Cardiopulmonary Bypass
Clinical Scenarios

Case 1:

A 65-year-old male presents with aortic stenosis, aortic insufficiency, coronary artery disease, and closure of a large atrial septal defect for aortic valve replacement, ASD closure, and coronary artery bypass grafting.

He presented to the emergency department noting that his progressive dyspnea on exertion has been getting worse and that on the day of presentation he had chest pain. He has no allergies and other than hypertension and hyperlipidemia he as an unremarkable past history. He does note that he has a stent in his left femoral artery due to a traumatic injury 5 years ago. He is currently on metoprolol, lisinopril, and rosuvastatin. He does not take aspirin. He is 5'10 inches tall and weighs 189 pounds. He has a systolic murmur in the left lower sternal boarder. Lungs are clear and his neurologic status is intact.

Blood pressure is 120/80 mmHg, heart rate 68 beats per minute (NSR), respiratory rate is 10.

Na	K	Cl	HCO_3	BUN	Cr	Glu	Hgb	Hct	Plts
140	4	100	24	24	1.20	106	12	37.3	243

Echocardiogram shows normal ventricular function with an LV thickness of 13 mm. There is severe aortic stenosis with a peak gradient of 78 and a mean of 43 mmHg. There is trace mitral and tricuspid regurgitation. These is mild to moderate aortic regurgitation. CXR is clear.

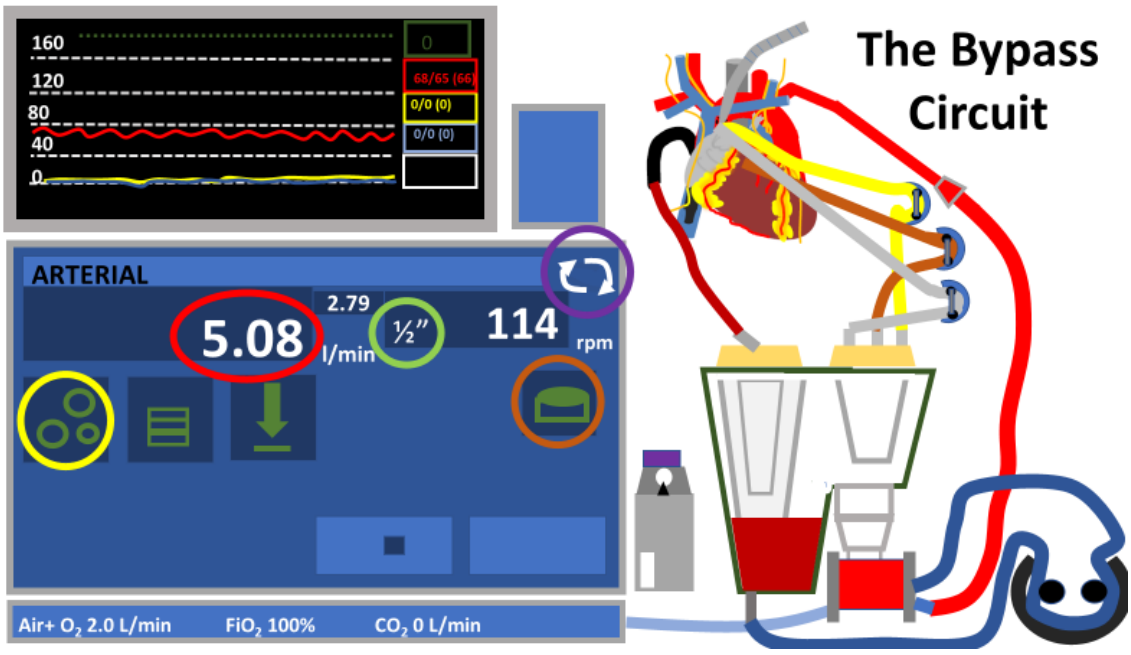
Cardiac catheterization shows a 95% left anterior descending coronary lesion, 75% left circumflex, and a 90% lesion of the mid right coronary artery. Right heart catheterization was also performed:

Blood pressure (right arm)	Heart rate	Aortic root pressure	CVP	RV	PA	WP	CO/CI
90/60 (mean 80)	68	150/90 (120)	8	36/8	36/15	15	

He is currently being managed with metoprolol, rosuvastatin, aspirin, and heparin infusion.

