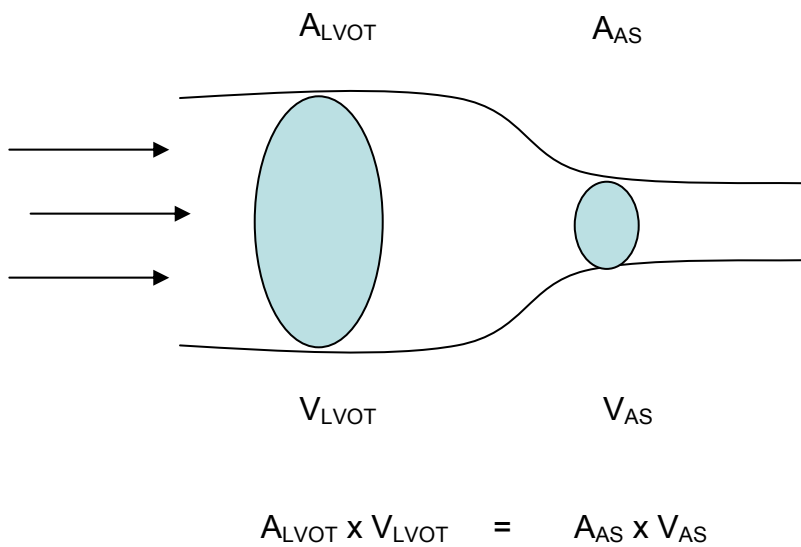


Continuity Equation

The continuity equation based on physics of flow in a closed system, an important tool to evaluate areas with unknown size such as areas of AS, MS or regurgitant areas of AI or MR. The main principle is: the flow is the same at every points of the system even if the area is changing.



LVOT : Left Ventricular Outflow Track

AS: Aortic Stenosis

A: area

V: velocity

In a closed fluid system the flow is constant:

Flow = area x velocity (ml/s)

$$A_{LVOT} \times V_{LVOT} = A_{AS} \times V_{AS}$$

In a closed fluid system the volume going through in different areas is constant:

Volume = area x VTI (ml)

$$A_{LVOT} \times VTI_{LVOT} = A_{AS} \times VTI_{AS}$$

VTI = Velocity Time Integral

In a clinical situation it is difficult to measure the area of the A_{AS} but A_{LVOT} , V_{LVOT} or V_{AS} can be measured using PWD or CWD.

Using the continuity equation:

$$A_{AS} = A_{LVOT} \times V_{LVOT} / V_{AS}$$

$$A_{AS} = A_{LVOT} \times VTI_{LVOT} / VTI_{AS}$$

$$A_{LVOT} = d^2 \times 0.785$$

$$\text{Area} = (d/2)^2 \times \pi$$

$$\text{Area} = d^2 \times \pi/4$$

$$\pi/4 = 0.785$$

d = diameter of LVOT

VTI_{LVOT} and V_{LVOT} can be measured by PWD at the level of the measurement of d_{LVOT} .

VTI_{AS} and V_{AS} are determined by the maximum velocity at the site of the stenosis. They have to be measured by CWD.