Radiology Quick Numbers For Call Or Everyday Life

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ABDOMEN AND PELVIS:

General

- Enhancement: 10–15 HU difference is borderline; >15 HU = true enhancement
- Ascites > 30 HU concerning for hemoperitoneum on CT although may be less, if older products/ anemic. Complicated/ indeterminate ascites can be 20 - 30. 10-20 is likely simple.

Liver

- Portal hypertension: clinically significant portal-systemic gradient ≥10 mmHg, variceal bleeding > 12 mmHg[1]
- Portal vein diameter: >16 mm suggests portal hypertension
- Liver segments: https://radiopaedia.org/cases/liver-segments-annotated-ct-1?lang=us
- Liver Fibrosis by MR elastography: https://www.resoundant.com/single-post/2019/07/31/mre-cut-offs-for-liver-fibrosis-assessment
- Hepatic steatosis grading by fat fraction:
    - Normal < 5%
    - Mild 5 – 15%
    - Moderate 15 – 20%
    - Severe > 25%[2]

Gallbladder & Biliary

- Gallbladder wall thickness: <3 mm.
- Gallbladder transverse diameter <4 cm
- Gallbladder length < 8 cm
- Intrahepatic bile duct dilation: >2 mm
- SRU guidelines for gall bladder polyp follow up: https://pubs.rsna.org/doi/full/10.1148/radiol.213079

Pancreas

- Normal pancreatic duct reference sizes (roughly)[3]:

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[1]https://pubmed.ncbi.nlm.nih.gov/29939540/

[2] https://pubs.rsna.org/doi/full/10.1148/radiol.2021204288

- **Head**: ≤ 3 mm
- **Body**: ≤ 2 mm
- **Tail**: ≤ 1.5–1.6 mm

Adrenal Glands

- Adrenal limb thickness > 5 mm or body > 10 mm suggests hyperplasia
- Adenoma growth: ~3 mm/year; malignant lesions ~5 mm/year[4]
- Adrenal adenoma: <10 HU on non-contrast CT
- Myelolipoma: macroscopic fat with attenuation < −30 HU and >50% fat content
- Pheochromocytoma: enhancement >110 HU on arterial, but not specific and can be seen with hyper vascular mets. [5]
- Malignancy concern > 20 HU on non-contrast CT. >43 HU highly suggestive. [6]
- Adrenal Adenoma washout calculator: https://pcheng.org/calc/adrenal_ct.html

Kidneys & GU

- Hemorrhagic renal cyst: >70 HU on non-contrast CT and <3 cm
- Bosniak: https://radiologyassistant.nl/abdomen/kidney/bozniak-2019
  Septa are defined as thin if < 3 mm[7].

Prostate

- Prostate volume: ≤30 mL in younger men; up to ~40 mL may be normal with aging
- PSA density < 0.15 ng/ml/cc is not suspicious.[8]
- Metastatic disease common if PSA > 20 ng/ml
- Pirads Calculator: https://www.prostate-mri.ch/pirads3

Uterus & Endometrium

- Uterus: normal length ~8 cm, AP ~4 cm
- Ovaries < 10 ml. PCOS criteria:
  a) follicle number per ovary (FNPO) ≥ 26
  b) and/or ovarian volume ≥10 mL, ensuring no corpora lutea, cysts or dominant follicles are present
- O-rads for Ultrasound: https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Reporting-and-Data-Systems/O-RADS/Ultrasound

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[3] https://pmc.ncbi.nlm.nih.gov/articles/PMC10237600/
[4] https://ajronline.org/doi/10.2214/AJR.19.21342
[5] https://ajronline.org/doi/full/10.2214/AJR.12.9753
[6] Blake MA, Kalra MK, Sweeney AT, et al. Distinguishing benign from malignant adrenal masses: multi-detector row CT protocol with 10-minute delay. Radiology 2005; 238:578-585
[7] https://radiologyassistant.nl/abdomen/kidney/bozniak-2019
[8] https://pmc.ncbi.nlm.nih.gov/articles/PMC10578357/

- Endometrium:
    - Premenopausal <16 mm
    - Postmenopausal <8 mm
    - Postmenopausal with bleeding ≤4 mm (guideline dependent but usual cut off is 4)
    - Not agreed upon universally but endometrial thickness > 8 on tamoxifen or hormone replacement should be biopsied[9].

