

Week 9: Congenital Heart Disease, Cardiac Masses & Ethics

CVSG2280 Cardiovascular Registry Review by Dr. Alice Matthews

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Registry weight this week. Congenital disease and cardiac masses live in the **Pathology** domain, which is the single heaviest block on both exams: ARDMS RDCS (Adult Echo V24.2) Pathology = **40%**, with Measurement/Views 25%, Anatomy/Physiology 15%, Clinical Care & Safety 11%, Instrumentation 9%. CCI RCS Pathology (Domain D) = **29%**, the largest CCI domain. The **Ethics, scope of practice, and HIPAA** material maps to ARDMS Clinical Care & Safety (11%) and CCI Domain E (13%). Together this week touches roughly two-fifths of the registry blueprint, so it is high-leverage study time.

Note to students: Congenital findings here follow the ASE guidelines library ([filter by Congenital](#)); for the transposition section see the [ASE TGA multimodality imaging guideline](#). No single congenital-coronary guideline governs this week. Ethics, scope, and HIPAA cross-reference the [ASE guidelines portal](#) (free landing pages at asecho.org). Ethics content follows the CCI Code of Ethics and the SDMS Code of Ethics (revised 2024; effective 09/24/2024), with HIPAA per the 1996 federal statute. Pressure and velocity cutoffs are quoted from the course canonical values file so they match every other guide. **What last week's EOM gives you:** Week 8 built your aorta and great-vessel baselines (coarctation and post-stenotic dilation read off those numbers), and every shunt gradient this week reuses the Bernoulli and Qp/Qs tools you have carried since Week 1. Always defer to the protocol your clinical site follows.

