

CARDIOVASCULAR FORMULAS



Cardiac out put [CO]= heart rate x SV

$$\text{CO} = \text{SV} \times \text{HR}$$

Cardiac ouput =SVxpulse rate

$$\text{-----} = \text{L/mn}$$

1000

SV [stroke volume] = CO/HR =cardiac out put/ heart rtate

$$\text{HR}_{\text{max}} = 220 - \text{age} \quad 65\% \text{ intensity: } (220 - (\text{age} = 40)) *$$

$$0.65 \rightarrow 117 \text{ bpm}$$

$$85\% \text{ intensity: } (220 - (\text{age} = 40))$$

$$* 0.85 \rightarrow 153 \text{ bpm}$$

$PP = SV/2$ PULSE PRESSURE =STROKE VOLUME/2

$SV=PP \times 2$

$PP = 3(MP - DP)$

DP [DIASTOLOC PRESSURE] = $SP - PP$ [SYSTOLIC PRESSURE]-PULSE PRESSURE

MP [MEAN BLOOD PRESSURE]= $DP + \frac{1}{3}PP =$

$$\% \text{ CHANGE IN CO} = \frac{\text{CO AFTER EXERCISE} - \text{CO REST}}{\text{CO AT REST}} \times 100$$

$$\text{Ejection Fraction (EF)} = (\text{SV} / \text{EDV}) \times 100\%$$

$$\text{Cardiac Index (CI)} = \text{Q} / \text{Body Surface Area (BSA)} = \text{SV} \times \text{HR} / \text{BSA}$$

BSA is Body Surface Area in square metres.

$$BSA(m^2) = \sqrt{\frac{\text{weight (kg)} \times \text{height (cm)}}{3600}}$$

Important Formulas

- $CO = HR \times SV = VR$ in most pts.

$$\text{Resistance} = \frac{8 \eta l}{\pi \bullet r^4}$$

- Tension = $\frac{(\text{Pressure inside the chamber} \times \text{radius})}{(2 \times \text{wall thickness})}$

More generally, $T \sim P \times R$

- Mean Art. P. = $(1/3 \text{ Pulse PP.}) + \text{Diast. P}$

- Stroke Volume = $EDV - ESV$

- Ejection Fraction = SV / EDV . Normal EF is 0.5-0.75

- Fick's : $CO = O_2 \text{ Uptake} / ([\text{Arterial } O_2] - [\text{Venous } O_2])$

$$Q = SV \times HR$$

cardiac output

$$SV = \frac{Q}{HR}$$

stroke volume

$$HR = \frac{Q}{SV}$$

heart rate

$$CI = \frac{Q}{BSA}$$

cardiac index

$$Q = CI \times BSA$$

cardiac output

$$BSA = \frac{Q}{CI}$$

body surface area

$$SV = EDV - ESV$$

stroke volume

$$EDV = SV + ESV$$

end diastolic volume

$$ESV = EDV - SV$$

end systolic volume

Measure	Typical value	Normal range
end-diastolic volume (EDV)	120 ml	65 - 240 ml
end-systolic volume (ESV)	50 ml	16 - 143 ml
stroke volume (SV)	70 ml	55 - 100 ml
ejection fraction (E_f)	58%	55 to 70%
heart rate (HR)	70 bpm	60 to 100 bpm
cardiac output (CO)	4.9 L/minute	4.0 - 8.0 L/min

Solving for heart rate reserve.

$$HR_{reserve} = HR_{max} - HR_{rest}$$

$$HR_{max} = 220 - age$$

maximum heart rate most commonly found

$$HR_{max} = 205.8 - 0.685 \times age$$

maximum heart rate by Inbar

$$HR_{max} = 206.3 - 0.711 \times age$$

maximum heart rate by Londeree and Moeschberger

$$HR_{max} = 217 - 0.85 \times age$$

maximum heart rate by Miller