ARRT REGISTRY TRAP-BUSTER SERIES — PART 1: PROCEDURES

Comprehensive High-Yield Cheat Sheet: Skull, Facial Bones & Sinuses | GI & GU Contrast Studies | Upper Extremities

1. SKULL, FACIAL BONES & PARANASAL SINUSES — BASELINES, ANGLES & LANDMARKS

THE GOLDEN 7° & 8° BASELINE CONVERSION RULE (ARRT FAVORITE TRAP)

- **OML (Orbitomeatal Line) vs. IOML (Infraorbitomeatal Line):** Always a **7° difference**. Because IOML requires less chin tuck, **ADD 7° caudad** (or subtract 7° cephalad) when switching from OML to IOML.
- **OML vs. GML (Glabellomeatal Line):** Always an **8° difference**.
- **IPL (Interpupillary Line):** Must be strictly **perpendicular to the IR** for all true lateral skull, facial bone, and sinus views (prevents tilt). MSP (Midsagittal Plane) must be strictly **parallel to the IR** (prevents rotation).

Projection / Method	Baseline & CR Angle	Anatomy Demonstrated	ARRT Exam Trap & Evaluation Criteria
AP Axial Skull (Townes Method)	**30° caudad** to OML *OR* **37° caudad** to IOML (Enter 2.5" above glabella)	Occipital bone, posterior clinoid processes, **dorsum sellae**, and **foramen magnum**.	**TRAP:** Dorsum sellae & posterior clinoids must be projected **inside the foramen magnum**. Too little angle projects them above; too much projects the arch of C1 inside.
PA Axial Skull (Caldwell Method)	**15° caudad** to OML (Exit at nasion)	Frontal bone, crista galli, internal auditory canals, and **frontal & anterior ethmoid sinuses**.	**TRAP:** Petrous ridges must lie in the **lower 1/3 of the orbits**. (If 0° PA skull is used, petrous ridges completely fill the orbits).
PA Axial Haas Method	**25° cephalad** to OML (Enter 1.5" below inion; exit 1.5" above nasion)	Reverse Townes: occipital bone, dorsum sellae, and foramen magnum (for obese/hypersthenic patients).	**TRAP:** Uses **cephalad** angle (25° to OML / 32° to IOML) because patient is prone; magnifies occipital area.
SMV (Schuller Method)	IOML parallel to IR; CR **perpendicular to IOML** (Enter 1.5"–2" inferior to mandibular symphysis)	Cranial base, foramen ovale & spinosum, sphenoid sinuses, and **zygomatic arches** (bilateral).	**TRAP:** Mandibular condyles must be projected **anterior to the petrous pyramids**. If chin isn't extended enough, condyles superimpose petrous ridges.
Parietoacanthial (Waters Method)	**MML** (Mentomeatal Line) perpendicular to IR; **OML forms 37°** with IR; CR perpendicular (exit acanthion)	**Maxillary sinuses**, inferior orbital rims, maxillae, nasal septum, and **blowout fractures**.	**TRAP:** Petrous ridges must be projected **immediately below the maxillary sinuses**. If petrous ridges overlap lower maxillary sinuses, head is under-extended.
Modified Waters Method	**LML** (Lips-Meatal Line) perpendicular to IR; **OML forms 55°** with IR; CR perpendicular (exit acanthion)	**Orbital floors** (less foreshortened than standard Waters) and inferior orbital rims.	**TRAP:** Petrous ridges lie in the **lower half of the orbits** (higher than standard Waters because chin is lifted less).
PA Axial Facial Bones (Caldwell)	**15° caudad** to OML (exit nasion) *Note:* **30° caudad** used if orbital floors are the primary interest.	Orbital rims, maxillae, nasal septum, and zygomatic bones.	**RULE:** 15° puts petrous ridges in lower 1/3 of orbits; 30° projects petrous ridges *below* the inferior orbital margins.
Lateral Facial Bones / Sinuses	IOML parallel to transverse axis; IPL perpendicular to IR; CR perpendicular (zygoma / 0.5"–1" posterior to outer canthus)	Superimposed orbital roofs, sella turcica, sphenoid, frontal, ethmoid, and maxillary sinuses.	**TRAP:** **Sinuses MUST be imaged ERECT** with a horizontal beam to demonstrate **air-fluid levels**. Trauma facial bones use horizontal beam cross-table lateral.