Regarding cardiopulmonary bypass planning:

1. Where will you place the arterial line?
    a. Right radial
    b. Left radial
    c. Right brachial
    d. Left femoral
2. What is the expected flow rate on bypass?
3. What is your target mean arterial pressure while on bypass?
    a. 55 mmHg
    b. 65 mmHg
    c. 75 mmHg
    d. 90 mmHg
4. What is circled red in the image below?
    a. Central venous pressure
    b. Flow rate
    c. Hemoglobin
    d. Potassium level

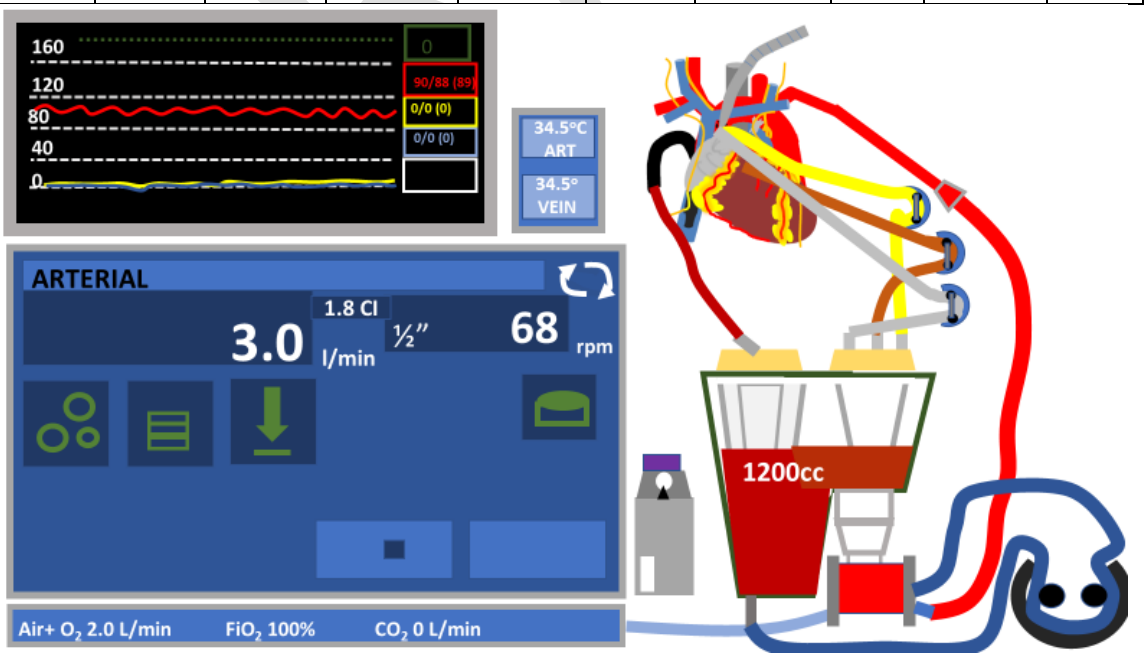


5. What is circled in yellow above?
    a. Pressure indicator
    b. Hemoglobin monitor
    c. Indication that the air detector is "on"
    d. Number of pumps running
6. What is the diameter of the circuitry tubing?

a. 1/8”
b. 5.08 mm
c. 2.79 cm
d. ½”

7. What is indicated by the figure circled in purple?
   a. Indication that the pump moves in a clockwise direction
   b. Indication that the pump flows in a counter clockwise direction
   c. Line pressure indicator
   d. Pump “On” button
8. What does the indicator in the orange circle mean?
   a. Pressure monitor is on
   b. Volume in the venous reservoir is adequate
   c. If the covering over the main roller pump is lifted, the pump will turn off
   d. The air detector is on
9. The surgeon places the aortic cannula in the ascending aorta. She requests that the perfusionist check the line pressure. Why?
   a. To assure that the pulsatility in the aortic cannula correlates with the pressure in the radial arterial line.
   b. To determine if there is a gradient between the aortic pressure and the radial pressure
   c. To confirm that there is a lot likelihood that a dissection occurred during cannulation
   d. All of the above.
10. Bypass is initiated and at 10 minutes the following lab parameters and bypass status is noted. Blood pressure is 90/88 (mean 89 mmHg).