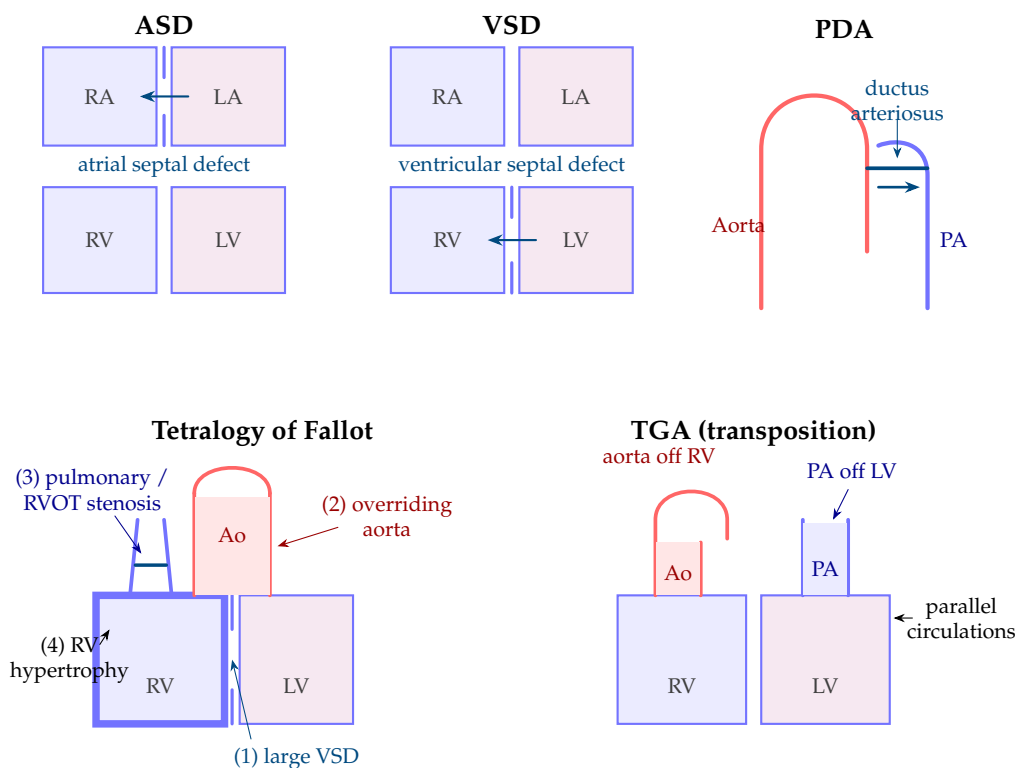
At a Glance: this week in one box

Must-know numbers. Bubbles to LA in ≤ 3 cardiac cycles = PFO/ASD (> 3 = transpulmonary/IVC source); significant shunt **Qp/Qs** > 1.5 ; coarctation gradient > 20 mmHg; Ebstein septal-leaflet displacement > 8 mm (> 0.8 cm/m² indexed); myxoma **LA in 75%** (recurrence $< 5\%$); pulmonary hypertension now **mean PAP** > 20 mmHg (PASP > 35 to 40 mmHg is the echo screen); TR Vmax ≤ 2.8 m/s normal; HIPAA breach: affected **individuals are always notified**, breaches affecting ≥ 500 are also reported to **HHS and the media** without unreasonable delay, and breaches affecting < 500 are logged and reported to HHS annually.

Formulas you will reuse. $\Delta P = 4V^2$ (gradients) • $Qp/Qs = SV_{pulm}/SV_{syst}$ (shunt size) • $PASP = 4(V_{TR})^2 + RAP$ (Eisenmenger and shunt follow-up).

Top 3 EOM traps. (1) VSD is the most common CHD *overall*, but ASD is the most common *diagnosed in adults* (most VSDs close in childhood). (2) AF/LAA thrombus lives in the *appendage*, not on the interatrial septum. (3) Answering a patient's diagnostic question crosses out of the sonographer's scope.

Acyanotic Congenital Heart Disease (Shunt Lesions)



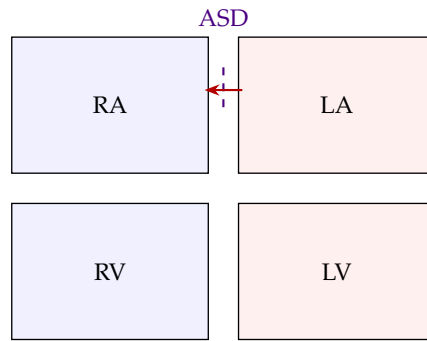
The five most-tested congenital lesions. Top row, simple shunts (left to right flow, acyanotic): ASD at the atrial septum, VSD at the ventricular septum, and PDA bridging the aorta to the pulmonary artery. Bottom row, cyanotic lesions: Tetralogy of Fallot (large VSD, overriding aorta, pulmonary/RVOT stenosis, RV hypertrophy) and transposition of the great arteries (aorta off the RV, pulmonary artery off the LV, parallel circulations).

Acyanotic lesions shunt **left to right**, so oxygenated blood recirculates through the lungs and the patient is not blue. The volume load falls on whichever chambers sit downstream of the hole. The registry wants you to localize the shunt level, recognize the chamber that dilates, and quantify the shunt with Qp/Qs.

Atrial Septal Defect (ASD). ★ The most common congenital lesion *diagnosed in adults*. A left-to-right shunt at the atrial level volume-loads the right heart, so you see a dilated RA and RV, paradoxical (flattened, D-shaped) septal motion in systole, and a prominent TR jet from RV and annular dilation.

Type	Location	Associated findings	Prevalence
Secundum (most common)	Fossa ovalis	Coexisting PFO; commonest type	75%
Primum (incomplete AV canal)	Low septum near AV valves	MV cleft, MR, abnormal TR	15 to 20%
Sinus venosus (high or low)	Near SVC or IVC entry	PAPVR (partial anomalous pulmonary venous return)	10 to 15%
Coronary sinus	Wall between coronary sinus and LA	Rare; usually insignificant	< 1%

- ★ **Bubble study:** inject agitated saline in a peripheral IV while imaging the apical 4-chamber; watch the **right atrium first**. Bubbles crossing into the LA within **3 cardiac cycles** indicate a PFO or ASD; later appearance suggests a transpulmonary or IVC source. Valsalva transiently raises RA pressure and opens a PFO.
- **Closure indication:** Qp/Qs > 1.5, or documented paradoxical embolism (stroke or TIA).



