Gorlin Formula — Cath Lab Quick Reference

Valve Area = Flow ÷ (Flow Period × √Gradient) | Practical worksheet for AVA & MVA calculation

AORTIC VALVE AREA (AVA)

$$AVA\ (cm^2) = \frac{CO \times 1000}{44.3 \times SEP \times \sqrt{\Delta P}}$$

CO Cardiac output (L/min)
SEP Systolic ejection period (sec/min)
ΔP Mean transaortic gradient (mmHg)
44.3 Gorlin constant (empirical)

Severity	AVA (cm²)
Normal	> 2.0
Mild AS	1.5 – 2.0
Moderate AS	1.0 – 1.5
Severe AS	**< 1.0**
Very Severe / Critical	**≤ 0.6**

MITRAL VALVE AREA (MVA)

$$MVA\ (cm^2) = \frac{CO \times 1000}{37.7 \times DFP \times \sqrt{\Delta P}}$$

CO Cardiac output (L/min)
DFP Diastolic filling period (sec/min)
ΔP Mean transmitral gradient (mmHg)
37.7 Gorlin constant for AV valves

Severity	MVA (cm²)
Normal	4 – 6
Mild MS	> 1.5
Moderate MS	1.0 – 1.5
Severe MS	**< 1.0**

DETERMINING SEP & DFP

Cycle length (sec/beat) = 60 ÷ HR

SEP — Systolic Ejection Period (Aortic)

- **From tracing:** AV opens (LV > Ao) to dicrotic notch (AV closes)
- **SEP (sec/min)** = ejection time/beat × HR
- **Typical:** ~0.30–0.35 sec/beat → **20–25 sec/min**
- Prolonged in: severe AS, low EF, bradycardia

DFP — Diastolic Filling Period (Mitral)

- **From tracing:** MV opens (LA/PCWP > LV) to MV closes (LV > LA)
- **DFP (sec/min)** = filling time/beat × HR
- **Typical:** ~0.40–0.50 sec/beat → **30–40 sec/min**
- **Shortened dramatically in tachycardia**
- In AFib: varies beat-to-beat → average multiple cycles

Memory Anchors

- **AVA = flow ÷ (time × √gradient)**
- **AS hates low flow** — low CO → falsely small AVA
- **MS hates tachycardia** — short DFP → overestimates severity
- **Fick > TD for valve area** when accuracy matters

CARDIAC OUTPUT: FICK VS THERMODILUTION

	Thermodilution	Fick
Pros	Easy, reproducible, less operator-dependent	Physiologically grounded; preferred in low CO, valvular disease, structural heart
Cons	Inaccurate in severe TR, low output, shunts	VO_2 often estimated → propagation error
Gorlin literature	Commonly reported in modern labs	Original Gorlin studies used direct Fick; guidelines favor Fick for valve areas

Pearl: If TD & Fick differ meaningfully, **use Fick for Gorlin** — especially in AS or MS.
Always document: CO method used + whether VO_2 was measured or assumed.

COMMON PITFALLS & INTERPRETATION

Pitfall	Effect & What to Do
Low cardiac output	**Falsely small valve area.** Consider dobutamine stress if low-flow low-gradient AS suspected.
Tachycardia	Minimal effect on **AVA**. **Major effect on the MITRAL GRADIENT** — a short DFP raises the mean gradient sharply. Gorlin MVA is theoretically DFP-invariant (DFP sits in the denominator and also drives the gradient), so the practical risk is measurement error, not bias: DFP is short, so a small timing error moves the answer a lot.
Atrial fibrillation	DFP varies beat-to-beat. **Average ≥ 5–10 consecutive cycles.**
Echo–Cath discordance	Often due to: different CO methods, SEP/DFP assumptions, or pressure recovery (echo < cath area).
PCWP for LA pressure	PCWP may overestimate true LA pressure (V-wave, overdamping). Consider direct LA measurement if available.
Estimated VO_2	125 mL/min/m² assumption may be ±25% off. Small VO_2 error → large AVA error. Measure when possible.

WORKED EXAMPLE — AVA

Given: CO = 4.2 L/min | HR = 72 bpm | Ejection time = 0.32 sec/beat | Mean gradient = 45 mmHg

Step 1: SEP = 0.32 × 72 = **23.0 sec/min**
Step 2: √45 = **6.71**
Step 3: AVA = (4.2 × 1000) ÷ (44.3 × 23.0 × 6.71) = 4200 ÷ 6836 = **0.61 cm²**
→ **Severe AS**

WORKED EXAMPLE — MVA

Given: CO = 4.8 L/min | HR = 80 bpm | Filling time = 0.42 sec/beat | Mean gradient = 12 mmHg

Step 1: DFP = 0.42 × 80 = **33.6 sec/min**
Step 2: √12 = **3.46**
Step 3: MVA = (4.8 × 1000) ÷ (37.7 × 33.6 × 3.46) = 4800 ÷ 4383 = **1.10 cm²**
→ **Moderate MS**

SAFE REPORT DOCUMENTATION LANGUAGE

- "Valve area calculated using Gorlin equation with **Fick / thermodilution** cardiac output"
- "SEP/DFP measured from simultaneous LV-Ao / LV-LA tracings" *(or: "estimated based on HR")*
- "Findings interpreted in the context of flow conditions"