T	HR	FiO_2	PaO_2	$PaCO_2$	pH	Lactate	BE	MVO2	Hgb
34.5ºC	0	100	400	40	7.28	3.5	-3	63%	10

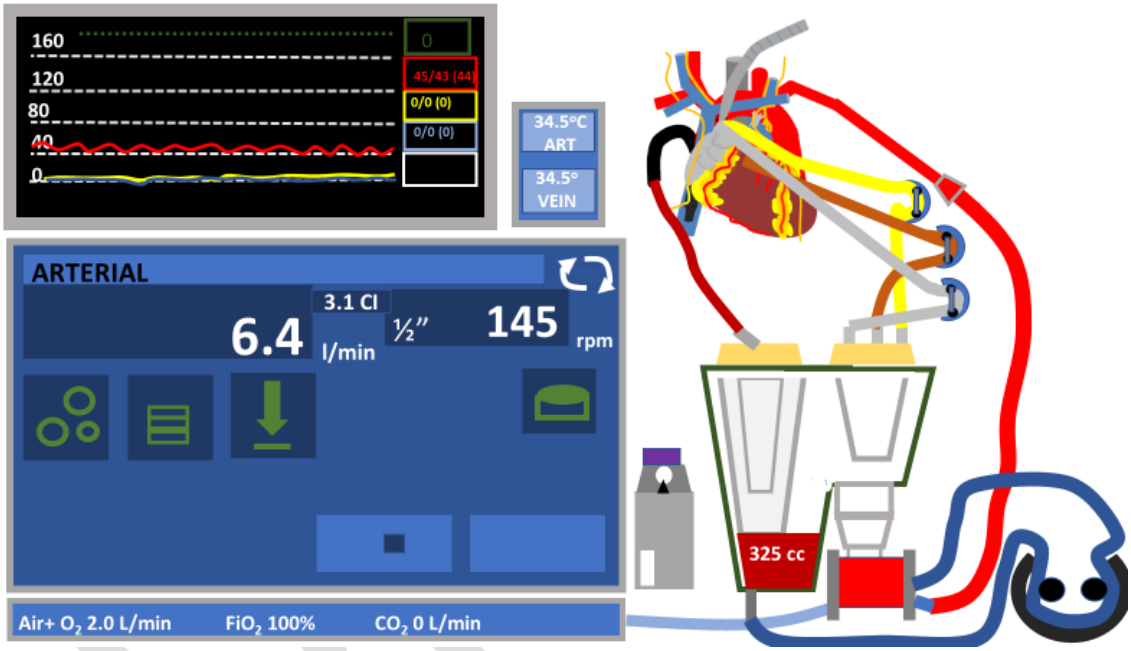


What is the likely diagnosis?

a. Vasoplegia
b. Excessive flow rates
c. Hyperventilation
d. Increased vascular tone

11. What is your intervention?
    a. Transfuse one unit of red blood cells
    b. Increase seep speed
    c. Reduce FiO_2
    d. Increase volatile agent or administer a narcotic
12. After 60 minutes of cardiopulmonary bypass the following lab parameters and bypass status is noted. Blood pressure is 44/43 (mean 44). What is your diagnosis?

T	HR	FiO_2	PaO_2	$PaCO_2$	pH	Lactate	BE	MVO_2	Hgb
34.5	0	100	400	40	7.28	3	-3	63%	10