Left-to-right shunt $\Rightarrow$ RA/RV volume overload

Schematic: a secundum ASD at the fossa ovalis shunts LA blood into the RA, dilating the right heart.

Common Trap

A 48-year-old has a dilated RA and RV and a brisk TR jet. The resident wants to call this primary tricuspid disease. **What is the error?**

Right-heart dilation with a clean tricuspid valve should prompt a hunt for a left-to-right shunt. Run an agitated-saline study: bubbles into the LA within 3 cycles point to an ASD or PFO that is volume-loading the right heart, and the TR is functional from RV dilation, not a primary leaflet problem.

Ventricular Septal Defect (VSD). ★ The most common congenital lesion *overall*, but most close in childhood, which is why ASD dominates the adult population. Shunting is at the ventricular level; a high-velocity systolic jet crosses left to right and the LV/LA carry the volume load.

Type	Location	Key association
Muscular	Trabecular septum	Spontaneous closure up to 90%; may be multiple
Perimembranous (most common)	Membranous septum below AV	Post-repair sub-aortic stenosis risk
Inlet (AV canal type)	Near tricuspid and mitral annuli	Down syndrome; cleft MV; AVSD
Outlet / supracristal	Just below the pulmonic valve	Right coronary cusp prolapse causing AR

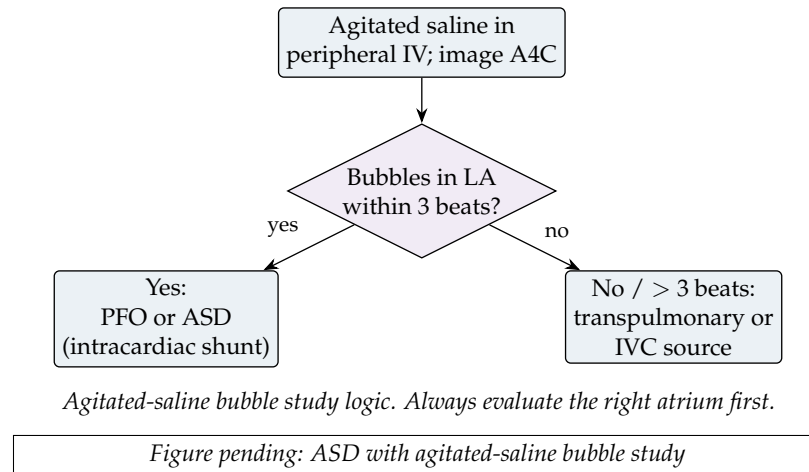
- **Doppler:** a CW jet across the defect; the peak velocity reflects the LV-to-RV pressure difference by $\Delta P = 4V^2$. A small, high-velocity (restrictive) jet means a large pressure gradient and a small defect.
- **Closure indication:** $Q_p/Q_s > 1.5$ with preserved chamber size; closing too late (after irreversible PH) is contraindicated.

Patent Ductus Arteriosus (PDA). A fetal connection between the pulmonary artery and descending aorta that fails to close. Because aortic pressure exceeds PA pressure throughout the cardiac cycle, flow is a **continuous** left-to-right shunt, producing the classic continuous “machinery” murmur and continuous color flow in the main PA (best from the suprasternal notch). The LA and LV volume-overload.