Projection / Method	Baseline & CR Angle	Anatomy Demonstrated	ARRT Exam Trap & Evaluation Criteria
Tangential Zygomatic Arch (May)	IOML parallel to IR; head rotated **15° toward** affected side; chin tilted **15°**; CR perpendicular to IOML	Single injured **zygomatic arch** projected free of superimposition (depressed tripod/arch fracture).	**TECHNIQUE TRAP:** Uses very **low kVp (60–65 kVp)** and reduced mAs because the thin arch is projected into soft tissue shadow.
Rhese Method (Parieto-orbital Oblique)	**AML** (Acanthiomeatal Line) perpendicular to IR; head rotated **37°** (MSP 53° to IR); CR perpendicular	**Optic foramen (canal)** on the side closest to the IR (downside orbit).	**TRAP:** Optic foramen must appear in the **lower outer (inferolateral) quadrant** of the orbit. Wrong quadrant = wrong rotation or AML tilt.
Axiolateral Mandible	Head in true lateral (for ramus), rotated **30°** (for body), or **45°** (for symphysis); CR **25° cephalad**	Mandibular ramus, body, or mentum free of opposite side superimposition.	**TRAP:** Side of interest is **closest to the IR**. 25° cephalad angle prevents superimposition of the opposite mandible.
AP Axial TMJs (Modified Townes)	**35° caudad** to OML (or 42° to IOML); enter 3" above nasion	Bilateral mandibular condyles and temporomandibular fossae (taken open & closed mouth).	**TRAP:** **NEVER perform open-mouth TMJs on trauma patients** until fracture is ruled out!
Axiolateral Oblique TMJs (Law / Schuller)	**Law:** 15° rotation toward IR + 15° caudad CR. **Schuller:** True lateral head + **25°–30° caudad** CR.	**Downside TMJ** (closest to IR). Closed mouth shows condyle in mandibular fossa; open mouth shows condyle moving anterior to articular tubercle.	**MEMORY HOOK:** Schuller = **S**traight lateral head + **S**teep (25°–30°) angle. Law = double 15s (15° rotation, 15° caudad).

2. GI & GU CONTRAST PROCEDURES — GRAVITY, ROTATION & FILLING TRAPS

THE GRAVITY & DENSITY LAW OF DOUBLE-CONTRAST GI STUDIES

- **Barium is heavy (sinks) / Air is light (rises):** In any position, barium fills the **dependent (downside)** anatomy, while gas/air rises to coat the **non-dependent (upside)** anatomy.
- **Water-Soluble Iodinated Contrast (Gastrografin):** Mandatory whenever **perforation, leak, or immediate surgery** is suspected (barium causes fatal chemical peritonitis if it leaks into the peritoneal cavity). *Contraindication:* Aspiration risk (pulmonary edema).

Exam & Position	Rotation & CR	Where Barium & Air Go	ARRT Exam Trap & Key Fact
Esophagram — RAO	**35°–40° RAO** (recumbent preferred for slower transit); CR at T5–T6	Entire esophagus projected cleanly **between thoracic vertebrae and heart**.	**MOST COMMON:** RAO gives the clearest unobstructed view of the esophagus (LAO projects it over the spine).
Upper GI — RAO Stomach	**40°–70° RAO** (40° sthenic, 70° hypersthenic); CR at L1–L2	**Barium fills pylorus & duodenal bulb** (dependent); air rises to fundus.	**TRAP:** Best single view to demonstrate the **duodenal bulb (C-loop)** and pyloric canal in profile.
Upper GI — LPO Stomach	**30°–60° LPO**; CR at L1–L2	**Barium pools in fundus** (dependent); **air fills pylorus & duodenal bulb** (double-contrast).	**TRAP:** LPO is the **double-contrast view of the pylorus and duodenal bulb** (opposite of RAO!).
Upper GI — Right Lateral	True Right Lateral; CR at L1–L2 (1"–1.5" anterior to midcoronal plane)	Barium fills anterior stomach/ pylorus; shows **retrogastric space**.	**CLINICAL:** Evaluates the **retrogastric space** for pancreatic masses pushing the stomach forward, and anterior/ posterior gastric ulcers.
Upper GI — PA Stomach	Prone (PA); CR at L1–L2	Barium moves into body and pylorus; air rises to fundus.	**TRAP:** **PA** puts barium in the **body/pylorus**; **AP supine** puts barium in the **fundus** (most posterior part of stomach).
Small Bowel Series (SBS)	PA prone (compresses bowel loops); first radiograph at **15–30 min** post-ingestion	Follows barium bolus until it reaches the **ileocecal valve / cecum** (usually ~2 hours).	**TRAP:** **Ileocecal valve** is located in the RLQ (level of ASIS); spot compression cone is used to separate overlapping ileal loops.
Barium Enema (BE) — RAO & LAO	**35°–45° RAO** and **35°–45° LAO**; CR at iliac crest	**RAO** opens the **right colic (hepatic) flexure**. **LAO** opens the **left colic (splenic) flexure**.	**TRAP:** Think about which flexure is higher: Splenic flexure is higher and more posterior, so **LAO** (or RPO) opens the splenic flexure; **RAO** (or LPO) opens the hepatic flexure!
Barium Enema — Axial (Butterfly / Chassard-Lapine)	**AP Axial:** 30°–40° cephalad (2" below ASIS). **PA Axial:** 30°–40° caudad.	Elongates and uncoils the **rectosigmoid colon** without superimposition.	**CHASSARD-LAPINE:** Patient sits on table edge and leans far forward until thighs touch chest (CR perpendicular through lumbosacral region).
Barium Enema — Lateral Rectum	True Left or Right Lateral; CR at level of ASIS & midcoronal plane	Shows rectum and distal sigmoid colon in profile (rectosigmoid junction).	**TIP ENEMA:** Sims position (left lateral decubitus with right knee flexed) is used for **enema tip insertion** (never insert tip > 1.5 inches; stop at 2nd resistance).
IVU / Urography — 30° RPO & LPO	**30° RPO** and **30° LPO**; CR at iliac crest	**30° RPO** places the **left kidney** parallel to IR. **30° LPO** places the **right kidney** parallel to IR.	**TRAP:** Kidneys lie at a 30° angle to the coronal plane, so the **upside kidney** is parallel to the IR (RPO = Left kidney; LPO = Right kidney).

