

## Lesson 7: Iodinated contrast agents (2)

### Ionicity, Viscosity

# Aims

- Learning the following topics:
- Ionicity
- Ionic contrast media
- Nonionic contrast media
- Viscosity

# Ionicity

- Ionicity is an important characteristic of iodine containing agents.
- Compounds are classified as either ionic or nonionic.

# Ionic contrast media

- The ionic compounds dissociate in solution →
- They breakdown into cations and anions →
- They have a high osmolality
- For every three iodine molecules present in an ionic media, one cation and one anion are produced when it enters a solution.
- Ionic contrast media are generally referred to as 3:2 compounds.

# Cations and anions

- Cations:
- Sodium and/or meglumine
- Common anions:
- Diatrizoate and iothalamate
- Which one is the radiopaque portion of the molecule?
- The anion
- Which one is osmotically active?
- Both the anion and cation are osmotically active.

# Effect of ionic CM on brain and heart

- The resultant ion charges from an ionic compound have the potential to disrupt the electrical charges associated with the brain as well as the heart.
- Neurotoxicity

# Non ionic contrast media

- The nonionics are water soluble but do not dissociate into charged particles in solution.
- For every three iodine molecules in a non-ionic solution, one neutral molecule is produced.
- Non-ionic contrast media are referred to as 3:1 compounds.

# Nonionic contrast media

- Nonionic agents have a lower osmolality
- ?
- Due to fewer particles in solution



# Table

Structure	Viscosity		<u>Osmolality</u>	Generic name	Trade name
	20°	37°			
<u>ionic</u> monomer	5 9	3 5	1500-1600	iothalamate  metrizoate amidotrizoate  ioxithalamate	Conray Vasoray Isopaque Urografin Angiografín Gastrografín Telebrix
<u>Ionic</u> dimer	12	6	600	ioxaglate	Hexabrix
<u>non-ionic</u> monomer	11	6	500-700	iohexol iopamidol iopromide ioversol	Omnipaque Iopamiro Ultravist Optiray
<u>non-ionic</u> dimer	25	10	300	iodixanol iotrolan	Visipaque Isovist

# Hemodynamic effects of nonionic CM

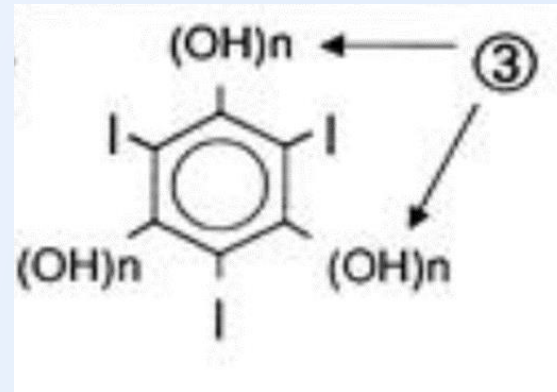
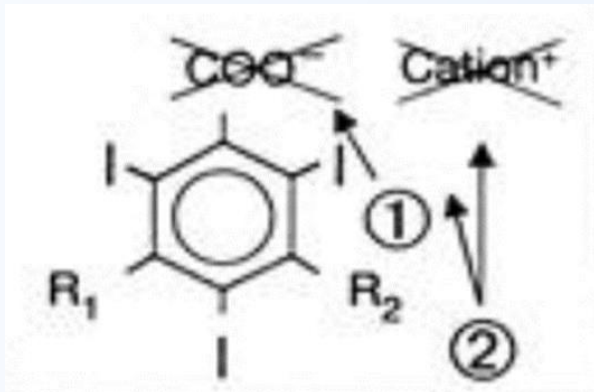
- Compared with nonionic LOCM, ionic HOCCM tend to have more adverse hemodynamic effects, particularly in patients with .....
- coronary artery disease.

# Advantages of nonionic agents

- The nonionic compounds compared to ionic agents have:
- Lower osmolality
- Reduced protein binding
- Reduced tissue binding
- Reduced tendency to affect cell membranes

# Chemical structure of nonionic agents

- 1) Eliminating carboxyl  $\rightarrow$  .....  
Decreases neurotoxicity
- 2) Eliminating ions  $\rightarrow$  .....  
Decreases osmotoxicity
- 3) Adding hydroxyl groups  $\rightarrow$  .....  
Decreases chemotoxicity



# Viscosity

- The viscosity of a contrast agent needs considerable attention because .....
- viscosity affects the rate of intravascular injection.

# Viscosity

- Higher viscosity →
- Lower injection rate →
- Insufficient iodine content at the scanning site

# Viscosity

- Warming the contrast agent to body temperature →
- Decreasing the viscosity →
- More rapid injection rate (higher flow rates) →
- Increasing adverse reactions

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# Summary

- Ionicity
- Ionic contrast media
- Cations and anions
- Nonionic contrast media
- Advantages of nonionic agents
- Viscosity

# References

- Widmark JM, Imaging-related medications: a class overview, Proc (Bayl Univ Med Cent) 2007;20(4):408–417.