**Ministry of Higher Education and
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Blood pressure and its measurement

By

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Objectives: after the end of this lecture, the student must know:

1-The principle laws that govern the heart structure and function

2- Blood pressure and its measurement

3- Types of blood flow (laminar and turbulent) and its application in diseases.

Blood Flow Laminar And Turbulent

Laminar (silent) if all blood flow were laminar information could not be obtained from the heart with stethoscope

If increase the velocity of the fluid in the tube by reduction the radius it will reach the critical velocity Vc, when laminar flow change into turbulent flow. The critical velocity will be lower if there is restriction or obstruction in the tube.

Osborne Rynold studied the property in 1883

$Vc = k \, \eta / \rho \, R$

R ; radius of the tube

K ; constant 1000 for many fluid

For aorta has radius = 1 cm in adults

$Vc = (1000) (4 \times 10^{-3} pas) / (10^{3} kg / cm^{3}) (10^{-2} m) = 0.4 \ m /s$

Figure 8.16. (a) When the flow in a tube becomes turbulent (at pressure Pc) the slope of the flow rate versus pressure decreases so that compared to laminar flow a greater increase of pressure is necessary to obtain a given increase in flow rate. (b) In an obstructed artery the pressure needed to produce a given flow rate is greater than in a normal artery of the same size. In addition, if the heart is called upon to increase the flow rate from V_A to V_B the turbulence produced in the obstructed artery requires a much larger pressure increase (ΔP_2 vs ΔP_1) and thus greater effort from the heart. (Adapted from I.W. Richardson and E.B. Neergaard, *Physics for Medicine and Biology*, Wiley-Interscience, New York, 1972, pp. 46–47.)
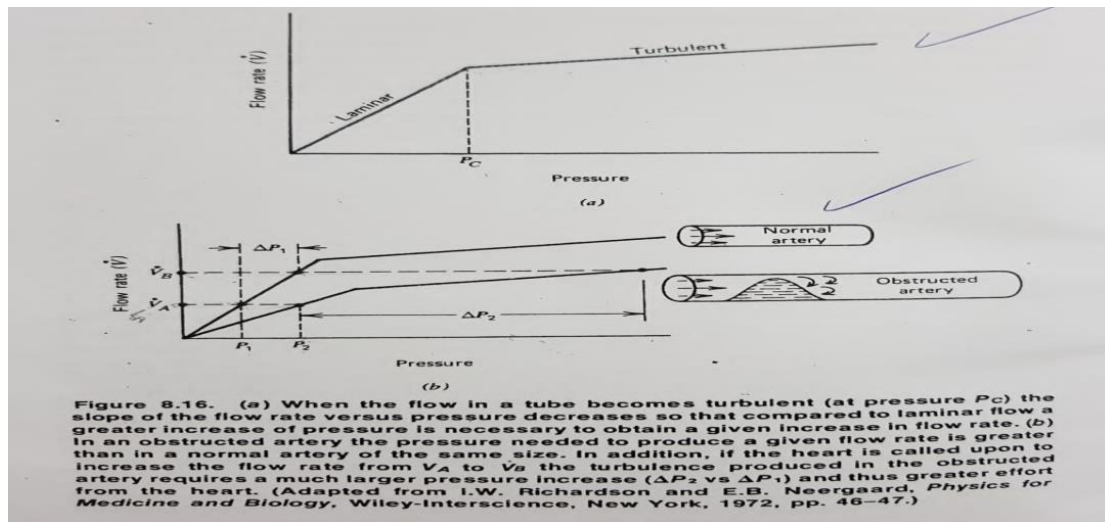
Figure: effect of gradual tapering of tube on velocity