OB/GYN – Early Pregnancy Failure

- https://pubmed.ncbi.nlm.nih.gov/24106937/

Week	Mean Sac Diameter (MSD)	Finding	BHCG (doubles q2 days)
4	4	Gestational sac	1,000
5	8 mm	Yolk sac	7,000
6	16 mm	Fetal pole	11,000

New Guidelines for Diagnosing Pregnancy Failure based on NEJM 2013 article
https://www.nejm.org/doi/full/10.1056/nejmra1302417

a) 7 is Heaven: CRL ≥ 7mm and no embryonic heart beat/motion (EHM)
b) Not Alive at 25: Mean sac diameter ≥ 25 mm and no EMBRYO
c) See nothing but a sac, wait ___14__ days; if no EHM, then failed pregnancy
d) See something (yolk sac +/- pole), wait __11__ days; if no EHM, then failed pregnancy

- [10]
- A gestational sac should be visualized transvaginally if beta hCG > 1500 mIU/L. When the transabdominal approach is preferred, the threshold for hCG is up to 6500 mIU/L.[11] By week 4 you can start seeing a gestational sac, if dating is accurate. By end of week 5/ 6, you should almost always see a gestation sac (assuming dating is clinically correct, which it may not be).
- SRU First Trimester Ultrasound Lexicon: https://pubmed.ncbi.nlm.nih.gov/39189906/

CARDIOVASCULAR

Chest

- Aorta: 4 ectasia, 5 aneurysmal
- RA < 4.5 cm in short axis
- RV < 4.2 cm in short axis[12]
- LA < 4.5 cm [13]

[9] https://pmc.ncbi.nlm.nih.gov/articles/PMC8310815/
[10] https://radres.ucsd.edu/documents/Ultrasound/Pearlsv2021.pdf
[11] https://pmc.ncbi.nlm.nih.gov/articles/PMC3881745/
[12] https://pubmed.ncbi.nlm.nih.gov/21835376/
[13] https://pubmed.ncbi.nlm.nih.gov/22071674/

- LV < 5.5 cm
- RV/LV ratio < 1
- PA < 3.1 cm (some people go up to 3.6 cm to increase specificity)
- Intra-aortic balloon pump radiopaque tip at 1.5 – 2 cm above the carina. [14]
- ET tube at 3 – 7 cm from the carina.
- Central pulmonary artery dilatation on radiograph is most accurately assessed by measuring the right interlobar artery on the frontal projection. The upper limit of normal is 15 mm for women and 16 mm for men.
- Swanz Ganz shouldn't go 2 cm beyond the mediastinal shadow.[15]

Abdomen

- Abdominal aorta PSV: 60–100 cm/s
- Abdominal aorta ectasia: 2.5 – 2.9 cm
- Abdominal aortic aneurysm ≥3 cm
- Celiac artery PSV: ~70–200 cm/s; >200 cm/s suggests stenosis
- SMA/ celiac artery aneurysm ≥ 1.0 cm, intervention recommended if ≥ 2.0 cm
- Common iliac artery aneurysm ≥ 1.8 - 2 cm
- Internal iliac artery is usually up to 1 cm, x 1.5 = aneurysm.
- External iliac artery aneurysm is greater than 1.5 – 2 cm.