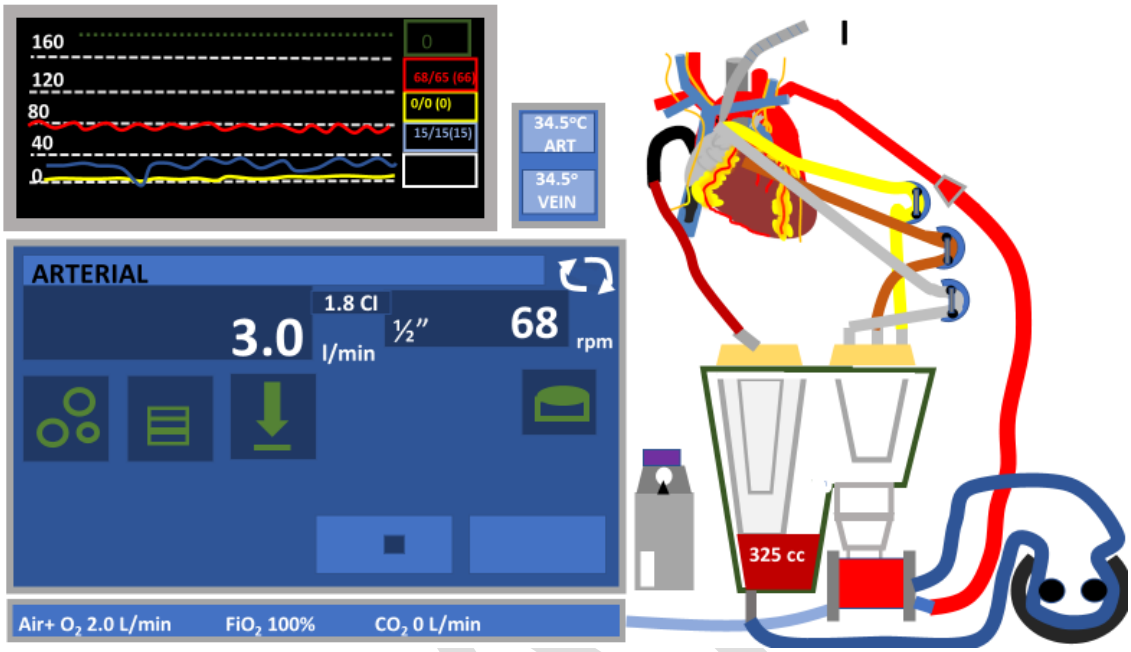


What is the likely diagnosis?
a. Vasoplegia
b. Increased vascular tone
c. Light anesthesia
d. Anemia

13. What is your intervention?
    a. Increase volatile agent
    b. Initiate phenylephrine
    c. Transfuse blood
    d. Reduce the sweep speed
14. After 2 hours of cardiopulmonary bypass, the surgeon is snares the superior venacava down on the SVC venous cannula. The perfusionist notes the following. Blood pressure is 68/65 (mean 66 mmHg) with 150 mcg/minute of phenylephrine.

The central venous pressure reads 15 mmHg. The following parameters are noted on the CDI:

T	HR	FiO_2	PaO_2	$PaCO_2$	pH	Lactate	BE	MVO_2	Hgb
34.5	0	100	400	40	7.28	3	-3	63%	10