Coarctation of the Aorta. ★ Focal narrowing of the descending aorta just distal to the left subclavian (post-ductal in adults). Look for upper-extremity hypertension with reduced lower-extremity pressure, LV hypertrophy from chronic pressure overload, and a frequently associated **bicuspid aortic valve**. CW Doppler across the narrowing shows systolic turbulence; a **peak systolic gradient** > 20 mmHg suggests significant coarctation. Watch for the “diastolic tail”: forward flow that persists into diastole instead of dropping to baseline. It matters because a fixed, severe narrowing keeps pushing blood through the stenosis even after systole ends, so antegrade flow that continues through diastole signals a severe, hemodynamically significant gradient (a normal or mild segment returns to baseline in diastole). Associated with Turner syndrome.

Patent Foramen Ovale (PFO). Not a true defect but a **probe-patent** flap from incomplete fusion of septum primum and secundum, present in 25 to 30% of the population. Clinically relevant only as a route for paradoxical embolism

(worked up after cryptogenic stroke or TIA). Detected with the same agitated-saline bubble study, with Valsalva to provoke the right-to-left crossover.



Memory hook: ASD is **A**dults, VSD is the **V**ery first (most common overall but closes early). Acyanotic shunts go *Left to right, Lungs get more blood, patient is not bLue*.

Common Trap

A board item states "VSD is the most common congenital heart defect found in adults." **What is the error?**

VSD is the most common congenital defect *overall* (counting all births), but most VSDs close spontaneously in childhood. The most common lesion still found *in adults* is the ASD. The exam loves this overall-versus-adult distinction.

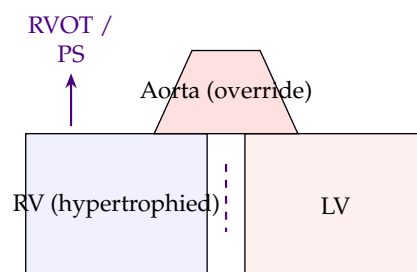
Cyanotic Congenital Heart Disease (Right-to-Left Shunts)

Cyanotic lesions shunt **right to left**, so deoxygenated blood bypasses the lungs and reaches the body; the patient is blue. The registry focuses on Tetralogy of Fallot, transposition, and Ebstein anomaly.

Tetralogy of Fallot (TOF). ★ The most common cyanotic CHD in older children and adults. Four components:

1. VSD (large, non-restrictive)
2. RV outflow tract obstruction (subpulmonic / pulmonic stenosis)
3. RV hypertrophy
4. Overriding aorta (the aorta straddles the VSD, taking blood from both ventricles)

Memory hook: **PROVe** the diagnosis: **P**ulmonic stenosis, **R**V hypertrophy, **O**verriding aorta, **V**SD. A right aortic arch coexists in about 30%. Repaired adults are followed for residual RVOT obstruction, pulmonic regurgitation, and RV dilation.

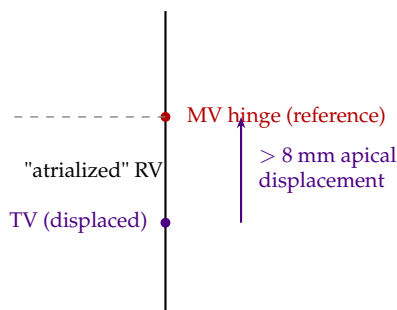


Schematic of the four TOF components: VSD, RVOT obstruction, RV hypertrophy, and an aorta overriding the septum.

Transposition of the Great Arteries (D-TGA). The aorta arises from the RV and the pulmonary artery from the LV, creating two parallel circuits. Survival requires mixing through a **PFO/ASD, VSD, or PDA**. Cyanosis appears within hours of birth and *does not improve with oxygen*, because oxygenated blood cannot reach the body without a mixing point. The preferred modern repair is the **arterial switch (Jatene)**; older patients may have a **Mustard** or

Senning atrial baffle (follow for baffle obstruction, baffle leak, and residual shunt), and complex TGA with VSD and PS may have a **Rastelli** repair.

