Radiographic Procedures III (RAD 228)

Urinary System

RADIOGRAPHIC EXAMINATIONS
Urinary System

- Antegrade Exam
  - IVU
    - Functional test
    - Hypertensive evaluation as per protocol

- Retrograde Exams
  - Retrograde Urography
    - Non-functional test (OR Suite)
  - Retrograde Cystography
    - Non-functional test
  - Voiding Cystourethrography
    - Functional test

Urinary System

- Kidneys (2)
- Ureters (2)
- Urinary bladder
- Urethra
Urinary System

- Retroperitoneal structures
  - Kidneys and ureters
- Infraperitoneal structures
  - Distal ureters
  - Urinary bladder
  - Urethra

Kidney Location

- Halfway between xiphoid process and iliac crest
- Between T11-T12 and L3
- Nephroptosis

IVU Demonstrating Kidneys, Ureters, and Bladder
## Equipment Preparation for IVU

![Image of medical equipment](image)

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## Nonionic Contrast Media

![Image of contrast media bottles](image)

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## Effects of Ionic versus Nonionic Contrast Media

<table>
<thead>
<tr>
<th>Ionic</th>
<th>Nonionic</th>
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<tbody>
<tr>
<td>Dissociates into separate ions when injected</td>
<td>Does not dissociate</td>
</tr>
<tr>
<td>Creates hypertonic condition</td>
<td>Remains near isotonic</td>
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<tr>
<td>Increase in blood osmolality</td>
<td>No significant increase in osmolality</td>
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Side Effect versus Reaction

- Side effects: expected outcome of injected contrast media
- Common side effects
  - Temporary hot flash
  - Metallic taste in mouth
- Reaction: An unexpected outcome of injected contrast media

Technologist Responsibilities

1. Patient history
   - Clinical complaints?
   - Food or drug allergies?
   - Previous contrast media reaction?
   - Asthma, hay fever, or hives?

Patient History

- Management of non–insulin-dependent diabetes: Glucophage (metformin hydrochloride)
- Check chart and/or ask patient the following:
  - “Are you currently taking glucophage or other medication for diabetes mellitus?”
- To be withheld 48 hours following iodinated contrast media procedure
- Must verify normal kidney function before resuming medication
Patient History

- Check blood chemistry—normal ranges
  - Creatinine level (adult)—0.6 - 1.5 mg/dL
  - BUN levels (adult)—8-25 mg/100 mL

Premedication Protocol

Common protocol:
- Prescribed combination of Benadryl and prednisone over period of 12 or more hours before procedure
- Patients who have history of hay fever, asthma, food allergies, or previous contrast media reaction may be candidates for premedication procedure

Categories of Contrast Media Reactions

- Local
  - Reactions that affect only a specific region of the body

- Systemic
  - Reactions that affect the entire body or a specific organ system
Local Reactions

Extravasation

- Leakage of iodinated contrast media outside the vessel and into surrounding soft tissues (also referred to as infiltration)
  - May be toxic to skin
  - Notify department nurse and/or physician
  - Elevate affected extremity above heart
  - Cold compress followed by warm compresses first to relieve pain and then to improve resorption

Phlebitis

- Inflammation of a vein
  - Signs include pain, redness, and possibly swelling surrounding the venous access site
  - Discontinue the venous access at this site
  - Notify department nurse and/or physician

Systemic Reactions

Mild

- Nonallergic reaction does not typically require drug intervention or medical assistance
- Symptoms include the following:
  - Anxiety
  - Light-headedness
  - Nausea
  - Vomiting
  - Metallic taste (common side effect)
  - Mild erythema
  - Warm, flush sensation during injection (common side effect)
  - Itching
  - Mild, scattered hives
Systemic Reactions
Moderate

- A true allergic reaction (anaphylactic reaction)
- Symptoms include the following:
  - Urticaria (moderate to severe hives)
  - Possible laryngeal swelling
  - Bronchospasm
  - Tachycardia (>100 beats/min)
  - Bradycardia (<60 beats/min)
  - Angioedema
  - Hypotension

Systemic Reactions
Severe (Vasovagal)

- Life-threatening reaction
- Symptoms include the following:
  - Hypotension (systolic blood pressure <80 mm Hg)
  - Bradycardia (<50 beats/min)
  - Cardiac arrhythmias
  - Laryngeal swelling
  - Possible convulsions
  - Loss of consciousness
  - Cardiac arrest
  - Respiratory arrest
  - No detectable pulse

Excretory Urography—IVU

- Correct term
  - Intravenous urogram (IVU): Radiographic examination of the urinary system
- Purpose of IVU (twofold)
  1. Visualize the collecting portion of the urinary system
  2. Assess the functional ability of the kidneys (a timed procedure)
Common Clinical Indications—IVU

1. Abdominal or pelvic mass
2. Renal or urethral calculi
3. Kidney trauma
4. Flank pain
5. Hematuria
6. Hypertension
7. Renal failure
8. Urinary tract infection (UTI) (pyelonephritis)

Patient Preparation for IVU*

- Light evening meal prior to procedure
- Bowel-cleansing laxative
- NPO after midnight (minimum of 8 hours)
- Enema on the morning of examination
- Voiding prior to procedure

* Suggested protocol; prep may vary among departments and clinical needs

IVU—Basic Routine

- Scout radiograph
- Injection
  - Note time at beginning of injection
- Sample imaging routine
  - 1 min nephrogram or nephrotomography
    - (Hypertensive)
  - 5 min AP supine
  - 10-15 min AP supine
  - 20 min posterior obliques
  - Postvoid (prone or erect)
IVU

- **Routine**
  - AP scout
  - Nephrotomography (1 min following injection)
  - AP
  - RPO and LPO
  - AP postvoid (recumbent or erect)

- **Special**
  - AP ureteric compression

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**IVU—AP Projection**

- No rotation
- CR to level of iliac crest (include symphysis pubis)

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**IVU—Posterior Obliques**

CR at level of iliac crest

30° RPO

30° LPO
Evaluation Criteria
Posterior Oblique

- Elevated side: Kidney is parallel to plane of IR
- Downside: Ureter is free of superimposition from spine
- Entire urinary system visualized
- No motion
- Appropriate technique employed
- Minute marker visible

Voiding Cystourethrography (VCUG)

- Technical—Positioning Factors
  - IR size: 24 × 30 cm (10 × 12 in), lengthwise
  - 70-80 kV, grid
  - CR perpendicular to symphysis pubis

Cystogram

CR 2 inches (5 cm) superior to symphysis pubis
Evaluation Criteria
Cystogram

- AP: urinary bladder not superimposed by pubic bones
- Posterior obliques: urinary bladder not superimposed by lower limbs
- Distal ureter, bladder, proximal urethra on male to be included

Voiding Cystourethrography

- Purpose: Functional study of the bladder and urethra
- Performed after routine cystogram
- Catheter removed and imaged while voiding

Retrograde Urography

- Performed in surgery
- Contrast media delivered retrograde through catheter
Retrograde Urography Procedure

- Scout radiograph taken
- Series of radiographs taken as requested
- Ureterogram taken once catheter has been removed