Renal Transplant Doppler[16]

- Graft dysfunction if RI > 0.8 in interlobar arteries.
- Renal artery stenosis:
  - velocities greater than 200 cm/s at the stenosis.
  - In the segmental branches of the transplant, ie more distal:
    - Tardus-parvus waveform
    - Prolonged acceleration time (>0.07 s)[17]
    - diminished acceleration index (<300 cm/s^2)
    - decreased RI (<0.56)
    - loss of systolic peak
- Renal vein thrombosis:
  - Doppler examination shows reduced or no flow in the main renal vein

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[14] https://pubmed.ncbi.nlm.nih.gov/17717232/
[15] Lionhart, P. (2022). *Crack the Core Exam Volume 1: Radiology Board Review* (9th ed.). Independently published.
[16] https://pmc.ncbi.nlm.nih.gov/articles/PMC4045518/
[17] https://radres.ucsd.edu/documents/Ultrasound/Pearlsv2021.pdf

- Increased resistance on the arterial conduit, often resulting in reversed diastolic flow in the main renal artery and/or intrarenal arteries or just an elevated RI. **NOTE:** Diastolic flow reversal can sometimes be seen in ATN or acute rejection but they would have venous flow.

Liver Transplant Doppler[18]:

Arterial:

- Normal acceleration time: 0.08 seconds.
- Normal RI: 0.5-0.8.
- If less than 72 hours since surgery, RI > 0.8 can be normal. Usually improves on follow up imaging, any worsening = complication.
- Thrombosis: initially normal diastolic flow to absent diastolic flow, dampening of the systolic peak, and finally complete loss of hepatic arterial flow.
- Stenosis:
  - Peal systolic velocity > 200 cm/s at the site of anastomosis:
  - Tardus-parvus waveforms distally (ie intrahepatic): acceleration > 0.08 and RI < 0.5:
- Pseudoaneurysm
- Splenic artery steal:
  - high-resistance waveform in the main, left, and right hepatic arteries.
  - Increased portal vein velocity and hyperdynamic splenic arterial flow are present. It can be normal postoperatively but concerning for splenic artery steal if persists.

Portal:

a) Immediate post op:
   i) Can have increased portal vein velocity.
   ii) Normal velocity: 20 – 40 cm/s.
b) Stenosis:
   i) Increased velocity and aliasing at stenotic segment.
c) Portal Vein Thrombus:
   i) absent flow/ filling defects. Turbulence can be normal post op.

Hepatic Vein:

a) Hepatic vein stenosis.

   i. Triphasic or biphasic waveform helps exclude significant hepatic vein stenosis.

[18] https://pmc.ncbi.nlm.nih.gov/articles/PMC4247505/

ii. A persistent monophasic waveform on Doppler sonography is a sensitive finding, but it is not specific for a significant hepatic vein stenosis.
iii. Direct signs include a focal stricture with turbulent flow and increased velocities at the stenosis compared with the prestenotic segment on pulsed Doppler images.
iv. Indirect signs of stenosis of the IVC or hepatic veins on Doppler sonography include reduction in caliber with impaired flow and resultant pre-stenotic dilatation of the hepatic veins.
v. A significant suprahepatic caval stenosis may result in reversed flow or the absence of phasicity in the hepatic veins.

TIPS

- TIPS velocity should be 100-200 cm/s. If more, then stenosis
- portal vein velocity after tips < 30 cm/s → stenosis.

Endoleaks

- Kassem, Tamer W. "Follow up CT angiography post EVAR: Endoleaks detection, classification and management planning." *The Egyptian Journal of Radiology and Nuclear Medicine* 48.3 (2017): 621-626??????????????????????????

Right Lower Extremity Run-Off

- It is the superficial femoral artery (or femoral artery for short) that becomes the popliteal artery. The deep femoral artery is smaller and provides circumflex arteries.

Upper Extremity Venous Drainage[19]

Deep Vessels: subclavian vein → axillary → Brachial vein → Ulnar vein, radial vein, Deep and superficial palmar arches.

Lower Extremity Venous Drainage[20]

External Iliac Vein → Common Femoral Vein → Deep Femoral and Femoral veins → Femoral vein becomes Popliteal vein after the adductor canal → anterior and posterior tibial veins and peroneal veins. Remember if superficial thrombosis < 3 cm from junction with deep venous system, treat as DVT. Gastrocnemial and Soleal veins are deep veins but below the knee.

