ARRT RADIOGRAPHY REGISTRY MASTER CHEAT SHEET • PART 3 OF 3

Pharmacology, Contrast Media & Venipuncture Traps

High-yield contrast classifications, renal/metformin protocols, adverse reaction differentials, drug classes, and IV rules.

1. Contrast Media Classifications & Selection Traps

Contrast Agent	Key Properties	Primary Clinical Uses	ARRT Registry Traps & Contraindications
Barium Sulfate **Negative / Radiopaque**	Inert, insoluble heavy metal suspension (Z = 56); NOT absorbed by GI mucosa.	Routine Esophagram, UGI, SBFT, and Barium Enema (single or double contrast).	**TRAP:** **NEVER use if GI perforation is suspected**—causes severe chemical peritonitis/ mediastinitis. Can cause barium impaction if not hydrated post-exam.
Water-Soluble Iodinated (GI) *(e.g., Gastrografin)*	High osmolality, hypertonic, bitter taste; safely absorbed by peritoneum if leaked.	Suspected GI perforation, pre-op bowel studies, fistulograms, neonatal meconium ileus.	**TRAP:** **Aspiration risk!** Hypertonic fluid pulls water into lungs causing severe **pulmonary edema**. Never use if tracheoesophageal fistula or aspiration risk exists.
Non-Ionic Low-Osmolar Iodinated (LOCM) *(e.g., Iohexol, Iopamidol)*	Low osmolality (~600–850 mOsm/kg), non-dissociating in blood, tri-iodinated benzene ring.	IVU, CT with contrast, angiography, arthrography, myelography, hysterosalpingography.	Standard of care for IV studies. Fewer chemotoxic and anaphylactoid reactions than older ionic high-osmolar agents (HOCM). Warm to body temp (37°C) to reduce viscosity.
Air / CO_2 **Negative / Radiolucent**	Low atomic number; appears **black** (high density/transmission) on radiographs.	Double-contrast GI studies (barium + air/CO_2 crystals), double-contrast arthrograms.	**TRAP:** Negative contrast = **radiolucent** (allows X-rays through). Positive contrast (barium/iodine) = **radiopaque** (absorbs X-rays, appears white).

2. Renal Function, Lab Values & The Metformin Rule

Lab / Clinical Metric	Normal Adult Range	Registry Significance & Contrast Safety Thresholds
Serum Creatinine	**0.6 – 1.2 mg/dL** *(or up to 1.3–1.5 mg/dL)*	Most reliable indicator of kidney function prior to IV iodinated contrast. Values **> 1.5–2.0 mg/dL** signal renal impairment and heightened risk of Contrast-Induced Nephropathy (CIN).
BUN (Blood Urea Nitrogen)	**7 – 20 mg/dL** *(or 8 – 25 mg/dL)*	Measures nitrogenous waste from protein metabolism. Less specific than creatinine because dehydration or GI bleeding elevates BUN even with healthy kidneys.
eGFR (Estimated Glomerular Filtration Rate)	**≥ 60 mL/min/1.73 m^2**	**≥ 45 mL/min:** Safe for IV contrast. **30 – 44 mL/min:** Caution; hydrate patient. **< 30 mL/min:** High CIN risk; avoid IV iodinated contrast unless life-threatening.

HIGH-YIELD TRAP: Metformin (Glucophage) & Iodinated IV Contrast

- **Why it matters:** Metformin (an oral antihyperglycemic for Type 2 diabetes) does NOT damage the kidneys directly, and contrast does NOT react with Metformin. However, if contrast causes acute kidney injury, Metformin accumulates in the blood and triggers life-threatening **lactic acidosis**.
- **Current ACR Protocol:** Patients with normal renal function (**eGFR ≥ 30** and no acute kidney injury) do **NOT** need to stop Metformin before or after IV contrast.
- **When to Hold:** If the patient has **eGFR < 30**, acute kidney injury, or is undergoing an **intra-arterial catheter study** with embolization risk, hold Metformin **at the time of the procedure for 48 hours** and recheck renal function before restarting.

3. Adverse Contrast Reactions: Anaphylactoid vs. Vasovagal

Feature	Anaphylactoid (Allergic-Like) Reaction	Vasovagal (Neurogenic) Reaction

Heart Rate (Key Clues!)	**TACHYCARDIA** (Rapid pulse > 100 bpm) as body compensates for vasodilation.	**BRADYCARDIA** (Slow pulse < 60 bpm) due to vagus nerve stimulation.
Blood Pressure	**Hypotension** (drops sharply in severe anaphylaxis).	**Hypotension** (causes fainting / syncope).
Classic Symptoms	Urticaria (hives), pruritus (itching), angioedema (facial/laryngeal swelling), wheezing, bronchospasm, stridor.	Dizziness, lightheadedness, diaphoresis (cold sweats), pallor, nausea, anxiety, brief loss of consciousness.
Immediate Treatment	1. Stop injection & call code/radiologist. 2. High-flow $\mathbf{O_2}$. 3. **Epinephrine** (IM/IV) for airway/hypotension; **Diphenhydramine (Benadryl)** for hives; Albuterol inhaler for bronchospasm.	1. Stop injection & elevate legs (**Trendelenburg / modified Trendelenburg** position) to restore cerebral blood flow. 2. Monitor vitals; IV fluids. 3. **Atropine** (anticholinergic) if severe bradycardia persists.

Mild vs. Moderate vs. Severe Contrast Reaction Triage

- **Mild (Self-limiting, observe only):** Warm/flushed sensation, metallic taste, mild nausea/vomiting, scattered hives without airway involvement. *Action:* Reassure patient, monitor closely, do not leave unattended.
- **Moderate (Requires prompt medication):** Diffuse urticaria, mild bronchospasm/wheezing, facial edema, vasovagal hypotension.
- **Severe (Life-threatening emergency):** Laryngeal edema (stridor), severe bronchospasm, profound hypotension/ anaphylactic shock, seizures, cardiopulmonary arrest.