Exam & Position	Rotation & CR	Where Barium & Air Go	ARRT Exam Trap & Key Fact
IVU — Post-Void & Nephrogram	**1-min Nephrogram:** Immediately after injection. **Post-Void:** Upright or supine AP.	Nephrogram shows renal parenchyma; Post-void checks **residual urine** & prostate enlargement.	**COMPRESSION:** Ureteral compression paddles (applied over distal ureters at ASIS) retain contrast in renal pelvis/calyces—**contraindicated** in stones, AAA, or trauma!
Cystography & VCUG	**AP Axial Bladder:** 10°–15° caudad (2" above pubic symphysis). **Obliques:** 40°–60° RPO/LPO.	10°–15° caudad projects pubic bones **below the urinary bladder**.	**TRAP:** **Male VCUG** is imaged in a **30° RPO** during voiding so the urethra is projected free of the pubic symphysis and femora; females are imaged AP.
HSG (Hysterosalpingography)	AP supine; CR 2" superior to pubic symphysis	Demonstrates uterine cavity and **patency of fallopian tubes** (contrast spills into peritoneal cavity).	**TIMING TRAP:** Scheduled **7–10 days after onset of menstruation** (proliferative phase) to ensure the patient is not pregnant.

3. UPPER EXTREMITIES — NAMED METHODS, ROTATION & JOINT PROFILES

Anatomy & Projection	Positioning & CR Angle	Specific Structure Demonstrated	ARRT Exam Trap & Evaluation Criteria
Thumb — AP (Roberts Method) vs. Bennett Fracture	**Roberts:** Hand internally rotated until posterior thumb rests on IR; CR perpendicular to 1st CMC. **Modified Roberts:** 15° proximal CR.	**1st Carpometacarpal (CMC) joint** and base of 1st metacarpal (Bennett fracture).	**TRAP:** **PA thumb is NOT performed** (causes severe OID/ magnification); always perform **AP thumb**!
Hand — Norgaard Method (Ball-Catcher)	Both hands supinated **45°** (like catching a ball); CR perpendicular to 5th MCP joints	Early **rheumatoid arthritis** changes at the medial aspects of proximal phalanges & 2nd–5th MCP joints.	**TECHNIQUE:** Do not over-flex fingers; radiolucent 45° sponge blocks support the dorsal hands.
Wrist — Scaphoid (Stecher & Ulnar Deviation)	**Ulnar Deviation:** Turn hand outward toward ulna. **Stecher:** Hand flat + **20° cephalad** CR (or 20° wedge with perpendicular CR).	Elongates and opens joint spaces around the **scaphoid** (most commonly fractured carpal bone).	**TRAP:** **Ulnar deviation** opens the lateral (scaphoid) side; **Radial deviation** opens the medial (pisiform/triquetrum/ hamate) side.
Wrist — Carpal Canal (Gaynor-Hart Method)	Hyperextend wrist; place hand vertical (palmar surface 90° to IR); CR **25°–30°** to long axis of hand	**Carpal tunnel/canal**, hook of hamate, pisiform, trapezium, and scaphoid tubercle.	**PATHOLOGY:** Evaluates bony impingement in **carpal tunnel syndrome**.
Wrist — Carpal Bridge (Tangential)	Flex wrist 90° (dorsal hand flat on IR); CR **45°** toward forearm (1.5" proximal to wrist joint)	Dorsal surface of carpals (scaphoid, lunate, triquetrum) for dorsal chip fractures or foreign bodies.	**TRAP:** Carpal **Canal** = hyperextend wrist + 25°–30° angle. Carpal **Bridge** = flex wrist + 45° angle.
Forearm — AP vs. PA Trap	**AP:** Hand supinated; humeral epicondyles parallel to IR. **PA:** NEVER used!	Radius and ulna parallel and free of superimposition (except slight overlap at proximal/distal radioulnar joints).	**TRAP:** Pronating the hand (PA) crosses the radius over the ulna midshaft—**always image the forearm AP (supinated)**!