[19] Dr.shubham_arora Instagram Page
[20] https://pbrainmd.wordpress.com/2013/05/26/deep-veins-of-the-lower-extremity-dvt/

CHEST

- Solitary pulmonary nodule: ≤3 cm; mass if >3 cm

Fleischner Criteria

https://radiologyassistant.nl/chest/plumonary-nodules/fleischner-2017-guideline

Thyroid

- Thyroid ultrasound recommended for nodule sizes:
  - < 35 → 1 cm
  - > 35 → 1.5 cm
- Thyroid lobe size: ~3 × 2 × 4 cm; long axis >5 cm enlarged
- Thyroid lobe volume: 4–11 mL
- Total thyroid volume: males 12–18 mL; females 10–15 mL

MUSCULOSKELETAL

1) C1-C2 articulation:
   - Lateral Atlanto-dental interval < 3 mm[21]
   - Anterior Atlanto-dental interval < 3 mm in males and 2 mm in females but usually is < 2 mm.
   - Posterior Atlanto-dental interval > 14-15 mm.
2) Craniocervical dissociation:
   - Occipital condyle to C1 on coronal highest sensitivity < 1.5 mm, historically agreed upon is < 2.5 mm. [22]
   - Basion-Dens Interval on saggital historically < 10, but on CT usually < 8.5. IF more than 10 definitely abnormal. On X-ray, < 10 is normal. [23]
   - Caution, may be normal if c1-c2 is dislocated and does not exclude craniocervical dissociation.

3) Acromioclavicular joint:
   - AC width normal between 5 – 8 mm. Greater than 2-4 mm compared to other side is abnormal.
   - Coracoclavicular distance normal between 10-13 mm. Greater than 5 mm asymmetry compared to other side is abnormal.

[21] Harris JH, Harris WH. The Radiology of Emergency Medicine, 5th ed.
[22] https://pmc.ncbi.nlm.nih.gov/articles/PMC6003796/
[23] https://pubmed.ncbi.nlm.nih.gov/17893223/

https://radiopaedia.org/articles/acromioclavicular-joint-injury-1?lang=us

4) Scapholunate distance > 3 mm of dorsal cortices suggestive of instability. [24]
5) Radioulnar distance > 6 mm on true lateral is suggestive of radioulnar instability. [25]
6) Scoliosis Radiographs:
    - Cob angle < 10 is normal
        - Coronal plum line < 3 cm is normal
        - Sagittal plum line: relative to posterosuperior corner of S1 < 2 cm is normal

        - https://radiopaedia.org/articles/sagittal-vertical-axis?lang=us

NEURO

- Chiari I malformation: tonsillar descent ≥5 mm (one tonsil) or ≥3 mm (both)
- Callosal angle: normal 100–120°; NPH 50–80°
- Temporal Horn > 5 mm suggestive of neuro-degenerative disorders.
- Prevertebral soft tissue (adults): <7 mm at C2, <2 cm at C7
- Prevertebral soft tissue (children): <8 mm at C2, <12 mm at C7

Age of Blood Products MRI

https://radiopaedia.org/articles/ageing-blood-on-mri-mnemonic

Age of Infarct by MRI

https://pubmed.ncbi.nlm.nih.gov/24380480/

CT Perfusion

- Core = rCBF <30%
- Core + Penumbra = Tmax > 6s
- Mismatch volume = Delta ie Penumbra
- If the Core is 0 the ratio will be NA and you need to rely on mismatch volume.