Ebstein Anomaly. ★ Apical displacement of the septal and posterior tricuspid leaflets toward the RV apex; the anterior leaflet is sail-like. Diagnostic threshold: **septal-leaflet displacement** $> 8 \text{ mm}$ below the mitral hinge point. This is a separate criterion from the BSA-indexed cutoff ($> 0.8 \text{ cm/m}^2$), not a unit conversion of it; the indexed value adjusts for body size in larger or smaller patients, and either crossing supports the diagnosis. The result is an “atrialized” RV, severe TR, a dilated RA, and an associated ASD with right-to-left shunting; accessory pathways (Wolff-Parkinson-White) are common.



Ebstein anomaly: the tricuspid hinge sits abnormally far toward the apex relative to the mitral hinge.

Eisenmenger Syndrome. The late, ominous endpoint of an uncorrected left-to-right shunt. Chronic pulmonary overcirculation causes irreversible pulmonary vascular disease; PA pressure eventually exceeds systemic pressure and the **shunt reverses to right-to-left**, turning a once-acyanotic patient blue. Echo shows the original shunt now flowing right to left on color, severe RV and PA dilation, and a PASP often 80 to 100+ mmHg. Surgical closure at this stage is contraindicated and carries high perioperative mortality.

Common Trap

A 30-year-old with a known childhood VSD is now cyanotic with clubbing, and the surgeon asks whether the VSD can simply be patched. **What is the error?**

Cyanosis in a patient with a long-standing shunt signals Eisenmenger physiology: the pulmonary vascular disease is fixed and the shunt has reversed to right-to-left. Closing the defect now removes the pressure “pop-off” and is contraindicated; the window for repair closed years earlier.

Cardiac Masses: Benign and Malignant Differential

The registry differential is built around four questions: where is it, how does it move, what is it stuck to, and is it benign or malignant. Myxoma versus thrombus versus fibroelastoma versus angiosarcoma covers nearly every item.

Myxoma. ★ The most common *primary* cardiac tumor, in the **left atrium in 75%** of cases, attached by a stalk to the interatrial septum (fossa ovalis region). Classic echo appearance is an “**egg on a stalk**” that prolapses through the mitral valve in diastole and can mimic mitral stenosis. The triad to recall is constitutional symptoms (fever, weight loss, elevated inflammatory markers), embolic events from a friable surface, and obstruction. Treatment is surgical resection with $< 5\%$ recurrence.

Figure pending: Left atrial myxoma

Papillary Fibroelastoma. Small (usually $< 1 \text{ cm}$), benign, papillary tumor attached to a **valve** (most often aortic), with a shimmering “sea anemone” frond appearance on a short stalk. Usually incidental; the concern is embolism. Observe unless symptomatic or embolic.

Cardiac Thrombus. ★ Not a tumor, but the most common intracardiac mass overall. **LV thrombus** forms in an akinetic or dyskinetic apex after an anterior MI with a low EF; it appears as a layered echodensity at the apex and carries systemic embolic risk (anticoagulate; avoid catheter trauma). **LA/LAA thrombus** forms in atrial fibrillation

or mitral stenosis and sits in the **left atrial appendage** (about 90% of AF thrombi), best seen on TEE (> 90% sensitivity, far above TTE). It is *not* on the interatrial septum, a favorite distractor.

Angiosarcoma. The most common primary *malignant* cardiac tumor, usually in the **right atrium**: an infiltrative, heterogeneous mass with necrosis, often with a hemorrhagic pericardial effusion and tamponade. Prognosis is poor.

Mass	Typical location	Morphology / motion	Associated findings	Management
Myxoma	LA in 75%; stalk on septum	Round/oval, prolapsing	Pericardial effusion, embolism	Surgical resection
Fibroelastoma	Valves (aortic)	Papillary, shimmering, mobile	Embolism if large	Observe; resect if symptomatic
Thrombus (LV)	LV apex	Layered, may be mobile	Post-MI, low EF, stasis	Anticoagulate
Thrombus (LA/LAA)	LAA	Irregular, may be mobile	AF, mitral stenosis	Anticoagulate; TEE to detect
Angiosarcoma	RA	Infiltrative, fixed	Hemorrhagic effusion, tamponade	Poor prognosis; palliative

Memory hook: Tumor frequency, most to least: **Myxoma, Fibroelastoma** (benign primaries), then **Angiosarcoma** (malignant primary). But **metastases outnumber all primaries** roughly 20 to 1, and **thrombus is the most common mass you will actually scan**.

