# Analysis & Probability/Algebra: Cardiovascular Specialist

**Boise Heart Clinic**

**Job Description:** Active cath lab and cardiovascular surgeon at the hospitals and clinical physician of primary or secondary heart disease at Boise Heart Clinic, P.A.

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## Problem:

#1 A man comes to the hospital and needs a medication based on his body size. He weighs 170 lbs. The Doctor prescribes Dobutamine, which stimulates the heart to increase the number of contractions and increases strength of contraction of heart muscle to pump blood more effectively. He needs to be given 10 mg/kg every minute of this medication intravenously.

If we put 500 mg of Dobutamine in one liter of normal saline, how much solution do we need to give per hour?

#2 A 59-year old man comes to the Boise Heart Clinic short of breath. Dr. Lee hears a heart murmur and suspects the patient's aortic valve is tight. He orders an echocardiogram (ultrasound of the heart) to find the valve area of the aortic valve. If it is too tight, he will have surgery to replace the valve.

You must calculate the aortic valve area:

CSA = cross sectional area $CSA=\pi r^2$
AVA = aortic valve area LVOT x CSA/AO
LVOT = minimal flow (before blood goes through the valve)
AO = maximum flow (after blood goes through the valve)
**$\pi = 3.14$**
LVOT = 1.0 m/sec
AO = 5.8 m/sec
LVOT Diameter = 2.5 cm

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***See problem for details.***

## Solution:

**#1** (Include diagrams as needed)

How much Dobutamine does this man need per min?
2.2 lbs = 1 kg
170 lbs ÷ 22 lb/kg = 77.3 kg
77.3 kg x (10 mg/kg)/min = **773 mg/min**

How many liters per min?
(1,000 ml ÷ 500 mg) x 773 mg/min = 155 ml/min = **1.55 liters/min**

How many liters per hour? 1.55 l/min x 60 min/hr = **93 l/hr**

**#2** (Include diagrams as needed)

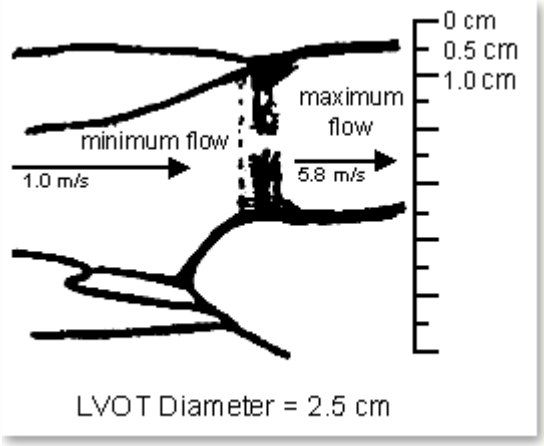
CSA = $\pi r^2$ = 3.14(2.5cm ÷ 2)² = 4.9cm² *r = LVOT DIAM ÷ 2*

AVA = LVOT x CSA ÷ AO

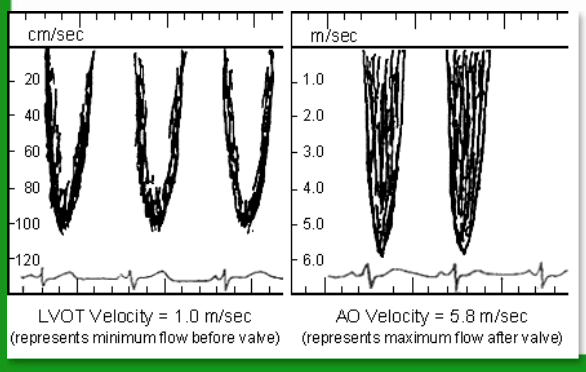
AVA = (1.0m/sec)(4.9cm) ÷ 5.8m/sec = .85 cm²

Aortic valve area ranges:

- Normal - 2.6 cm² to 1.6 cm²
- Mild - 1.6 cm² to 1.2 cm²
- Moderate - 1.2 cm² to 1.0 cm²
- Severe - 1.0 cm² to 0.8 cm²
- Critical - less than 0.75 cm²



LVOT Diameter = 2.5 cm



LVOT Velocity = 1.0 m/sec (represents minimum flow before valve)

AO Velocity = 5.8 m/sec (represents maximum flow after valve)

This patient has now been diagnosed with severe aortic stenosis. He will have echocardiograms to monitor the tightness of the valve. He will probably have a valve replacement in the near future.