[24] https://pubmed.ncbi.nlm.nih.gov/11433158/
[25] https://pubmed.ncbi.nlm.nih.gov/26328241/

Expanded Indications for CTP:

Mechanical Thrombectomy

- Window: 6-24 hr
- Core (rCBF) < 70 ml
- Penumbra (Mismatch Volume) ≥ 15 ml
- Mismatch Ratio ≥ 1.8

TNK

- Window: 4.5 – 24 hr
- Core (rCBF) < 50 ml
- Penumbra (Mismatch Volume) ≥ 10 ml
- Mismatch Ratio ≥ 1.2

Head and Neck Anatomy Free Website

https://www.learningheadandneck.com/anatomy

TRAUMA

An apex medial angulation will result in a valgus deformity because the distal portion will point laterally and vice versa. [26]

Transsphenoidal Skull Base Fractures[27]

Fracture Pattern	Fracture Plane	Fracture Course / Key Structures Involved	Associated / Possible Extensions
Anterior Transverse	Coronal – think temple hit	Extends from squamous temporal bone → base of anterior clinoid processes (anterior to pituitary fossa) → contralateral sphenotemporal buttress ± into squamous temporal bone	May extend inferiorly to the pterygoid processes
Lateral Frontal Diagonal	Oblique – think frontal orbit hit	Extends from lateral frontal bone / lateral orbital roof → sphenoid sinus → through or adjacent to contralateral carotid canal → sphenopetrosal synchondrosis	Often continues as a petrous temporal bone fracture; frequently associated with maxillary sinus fractures and lateral orbital wall fractures
Posterior Transverse	U-shaped configuration – think ear hit	Formed by bilateral longitudinal (or mixed) temporal bone fractures united by a midline fracture through the posterior sphenoid wall / clivus	Involves sphenopetrosal synchondrosis, foramen lacerum, and carotid canal
Mastoid Diagonal	Oblique – think mastoid hit	Originates in the occipital bone → extends to jugular foramen and petro-occipital fissure → passes diagonally through sphenoid → reaches contralateral ethmoid air cells or orbital roof	Cross-skull base trajectory involving posterior and central skull base structures

[26] https://www.ortho-teaching.feinberg.northwestern.edu/XRreading/general/angulationdisplacementdislocation.html
[27] https://radiopaedia.org/cases/transsphenoidal-base-of-skull-fractures-illustrations

Facial Fractures[28]

FRACTURE	MAIN BONES INVOLVED
NASAL	Nasal bones ± maxilla, septum
ORBITAL BLOW OUT	Orbital wall but orbital RIM intact. Does not cause telecanthus.
ZYGOMATICOMAXILLARY COMPLEX (TRIPOD)	Zygoma + frontal (lateral orbital RIM), maxilla (inferior orbital RIM), temporal (zygomatic arch), sphenoid (lateral orbital wall)
ZYGOMATIC ARCH	Zygoma + temporal only (less severe than tripod)
LE FORT I	Maxilla + pterygoid plates
LE FORT II	Pyramidal through maxilla, nasal, ethmoid, lacrimal, medial orbit + pterygoid
LE FORT III	Zygoma, lateral and medial orbit, maxilla, nasal, ethmoid, frontal + pterygoid
NASOORBITOETHMOIDAL FRACTURE	Medial orbital wall (lamina papyracea), medial orbital rim, nasal bones, ethmoids, frontal process of maxilla, frontal, lacrimal. Causes telecanthus clinically.

MANDIBULAR FRACTURES

assi D, Malkunje L, Atri M, Chahal D, Singh TK, Goyal J. Newer proposed classification of mandibular fractures: A critical review with recent updates. Annals of Medical and Health Sciences Research| September-October. 2017;7(5).?????

Forearm Fractures

Colles fracture	Smith	Barton	Hutchinson/ Chaufffer fracture
Dorsal dislocation of distal radius metaphysis fracture	Volar dislocation of distal metaphysis.	Dorsal intraarticular distal radial fracture vs. intraarticular smith/ reverse barton which is	Intraarticular fracture of the ulnar styloid