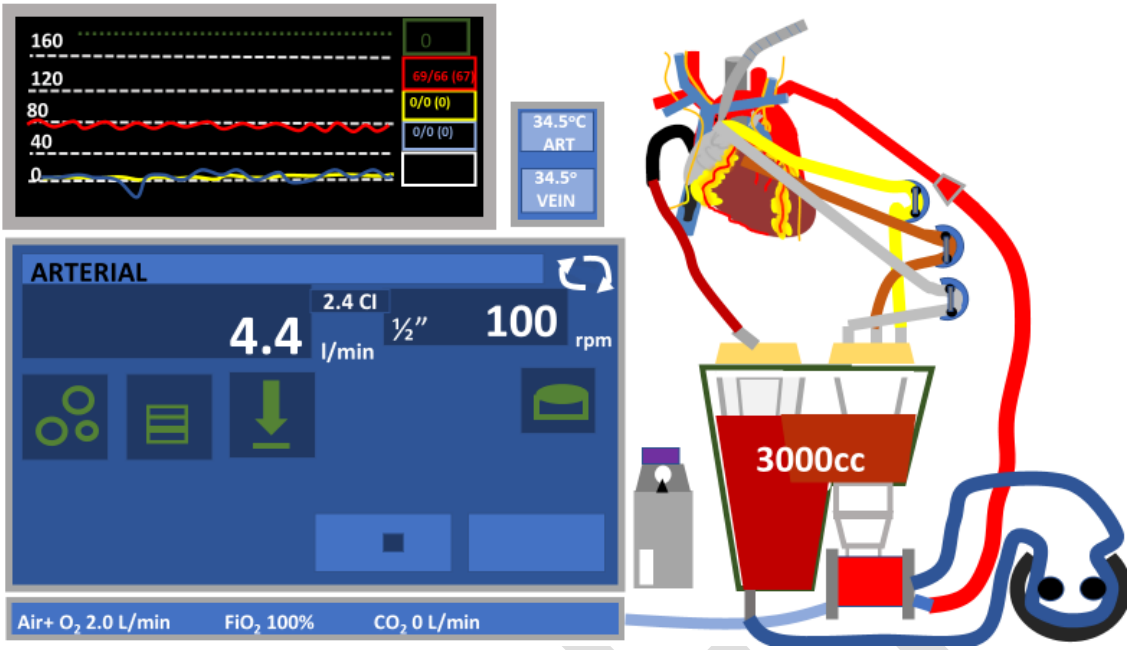


What is the likely problem?

a. Systemic hypovolemia
b. Obstruction of the inferior venacava
c. Obstruction of the superior venacava
d. Clot in the right atrium

15. At the 3-hour mark, the surgeon administers cardioplegia along. The perfusionist notes that 1L of Lactated Ringers was also administered to the bypass circuit. The following parameters are noted on the CDI:

T	HR	FiO_2	PaO_2	$PaCO_2$	pH	Lactate	BE	MVO_2	Hgb
34.5	0	100	400	40	7.40	3	-3	63%	5.8

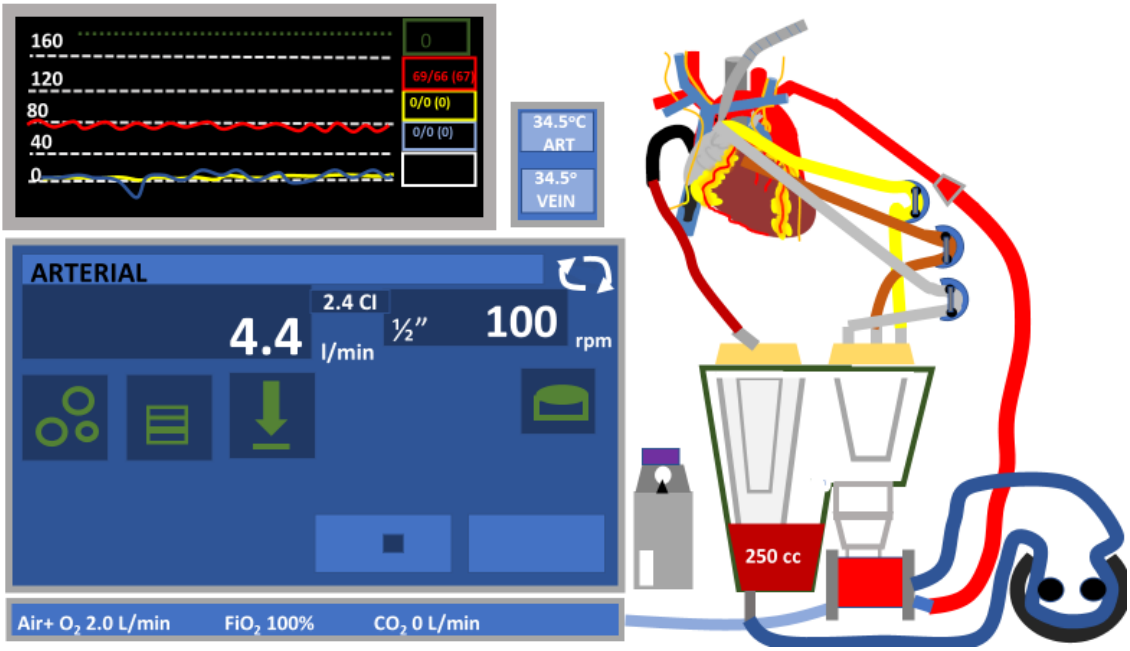


What is your course of action?

a. Increase the flow rate
b. Administer a unit of blood
c. Reduce the sweep speed
d. Ask the perfusionist to hemoconcentrate

16. At the 3.5 hour mark, the following parameters are noted on the CDI:

T	HR	FiO_2	PaO_2	$PaCO_2$	pH	Lactate	BE	MVO_2	Hgb
35.4	0	100	400	40	7.40	3	-3	63%	5.8



What is your next course of action?

a. Administer blood cells

b. Hemoconcentrate
c. Add Lactated Ringers to the hard shell venous reservoir
d. Increase the flow rate