

Pulmonary Shunt



Proper oxygenation of blood in the lungs depends on having almost all of the pulmonary blood flow come in contact with well-ventilated alveoli. If blood shunts from pulmonary artery to pulmonary vein without contacting working alveoli, the blood in the peripheral circulation will subsequently not be fully oxygenated.



Pulmonary shunting, also called venous admixture, can be significant in some cardiovascular and respiratory diseases.

The Pulmonary Shunt Protocol

Click Restart to reestablish initial conditions and then record control data. Go to . Scroll down to the hemodynamics box and slide the basic shunt flow up to 2000. Advance the solution 10 minutes

Acutely, focus on the ability of shunt to alter arterial pO₂ and oxygen content.



- Arterial pO₂ (mmHg)
- Arterial [O₂] (mL/mL)
- Venous pO₂ (mmHg)
- Venous [O₂] (mL/mL)

- Arterial Pressure (mmHg)

- Cardiac Output (mL/Min)
- Heart Rate (/Min)
- Stroke Volume (mL)
- Fistula Flow (mL/Min)

- Sympathetic Nerve Activity

- Plasma Renin Activity

- Na⁺ Excretion (mEq/Min)



Erythropoietin



Blood Volume (mL)

Red Cell Volume (mL)

Plasma Volume (mL)

Hematocrit (%)

| Time | 0 Min | 10 Min | 1 Day | 1 Month |
|----------------------------|----------|-----------|----------|------------|
| Arterial pO ₂ | | | | |
| Arterial [O ₂] | | | | |
| Venous pO ₂ | | | | |
| Venous [O ₂] | | | | |
| Blood Pressure | | | | |
| Cardiac Output | | | | |
| Heart Rate | | | | |



| | | | | |
|---------------------------|--|--|--|--|
| Stroke Volume | | | | |
| Symp. Nerves | | | | |
| Plasma Renin | | | | |
| Na ⁺ Excretion | | | | |
| Erythropoietin | | | | |
| Blood Volume | | | | |
| Red Cell Volume | | | | |
| Plasma Volume | | | | |
| Hematocrit | | | | |

Use an exercise stress test to characterize cardiac function.

Treadmill Speed (MPH)

Treadmill Grade (%)

Heart Rate (/Min)

| | | | | | | |
|------------|----|----|----|----|----|----|
| Time | 0' | 1' | 2' | 3' | 4' | 5' |
| Speed | 0 | 6 | 6 | 6 | 6 | 6 |
| Grade | 0% | 0% | 2% | 4% | 6% | 8% |
| Heart Rate | | | | | | |

Record the elapsed time and distance when this subject finally gives up.

Elapsed Time (Min)

Distance Traveled (Ft)

| | |
|--|--|
| | |
|--|--|

Pulmonary Shunt And Arterial pO₂

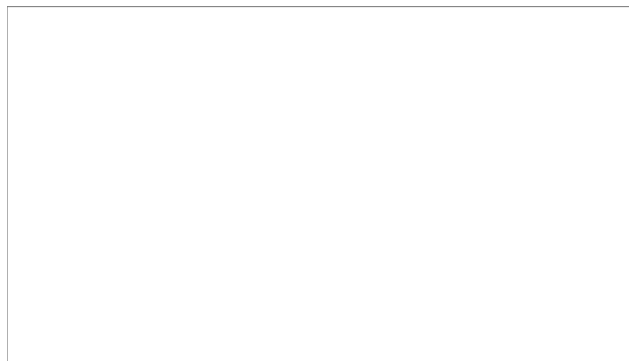
In this exercise, we'll observe the effect of pulmonary shunt on arterial pO₂ and [O₂].

Pulmonary Shunt (mL/Min)

Arterial pO₂ (mmHg)
Arterial [O₂] (mL/mL)

| | | | | | | |
|-------------------------------|-----|------|------|------|------|------|
| Shunt (mL/Min) | 500 | 1000 | 1500 | 2000 | 2500 | 3000 |
| Shunt (%CO) | | | | | | |
| Arterial [O ₂] | | | | | | |
| Arterial pO ₂ | | | | | | |
| Art. pO ₂ (% Norm) | | | | | | |

Plot arterial pO₂ as a function of pulmonary shunt. Use percent of normal as units for pO₂. Use percent of cardiac output as units for shunt.



Can arterial pO₂ be used to predict the magnitude of pulmonary shunt?

Question For Discussion

To distinguish between pulmonary shunting and diffusion block, a patient is given pure (100%) O₂. What is the rationale for this test? Try it.