Elbow — Medial (Internal) vs. Lateral (External) Oblique	**Internal (Medial):** Rotate hand/arm **45° medially**. **External (Lateral):** Rotate hand/arm **45° laterally**.	**Internal Oblique: Coronoid process** in profile & trochlea. **External Oblique: Radial head, neck & tuberosity** free of ulna.	**MEMORY HOOK:** **M**edial = **C**oronoid (M-C). **L**ateral = **R**adial head (L-R). In a true AP elbow, the radial head is *slightly superimposed* over the ulna.
Elbow — Trauma Coyle Method	Elbow flexed **90°** (or 80° for coronoid): • **45° toward shoulder** (radial head) • **45° away from shoulder** (coronoid)	Demonstrates **radial head** or **coronoid process** in trauma patients who cannot extend the elbow.	**TRAP:** **45° IN (toward shoulder)** = Radial head; **45° OUT (away from shoulder)** = Coronoid process.
Elbow — Radial Head Lateral Series (4 Views)	Elbow flexed 90°, true lateral; take 4 exposures rotating hand: 1) External, 2) Lateral/Thumb up, 3) Internal, 4) Extreme internal	Rotates the **radial head 360°** to detect subtle hairline fractures without moving the elbow joint.	**EVALUATION:** Radial tuberosity faces anteriorly on views 1 & 2, and posteriorly on views 3 & 4.
Humerus & Shoulder — Rotation Series	**External Rotation:** Epicondyles parallel to IR. **Internal Rotation:** Epicondyles perpendicular to IR. **Neutral:** Palm against thigh.	**External:** True AP humerus; **greater tubercle** in profile. **Internal:** True lateral humerus; **lesser tubercle** in profile medially.	**TRAUMA RULE:** **NEVER rotate a suspected fracture or dislocation!** Perform neutral AP + transthoracic lateral or Scapular Y.
Shoulder — Grashey Method (AP Oblique)	Rotate body **35°–45° toward affected side** (RPO/LPO); CR perpendicular to glenoid cavity	Opens the **glenoid cavity (scapulohumeral joint space)** in profile (Hill-Sachs / Bankart evaluation).	**RULE:** Body is rotated until the scapular body is parallel to the IR (35°–45° posterior oblique).

Anatomy & Projection	Positioning & CR Angle	Specific Structure Demonstrated	ARRT Exam Trap & Evaluation Criteria
Shoulder — Inferosuperior Axial (Lawrence)	Abduct arm **90°**, external rotation; CR directed **25°–30° medially** toward axilla (IR against top of shoulder)	**Scapulohumeral joint**, lesser tubercle anteriorly, coracoid process, and anterior/posterior dislocation.	**NOTE:** If patient cannot abduct 90°, reduce medial CR angle to 15°–20°.
Shoulder — Stryker Notch Method	Supine; flex arm and place **palm on top of head** (humerus vertical); CR **10° cephalad** at coracoid	Posterolateral humeral head defect (**Hill-Sachs lesion**) caused by recurrent anterior dislocations.	**TRAP:** Palm goes on **top of the head** (not behind the neck) with a **10° cephalad** angle.
Shoulder — Tangential Supraspinatus Outlet (Neer)	Anterior oblique (**45°–60° RAO/LAO**, affected shoulder against IR); CR **10°–15° caudad**	**Coracoacromial arch (supraspinatus outlet)** to rule out subacromial impingement / bone spurs.	**TRAP:** Scapular Y with **0° CR** = trauma dislocation check; Scapular Y with **10°–15° caudad CR** = Neer supraspinatus outlet!
Clavicle & AC Joints	**AP Axial Clavicle:** 15°–30° cephalad (PA Axial = 15°–30° caudad). **AC Joints:** Bilateral erect, 72" SID, with & without **5–8 lb weights**.	Projects clavicle above scapula/ ribs; AC joint separation comparison (weights strapped to wrists, **never held in hands**).	**TRAP:** Holding weights in hands tenses shoulder muscles and pulls a separated AC joint back into place—always strap weights to wrists!