (which is responsible For the side effect of CM)

Osmolality



Osmolality describes the concentration of solute per kg of water

The osmolality of CM solutions is expressed in millios mol/kg water

The osmolality of CM is dependent on the concentration

Ionic contrast media(HOCM)



High Osmolar Contrast Media (HOCM)

- Composed of salts which dissociate in water into anions (radiopaque) and cations.
- Osmolality up to 5x serum osmolality (toxicity).
- **E.g.** Gastrografin, Urografin, Isteropac



Non-ionic contrast media



Low Osmolar Contrast media (LOCM)

- 1-Non-dissociating.
- 2-Only about 2x serum osmolality.
- 3-Less side effects, less nephrotoxic.
- 4-E.g. Ultravist, Omnipaque

Iso-osmolar Contrast Media (ISOCM)

- 1- Osmolality approximately equals serum osmolality.
- 2- Preferred in renal impaired patients.
- 3-E.g. Visipaque





Note

The low- and iso-osmolar contrast media are(5–10) times safer than the HOOCM and are used routinely in clinical practice

IDEAL CONTRAST MEDIA



- 1- High water solubility.
- 2- Heat & chemical stability(shelf life) ideally 3 to 5yrs.
- 3- Biological inertness (non antigenic).
- 4- Low viscosity.
- 5- Low or iso osmolar to plasma.
- 6- Selective excretion, like excretion by kidney is favorable.
- 7- Safety: LD50 (lethal dose) should be high.
- 8- Reasonable cost.

Commonly used preparations



Ionic contrast media :

- 1- Urograffin
- 2- Gastrograffin
- 3- Angiograffin
- 4- Trazograph
- 5- Conray

Most commonly used media



Non ionic monomers

- 1- Omnipaque
- 2- Optiray
- 3- Ultravist
- 4- Lek-Pamidol
- 5- Iopamiro



Non ionic dimers :

- 1- Isovist
- 2- Visipaque

Thank
you

