Contrast Media and Introduction to Radiopharmaceuticals

Contrast Media

Large focus on contrast and GI tract

Other contrast medias are used outside the GI tract
Air and gas (Carbon Dioxide)

Exact techniques will vary between facilities

May be complex

Contrast Media

Five Radiographic Densities

Air (gas)
Fat (oil)
Water
Mineral
Metal
### Contrast Media

**Visualizes anatomy normally not seen on plain images**

Uses photoelectric effect and high-atomic number elements x-ray photon is absorbed and does not strike IR

Requires the administration of media classified as negative (black) or positive (white)

Requires attention to indications and contraindications

Warrants serious attention to patient reactions

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**Perfect Contrast Media**

- Good visualization
- Low toxicity
- Persistence until imaging is completed
  - Air has low persistence
- Low cost
- Minimal or no side effects
- No residual effects within patient

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**Key Contrast Characteristics**

- Ability of agent to mix with body fluids
- Viscosity
- Ionic strength
- Persistence in the body
- Iodine content
- Osmolality (HOCA/LOCA)
- Potential for toxicity
Contrast Media

Popular Contrast Choices

Barium sulfate (BaSO4)

Air/gas (CO2)

Oil-based iodine contrast agents

Water-soluble iodine contrast agents
  (Ionic vs Non-ionic)

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Contrast Media

Barium

Low rate of allergic reaction

Produces excellent images

Can be used orally/rectally

Difficult to ingest/evacuate

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Contrast Media

Water soluble Iodine

Majority of all contrasts

Given orally, IV, arterially, injected directly into organ

Can be given slowly or by rapid bolus under pressure

Assure catheter size and placement can with hold injection
  Power PICC/Power Ports
**Contrast Media**

**Characteristics that Influence Performance**

- **Iodine Concentration**
  - Determines degree to which structures are attenuated

- **Osmolarity**
  - Number of particles in solution
    - Ionic – molecules split/multiply
    - Nonionic – molecules stay whole

- **Viscosity**
  - Measures resistance of fluid to flow (thick vs thin)

- **Toxicity**
  - Negative effect on tissues
    - HOCA/LOCAs – lower concentrations have lower toxicity
    - Most ionic contrasts are HOCA

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**Contrast Media**

**Pharmacodynamics/Adverse Reactions**

- Procedures involving IV, IA, or IT administration - ↑ risk
- May require informed consent
- Get accurate and thorough history
- Evaluate renal function (BUN/Creatinine/GFR/Bilirubin)
- Know facility policy

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**Contrast Media**

**Oil Based Iodine Contrasts**

- Made from fatty acids
- Iodine added to ester groups
- Insoluble in water
- Long persistence in body
- Infrequently used except for specific exams
- Cannot be used with plastic syringes
Contrast Media
Concerns
Diabetics are predisposed to renal insufficiency
Metformin held 24 hours prior and 48 hours post - know combinations
Important to know the use of insulin as well
May screen for cardiac history – poor perfusion/renal impairment
Contrast may cause vasodilation - ↓ BP, serious or fatal outcome
Diabetics and cardiac patients are at greater risk for CIN

Avoid excessive doses (back to back studies)
Report diagnostics during inter-facility transfers
Inquire about any out-patient or previous studies
Anaphylaxis
Increases with prior history, asthma, shellfish allergy
May choose to pre-medicate – typically time sensitive
Allergic responses occur quickly – may shoot test dose
Be alert for reactions – know your responsibility
Stay calm

Warm, flushing, metallic taste, n/v, cough – no treatment necessary
Erythema, urticaria, bronchospasm – notify MD, may use rescue inhaler, antihistamines, steroids, epinephrine
Vasovagal – vasodilation, diaphoresis, hypotension, bradycardia
notify MD, lay head flat if able, give IVF, atropine

Reactions can be mild, moderate, or severe
Contrast Media
Severe Reaction

- Respiratory/cardiac arrest, seizures, throat closing, feeling of doom
- May happen quickly – can be fatal
- Maintain airway, notify MD, CPR if needed
- If IV fluid is present in the line – aspirate before injecting
- Start 2nd IV site – give fluids and medications

Contrast Media
Contrast Induced Nephropathy

CIN is a risk associated with procedures requiring IV contrast
Accounts for more than 10% of hospital acquired renal failure

- Increases:
  - Morbidity
  - Mortality
  - LOS
  - Long term chronic renal failure (CRF)

Contrast Media
Contrast Induced Nephropathy

Incidence:
- 3% in mild renal insufficiency
- 50% in severe renal dysfunction and DM

Increased Risk for CIN:
- More contrast = greater risk
- Use of ionic and high osmotic agents
- History:
  - renal dysfunction, DM, CHF, HTN, any reduced circulation
### Contrast Media

#### Contrast Induced Nephropathy

**Process:**
- Contrast agents are small molecules with low protein binding/lipid solubility
- Renal tubule absorption is negligible so they get stuck in the kidney
- Concentrated up to 100 times
- Sodium and water excretion increases markedly
- Causes a decrease in GFR (glomerular filtration rate)

**Prevention:**
- Adequate hydration with NS IV fluid
- Total of 1000ml to 2000ml before, during, and after procedure
- Closely monitor serum creatinine levels
- Consult the prescribing MD or Radiologist if in doubt
- Substitute U/S or nuclear med scans instead

#### Radiopharmaceuticals

- Not contrast agents
- Radioactive material injected or inhaled
- Biodistribution is very important
- Typically emit gamma radiation
- Detected by gamma camera in nuclear department
- Effective for cellular physiology assessment
- Contamination and spillage of critical importance
Contrast Media
RTs Responsibility
Administered under the supervision of an MD
Patient assessment and history
Patient comfort and education
Recognize signs and symptoms of reaction and act appropriately
Patient care and surveillance
Post exam considerations for patient

References