

Scenario Design

1) Access insufficiency

Reference

<https://intensiveblog.com/an-ecmo-earthquake/>

Scenario Description

Insert clip: https://www.youtube.com/watch?v=0NUhDTp5v_8&t=2s&ab_channel=AlfredICU

“Kicking” of the ECMO lines.

Kicking is visible and palpable shaking of the circuit tubing draining to the pump. It indicates access insufficiency (not an earthquake).

Access insufficiency occurs when the suction pressure at the access cannula can draw in blood flow greater than venous return. When this occurs inflow is interrupted due to partial or complete occlusion of the inlet ports of the access cannula by the walls of the collapsible vein. After a few seconds, ongoing venous return fills up the vein again and the cannula ports reopen to function once more. This cycle repeats itself resulting in unstable, fluctuating ECMO flows (shown in L/min on the ECMO console) despite a stable pump speed (rpm).

Scenario flow

1. Load Scenario - flag which turn on the access insufficiency
2. Popup: Somethings wrong, your instructor asks you to check for access insufficiency
3. **blue button** - Check flows - these will be low, and oscillatory
{ecmo flow - (something really negative), rpm - 3000, }
4. **blue button** - Check ECMO pre oxygenator pressure - these will be very negative and oscillatory
5. **blue button** - Check plasma free haemoglobin - will come back as slightly elevated.

Confirming access insufficiency

6. Increase pump speed in steps of 100, this will cause flow and pressure to continue to decrease
7. Pop up - Confirmed Access Insufficiency
8. Pop up - you've confirmed access insufficiency thought the cause is unknown, how will you solve the access insufficiency?

Action:

9. Reduce pump speed by 500 rpm, this will alleviate the AI
10. **blue button** - Check cannula positioning - comes back with message cannula positioning is good
11. Give fluid x ml bolus. As a fluid challenge, look for BP response.
 1. Patient BP goes up

2. Access insufficiency has been resolved for a while you believe the cause was inadequate fluid regime (with respect to diuretics). Your supervisor thinks that the patient could benefit from more ecmo support.
3. Return the pump speed to a higher level (but not so high that AI returns).

Scene (flow of the scenario from Beginning to End)

No.	Objectives Description	Steps / Actions
1	Suspect access insufficiency	<ul style="list-style-type: none"> - Check circuit flows (unstable indicates) <ul style="list-style-type: none"> - Flow meter reading on ecmo console - Check negative pressures (increasing value indicates) <ul style="list-style-type: none"> - This should be part of our simulation (check reading for pre oxygenation pressure) - Check plasma free haemoglobin level (>0.1 g/dL indicates hemolysis?) <ul style="list-style-type: none"> - Can be a box with static value for now - value - slightly elevated
2	Confirms presence of access insufficiency	Ramp test <ul style="list-style-type: none"> - Increase the pump speed (x100 rpm) in a stepwise fashion - Observe if <ul style="list-style-type: none"> - ECMO blood flow increases steadily != access insufficiency - & vice versa
3	Immediate action to resolve "kicking"	<ul style="list-style-type: none"> - Reduce the pump speed, 500 rpm every 10 seconds until resolve - Maintain adequate oxygenation (how?) - Alternative <ul style="list-style-type: none"> - Give a fluid bolus
4	Discuss Kicking Causes <ul style="list-style-type: none"> - Can include this as part 2 of the scenario, maybe not part of the flow 	MCQ with ticking boxes? <ol style="list-style-type: none"> 4. Hypovolaemia/ haemorrhage 5. Poorly sited access cannula (too low) 6. Excessive pump speed (rpm setting) 7. Patient coughing or straining 8. Positional (e.g. after turning the patient) 9. Acute vasodilatation (e.g. sedation bolus) 10. Increased intra-abdominal pressure 11. High output cardiac failure (e.g. septic shock) 12. Cardiac tamponade (e.g. may occur after sternotomy performed during cardiothoracic surgery) 13. Thrombosis at cannula access site 14. Worsening cardiac function (e.g. cardiac

		arrest or acute heart failure while on VV ECMO)
5	Additional measures to resolve this - Part 2 of scenario	<ul style="list-style-type: none"> • Exclusion of ongoing haemorrhage and/or hypovolaemia • Confirmation of adequate cannula position • Optimise cannula positioning • Optimise patient position • Avoid vasodilators • Check intra-abdominal pressure, seek and treat underlying cause if increased • Exclude causes of obstructive shock (e.g. perform echocardiography) • If these measures are unsuccessful an additional access cannula may need to be inserted (high flow configuration).

15.