Common Trap

A TEE report describes an AF patient's thrombus "on the interatrial septum." **What is the error?**

Atrial-fibrillation thrombus collects in the **left atrial appendage**, not on the interatrial septum. Roughly 90% of AF thrombi are in the LAA, which is exactly why TEE is the test of choice; the septum location is a classic exam distractor.

Implanted Devices and Artifacts

CCI Domain D now includes implanted cardiac hardware. Recognize the device, its leads, and the shadowing/reverberation artifacts it throws, and know what to assess.

- **ICD (implantable cardioverter-defibrillator):** senses and shocks ventricular tachycardia or fibrillation; bright linear lead echoes in the RA and RV with posterior shadowing. Confirm the RV lead seats in the apex.
- **Pacemaker (PPM):** paces for bradycardia or AV block; leads in RA and/or RV. For a dual-chamber device, confirm normal AV synchrony (mitral and tricuspid filling sequence).
- **LAA occluder (Watchman):** percutaneous LAA closure as an anticoagulation alternative in AF; an umbrella-shaped device at the appendage ostium seen on TEE. Assess full deployment and any residual peri-device leak jet.
- **ASD/PFO closure device (Amplatzer):** a double-disc spanning the atrial septum; color should show no residual shunt across the defect.
- **Mechanical circulatory support (LVAD, ECMO, total artificial heart):** bridge or destination therapy; assess native function in context, cannula position, and device thrombosis.

Common Trap

A bright linear echo with dense posterior shadowing crosses the right atrium on a study with an ICD. The student labels it a thrombus. **What is the error?**

That is the **lead artifact**: a pacing or defibrillator lead is strongly reflective and casts an acoustic shadow. Track the structure along its course into the RV apex and recognize the reverberation pattern before calling a mass; true lead thrombus is rare and looks like soft tissue adherent to the lead, not the bright line itself.

Professional Ethics, Scope of Practice, and HIPAA

Three frameworks govern your conduct: the **CCI Code of Ethics** (cardiac sonographer standard), the **SDMS Code of Ethics** (revised 2024; effective 09/24/2024), and **HIPAA** (the 1996 federal privacy statute). The registry tests the principles and, more often, the application.

CCI Code of Ethics (core tenets). Maintain the highest standard of professional conduct; hold appropriate credentials (ARDMS RDCS or CCI RCS); follow imaging protocols; **practice within your scope**; protect patient privacy (HIPAA); refuse unethical requests; and **report unethical conduct to institutional leadership**.

SDMS Code of Ethics (revised 2024; three principles).

- **Memory hook: "W-C-I": Well-being, Competence, Integrity.**
- **Principle I (Promote patient well-being):** explain the procedure; respect autonomy and the right to refuse; provide non-judgmental care; protect privacy, dignity, and comfort (draping); maintain HIPAA confidentiality; promote safety.
- **Principle II (Promote competent practice):** obtain education and credentials; uphold protocols; **practice within scope and acknowledge personal and legal limits**; pursue continuing education; perform only physician-ordered, medically indicated studies; avoid impairing substances.
- **Principle III (Promote professional integrity and public trust):** communicate truthfully; avoid conflicts of interest; accurately represent credentials; bill ethically; and **report deviations from the Code to institutional leadership**.

Scope of practice. ★ The range of activities a sonographer is qualified, trained, and legally authorized to perform. You *are* qualified to acquire 2D, M-mode, spectral and tissue Doppler, color, contrast, stress echo, and (with training) TEE and strain. You are **not** authorized to interpret images, diagnose disease, modify medications, or perform interventional procedures. **Scope creep** is the trap: telling a patient "you have an enlarged heart," advising on anticoagulation, or performing a procedure outside your training.