4. Essential Pharmacology Drug Classes & Antidotes

Drug Class	Common Examples	Clinical Action & Radiology Registry Traps
Adrenergics (Sympathomimetics)	**Epinephrine** (Adrenalin), Dopamine, Albuterol	**Drug of choice for severe anaphylaxis.** Increases heart rate, constricts blood vessels (raises BP), and dilates bronchioles. Albuterol is inhaled for acute bronchospasm.
Antihistamines	**Diphenhydramine** (Benadryl), Loratadine	Blocks H_1 histamine receptors to relieve **urticaria (hives), itching, and mild allergic edema**. Causes drowsiness—patient needs a driver if given IV/IM.
Corticosteroids	**Prednisone**, Methylprednisolone (Solu-Medrol), Hydrocortisone	Reduces systemic inflammation and airway swelling. **TRAP:** Slow onset (hours)—used as a **premedication** (12 hrs & 2 hrs prior) for patients with prior contrast allergies, NOT as first-line rescue.
Anticholinergics	**Atropine**, Glucagon	**Atropine:** Blocks vagus nerve to treat severe **bradycardia** during vasovagal reactions. **Glucagon:** Relaxes GI smooth muscle (reduces peristalsis) during double-contrast GI/barium enema exams.
Benzodiazepines & Opioid Antagonists	**Midazolam (Versed)**, Diazepam (Valium); **Naloxone (Narcan)**, **Flumazenil**	Benzodiazepines relieve anxiety/seizures (conscious sedation). **Antidote Traps: Naloxone (Narcan)** reverses **opioid** overdose (morphine/fentanyl respiratory depression). **Flumazenil (Romazicon)** reverses **benzodiazepine** sedation.
Anticoagulants & Antiplatelets	**Heparin**, **Warfarin (Coumadin)**, Aspirin, Clopidogrel (Plavix)	Prevent blood clots. Check **PT/INR** (for Warfarin) or **PTT** (for Heparin) and platelet count before invasive procedures (angiography, biopsy, LP) to prevent hemorrhage.
Antianginals (Vasodilators)	**Nitroglycerin** (sublingual tablet/spray)	Dilates coronary arteries to relieve acute chest pain (angina). Causes rapid drop in BP—keep patient seated/supine.

5. Medication Administration, Venipuncture & Extravasation Rules

Topic	Registry Standards, Angles & Step-by-Step Protocols
The "Five Rights" (+1) of Medication	Always verify before administering any drug or contrast: **(1) Right Patient** (2 identifiers), **(2) Right Drug**, **(3) Right Dose**, **(4) Right Route**, **(5) Right Time** (+ Right Documentation). Read the label **3 times** (picking up, drawing up, before discarding).
Parenteral Needle Insertion Angles	**Intramuscular (IM): 90°** (deltoid, gluteus medius, vastus lateralis). **Subcutaneous (SubQ): 45°** (fatty tissue of upper arm/abdomen). **Intravenous (IV): 15° – 30°** (bevel up; flatten angle once flash of blood appears). **Intradermal (ID): 10° – 15°** (just under epidermis, e.g., TB skin test).
Needle Gauge & Power Injector Rules	**Smaller gauge number = LARGER bore diameter.** • **18G – 20G angiocatheter:** Required for high-flow **power injectors** (≥ 3–5 mL/sec) in CT/angiography. • **22G angiocatheter:** Standard adult hand/forearm IV for slower flow rates (≤ 1.5–2 mL/sec). • **Butterfly (winged infusion) needles:** Used for brief blood draws or small veins—**avoid for high-pressure power injection** due to high vein rupture/extravasation risk.
Venipuncture Site Selection	Preferred sites: **Median cubital vein** (antecubital fossa—largest, best anchored), **cephalic vein**, or **basilic vein**. **AVOID:** Arms with a **dialysis fistula/shunt**, side of a **mastectomy / lymph node dissection** (lymphedema risk), areas of infection/phlebitis, or lower extremities (thrombosis risk without MD order).
Extravasation (Infiltration) Management	Occurs when contrast leaks outside the vein into surrounding soft tissue (causes burning pain, swelling, tight skin). **Step-by-Step Action:** 1. **Stop the injection immediately** and disconnect tubing. 2. Remove the IV catheter and apply firm, direct pressure with sterile gauze until bleeding stops. 3. **Elevate the affected extremity** above heart level to reduce hydrostatic swelling. 4. Apply a **warm compress** to promote vasodilation and fluid absorption (or cold compress initially for pain/swelling per institutional protocol). 5. Document estimated volume extravasated, site, symptoms, and notify the radiologist/ordering physician. Watch for **compartment syndrome** (numbness, pale/cool skin, loss of distal pulse).

Quick-Check Pharmacology Traps on Mock Exams

- **Barium Preparation:** Mix barium sulfate with **cold or room-temperature water** (hot water makes suspension clump and can scald bowel mucosa).
- **IV Drip / Rate Terminology:** *Bolus* = rapid single injection of contrast all at once; *Drip infusion* = slow continuous administration over several minutes.
- **Sublingual vs. Buccal:** *Sublingual* = placed **under the tongue** (rapid absorption, e.g., nitroglycerin); *Buccal* = placed between the **cheek and gum**.
- **Gadolinium (MRI Contrast) Bonus Trap:** Associated with **Nephrogenic Systemic Fibrosis (NSF)** in patients with severe renal failure (eGFR < 30)—do not confuse with iodine's CIN.