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Physio Laws

بسم الله الرحمن الرحيم

With IMP. notes

1) Flow (Q) = ΔP (pressure difference) / R (resistance)

2) Resistence (R) = $\frac{8 n l}{\pi r^4}$ → n = viscosity / l = length of the vessel / r^4 = radius to the power of 4

3) Velocity (V) = $\frac{Q}{A}$ Q = flow | A = cross sectional Area → least in the aorta

→ Lec 1 (laws 1–3)

4) Series resistence = $R_1 + R_2 + R_3 + R_4 + R_5$ | R artery + R arteriol + R capillary + R venule + R vein
(R_{total} within one organ / one system)

R arteriol → the main resistance vessel in the vascular tree and the largest decrease in pressure happens there

Q → same in each level → why? → as moving from artery to vein

↑ resistance → ↓ radius

↑ ΔP = $P_1 - P_2$ → ↓ in pressure 2 = ↑ ΔP

5) arranged resistence (or parralel) → $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$

sum of resistence within many organs or multi system

ΔP_{total} = Constant

(Q for each system/organ) a friction from Q_{total}

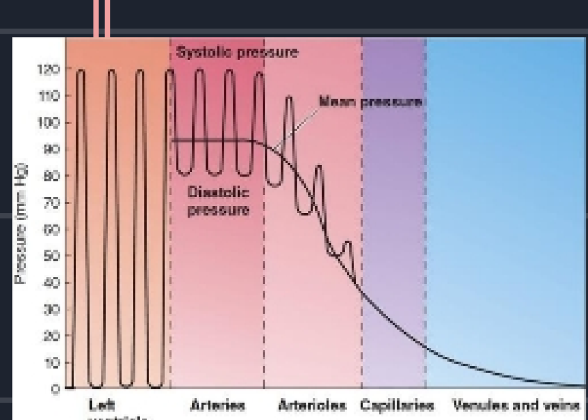
(R_{total} = ↑ → when increasing one of the R's) *

R_{total} < R 1 or 2 or 3 ....
Why?

If adding more R → R_{total} ↓ why?

* remember it's $\frac{1}{R_{total}}$

* أذا حسي مصعب جرب بأرقام إفتراضية :)



6) Reynold's No. → $N_R = \frac{\rho d v}{n}$

→ $N_R = \frac{v}{n}$ — we will deal with this equation only

ρ = density   d = diameter
V = Velocity
n = viscosity

if N_R < 2000 → laminar Blood flow

else N_R > 3000 turbulent Blood flow → ex:
- anemia? → ↓ n
- ↑ co? → ↑ V
- thrombus? → ↓ diameter thus ↑ V

(7) Pulse pressure (PP) = SBP − DBP

- SBP ↑ Systolic
- DBP ↑ Diastolic
- → * increased in → ↑ stroke volume
  - → ↓ Compliance

(8) Mean Arterial pressure (MAP) = DBP + $\frac{PP}{3}$

- PP → pulse pressure
- 3 → why? ↓ Diastolyic phase occupies 2/3 of the cardiac cycle

* pressure in all arteries is the same

* end of lec 2 :)

→ there is no laws in lec3

(10) $J_v = K_f[(P_c - P_i) - (\pi_c - \pi_i)]$ →

J_v = Fluid movement (mL/min)
K_f = Hydraulic conductance (mL/min per mm Hg)
P_c = Capillary hydrostatic pressure (mm Hg)
P_i = Interstitial hydrostatic pressure (mm Hg)
π_c = Capillary oncotic pressure (mm Hg)
π_i = Interstitial oncotic pressure (mm Hg)

LEC. 4

(11) lapelace's equation $T = r \times P$ → T: tension / r: radius / p: pressure

(vascular remodeling for Longterm Blood flow regulation)

LEC.5 end...