Common Trap

During a study the patient asks, "Do I have a hole in my heart?" The sonographer, confident in the bubble study, says yes. **What is the error?**

Diagnosis and interpretation are the reading physician's scope, not the sonographer's. The correct response is to acquire and document the findings, reassure the patient that the physician will review and discuss results, and defer the interpretation. Answering crosses into scope creep regardless of how clear the image looks.

HIPAA essentials. The Health Insurance Portability and Accountability Act of 1996 protects patient privacy and the security of health information. **Protected Health Information (PHI)** is any data that can identify a patient in a healthcare context: name, MRN, phone, email, date of birth, images, notes, diagnoses, medication lists. De-identified data (identifiers removed) is not PHI. Use the **minimum necessary** information, secure and log off workstations, never share passwords, never email PHI to personal accounts, and report breaches to your compliance officer. ★ Breach reporting follows a three-tier rule: **affected individuals are always notified** (regardless of size); a breach affecting **≥ 500 individuals** is also reported to **HHS and the media** without unreasonable delay (within 60 days); a breach affecting **< 500 individuals** is logged and reported to HHS annually. Common breaches: an open chart left on screen, discussing a patient in an elevator or cafeteria, or sharing identifiers with a student without consent.

Scope of Practice vs. Mandatory Reporting Cheat Sheet

Situation	Sonographer action	Scope decision
New aortic stenosis seen on a routine study	Report the measurement to the attending; do not diagnose	Within scope; interpretation is the physician's role
Patient asks "do I have a hole in my heart?"	Defer to the physician's report; do not answer	Outside scope; diagnosis requires a physician
Patient is unsafe (fall risk, altered mental status)	Notify clinical staff or nursing immediately	Mandatory reporting; patient safety
Suspected abuse or neglect indicators	Escalate to the supervisor or mandatory-reporter coordinator	Mandatory reporting; facility policy prevails
Colleague scanning incorrectly	Discuss privately; escalate if a safety concern	Professional responsibility; quality improvement
Patient discloses substance abuse or suicidal thoughts	Inform the clinical team immediately; do not minimize	Mandatory reporting; facility policy critical

Essential Formulas

Simplified Bernoulli: $\Delta P = 4V^2$ Plain English: a faster jet means a bigger pressure difference. Clinical use: read the LV-to-RV gradient across a VSD, the coarctation gradient, and the pulmonic-stenosis gradient in TOF.

Shunt ratio (Qp/Qs): $Qp/Qs = \frac{SV_{pulm}}{SV_{syst}} = \frac{RVOT\ SV}{LVOT\ SV}$ Plain English: how many times more blood the lungs receive than the body. Clinical use: a ratio > 1.5 marks a hemodynamically significant ASD, VSD, or PDA and supports closure.

Pulmonary pressure from TR jet: $PASP = 4(V_{TR})^2 + RAP$ Plain English: square the TR velocity, times four, plus the right atrial pressure from the IVC. Clinical use: tracks pulmonary hypertension in shunts and confirms Eisenmenger when PASP approaches systemic pressure.

Stroke volume (for each Qp/Qs limb): $SV = CSA \times VTI$, with $CSA = \pi(d/2)^2$ Plain English: area times the column of blood that passes per beat. Clinical use: the RVOT and LVOT stroke volumes that feed the Qp/Qs ratio.

Ebstein displacement index: $\text{Displacement} > 8\text{ mm OR } > 0.8\text{ cm/m}^2\text{ indexed}$ Plain English: how far the tricuspid hinge sits below the mitral hinge. The 8 mm absolute cutoff and the 0.8 cm/m² BSA-indexed cutoff are two separate criteria (the indexed one corrects for body size), not the same number expressed two ways. Clinical use: the cutoff that separates Ebstein anomaly from a normal tricuspid position.