28 Rereference would not load but available on google images: https://www.google.com/search?q=oediatric+lefort+zygomatic+nasaoorbitoethmoid&sca_esv=286534660d0b6d5d&rlz=1C1RXQR_enUS1121US1121&udm=2&biw=1599&bih=812&sxsrf=ANbL-n7oYFqGj3C62_wxANcdDCc7Tdpetw%3A1772734008526&ei=OMapaYrlH-PTkPIP7Nm0QQ&ved=0ahUKEwiK4e_mrlmTAxXjKUQIHewsLQgQ4dUDCBI&uact=5&oq=oediatric+lefort+zygomatic+nasaoorbitoethmoid&gs_lp=Egtnd3Mtd2l6LWltZyItb2VkaWF0cmljIGxlZm9ydCB6eWdvbWF0aWMgbmFzYW9vcmJpdG9ldGhtb2lkSKlMUABYrEtwA3gAkAEBmAFroAH0FKoBBDQ3LjG4AQPIAQD4AQGYAgmgArsEwgIIEAAYgAQYsQPCAgUQABiABMICDBAAGIAEGLEDGAoYC8ICChAAGIAEGEMYigXCAgkQABiABBgKGAuYAwCSBwE5oAevTbIHATm4B7sEwgcDMi05yAcmgAgA&sclient=gws-wiz-img

		volar	
Old lady fracture. If male → DEXA.	Young. Usually extraarticular but if intraarticular it's a reverse barton fracture.	Radiocarpal dislocation is hallmark → surgery	
Associated with ulnar styloid fracture.	Associated with ulnar styloid and carpal tunnel.		Associated with scapholunate dissociation and perilunate dislocation.

Pelvic Fractures

https://radiopaedia.org/cases/pelvic-fracture-diagrams#image-13972474=

In lateral you get compression of the SI joint while vertical you get upward displacement. In both you have superior and inferior pubic rami fractures but different kinds (horizontal vs. vertical fractures, respectively).

Judet and Letournel 2 Column Acetabulum Theory:

- The two columns: https://epomedicine.com/medical-students/column-concept-of-acetabulum/
- The different kinds of fractures: https://radiopaedia.org/articles/judet-and-letournel-classification-for-acetabular-fractures?lang=us
- This classification system uses the column principle of the acetabulum. The anterior column is longer and larger and extends from the superior pubic ramus to the iliac wing. The posterior column extends from the ischiopubic ramus to the ilium. So only the anterior column involves the ilium. Iliopectineal line is anterior while ilioischial line is posterior.

Hip Fractures

- Intracapsular fractures, which include capital, subcapital, and transcervical produce a higher subsequent risk of femoral head osteonecrosis. But don't forget about:
- https://radiopaedia.org/cases/proximal-femoral-fractures-illustration

- Don't forget about reverse oblique fractures of the proximal femur.

Knee Injuries and Associations

Injury / Sign	Anatomic Finding	Associated Injury	Clinical Relevance
Fibular Styloid Avulsion ("Arcuate Sign")	Avulsion of fibular styloid	Strongly associated with cruciate injuries (especially PCL)	High positive predictive value for PCL injury
Reverse Segond Fracture	Avulsion of medial tibial plateau at deep MCL origin	PCL tear	"Mirror" of Segond; points toward PCL rather than ACL
Segond Fracture	Avulsion of lateral tibial cortex	ACL tear	Classic radiographic marker of ACL injury

Ankle Injuries

- https://radiologyassistant.nl/musculoskeletal/ankle/weber-and-lauge-hansen-classification
- Scorable pictures showing the injury pattern on the radiology assistant website referenced. Trimalleolar is at least a Weber B.

VS. Pilon fracture (tibial plafond fracture): distal intraarticular with 3 fracture fragments and Mercedes Benz sign.

VS. Tillaux fracture (SH 3): in peds, anterolateral distal epiphyseal tibial fracture that extends into the tibial plafond. Seen in younger patients because it requires the medial physis to be fused and the lateral still open.

VS. Triplane fracture (SH 4): in peds, additional fracture from tillaux with distal tibial metaphysis in the coronal plane. Also only in peds 10-17 years old.

AAST Trauma Grading

https://radiologyassistant.nl/abdomen/acute-abdomen/ct-in-trauma