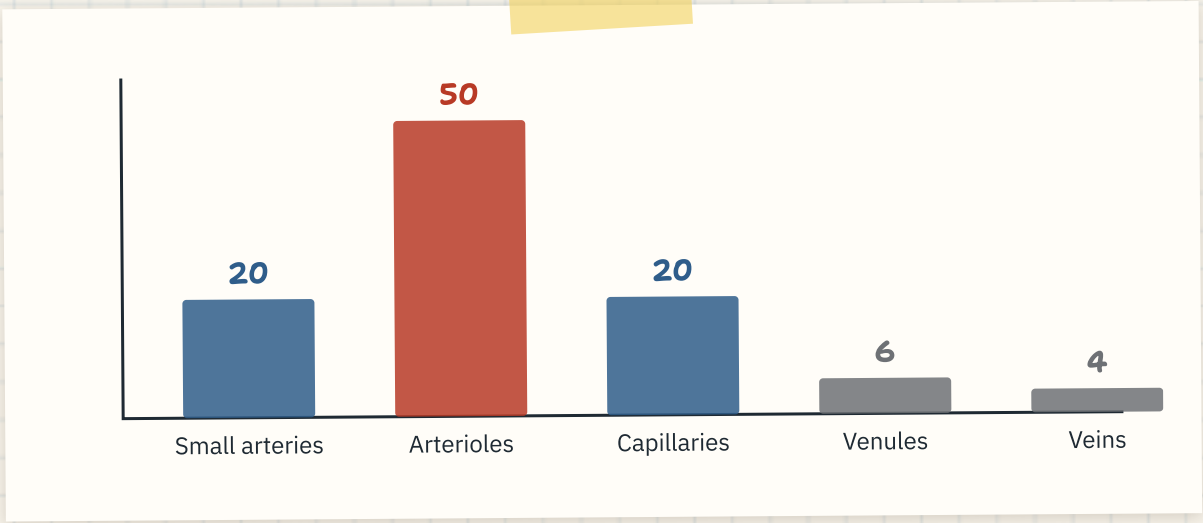
Poiseuille's law and resistance

Why arterioles set MAP = CO × TPR



Step by step

1. Flow = ΔP / R, so MAP ≈ CO × TPR
2. MAP = diastolic + ⅓ pulse pressure
3. Resistance ∝ length and viscosity, $1/r^4$
4. Series: add. Parallel: add reciprocals

MEAN ARTERIAL PRESSURE

$$MAP \approx CO \times TPR$$

MAP ≈ diastolic + ⅓ pulse pressure; $R \propto (\eta \times L) / r^4$

Radius	Resistance
Halved	Rises 16-fold
Doubled	Falls to 1/16

Radius and resistance

Rule of thumb

Length and viscosity change slowly; radius changes in seconds

Series: the biggest term controls the total

Parallel: the total is lower than the lowest bed (20 and 20 give 10)

Exam traps

- Mean pressure is not the simple average of systolic and diastolic.
- Radius carries a power of four, not one, two or three.
- Parallel resistances add as reciprocals, not directly.

Poiseuille's law and vascular resistance: why arterioles matter

Video, written lesson, practice question and sources: medservatory.com/usmle-step-1/cardiovascular/poiseuille-law-vascular-resistance

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