Congenital Lesion Cheat Sheet

Lesion	Shunt direction	Chamber loaded	Signature echo finding	Best window
ASD	Left to right (atrial)	RA, RV	Bubbles to LA ≤ 3 beats; D-shaped septum	Subcostal; A4C bubble study
VSD	Left to right (ventricular)	LV, LA	High-velocity systolic CW jet	PLAX/PSAX; color across septum
PDA	Left to right (continuous)	LV, LA	Continuous flow in main PA	Suprasternal notch
Coarctation	n/a (obstruction)	LV (pressure)	Gradient > 20 mmHg; diastolic tail	Suprasternal notch
TOF	Right to left	RV (hypertrophy)	VSD + overriding aorta + PS	PLAX/PSAX

Lesion	Shunt direction	Chamber loaded	Signature echo finding	Best window
D-TGA	Parallel circuits	depends on repair	Great arteries reversed; baffle flow	PSAX/subcostal
Ebstein	Right to left via ASD	RA (atrialized RV)	Septal leaflet > 8 mm apical	A4C
Eisenmenger	Reversed to right to left	RV, PA	Shunt reversal; PASP 80 to 100+	depends on original lesion

Glossary

- **ASD** — atrial septal defect; left-to-right shunt at the atrial level
- **VSD** — ventricular septal defect; most common CHD overall
- **PDA** — patent ductus arteriosus; continuous aorta-to-PA shunt
- **PFO** — patent foramen ovale; probe-patent fetal flap, normal variant
- **Coarctation** — focal descending-aortic narrowing
- **Qp/Qs** — pulmonary-to-systemic flow ratio; significant if > 1.5
- **Bubble study** — agitated saline contrast to detect right-to-left shunt
- **Paradoxical embolism** — venous clot crossing a shunt to the systemic side
- **TOF** — Tetralogy of Fallot; most common cyanotic CHD in adults
- **RVOT** — right ventricular outflow tract
- **Overriding aorta** — aorta straddling a VSD over both ventricles
- **D-TGA** — D-transposition; great arteries arise from the wrong ventricles
- **Jatene** — arterial switch, the preferred TGA repair
- **Mustard / Senning** — older atrial baffle TGA repairs
- **Rastelli** — repair for complex TGA with VSD and PS
- **Ebstein anomaly** — apically displaced tricuspid leaflets (> 8 mm)
- **Atrialized RV** — RV portion above the displaced TV in Ebstein
- **Eisenmenger** — shunt reversal from fixed pulmonary hypertension
- **Myxoma** — most common primary cardiac tumor; LA in 75%
- **Fibroelastoma** — benign papillary valve tumor
- **Angiosarcoma** — most common primary malignant tumor; RA
- **LAA** — left atrial appendage; site of most AF thrombi
- **Scope of practice** — activities a sonographer is qualified and authorized to perform
- **Scope creep** — unauthorized expansion of role (e.g., diagnosing)
- **HIPAA** — 1996 federal patient-privacy and data-security law
- **PHI** — protected health information; identifiable health data
- **De-identification** — removing identifiers so data is no longer PHI
- **Breach notification** — duty to report unlawful PHI disclosure
- **Mandatory reporting** — legal duty to report abuse, neglect, or threats

Registry Connection

This week feeds the **ARDMS RDCS Pathology** subdomain (congenital lesions, cardiac masses) plus **Clinical Care & Safety** (ethics, scope, HIPAA), and **CCI RCS Domain D** (pathology and implanted devices) plus **Domain E** (professional and ethical practice). Expect item formats that show a shunt-direction or chamber-overload pattern and ask for the lesion; "most common" stems (overall versus adult, primary versus malignant, AF thrombus location); a bubble-study timing question; and applied scenarios that test whether an action is within scope, outside scope, or mandatory reporting. **Carry forward into Week 10:** the Bernoulli, Qp/Qs, and TR-jet pressure tools, plus the professional-conduct framework, anchor the comprehensive registry review and mock-exam synthesis.

Study smart. Scan with confidence.

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