

ECMO ESSENTIALS PART 3

ECMO Weaning, Trial Off, and Decannulation

Veno-Venous (VV) and Veno-Arterial (VA) assessment pathways

CLINICAL FRAMEWORK

VV and VA assessment pathways

VV ECMO

Pulmonary recovery

Reduce circuit gas-exchange support and assess tolerance of a sweep-off trial.

VA ECMO

Cardiac recovery and perfusion

Reduce circulatory support and assess hemodynamics with echocardiography.

Both pathways require a team decision, defined failure criteria, and a decannulation plan.

02

VV ECMO

VV ECMO readiness

Underlying disease

The treatment team identifies meaningful improvement in the original disease process.

Gas exchange

ABGs and oxygenation improve in the context of current ventilator and circuit support.

Lung mechanics

Ventilator mechanics and pulmonary compliance support consideration of weaning.

Imaging

CXR findings and aeration indicate lung recovery.

03

VV ECMO

VV ECMO support reduction

Sweep gas	Reduce as carbon dioxide clearance improves. Sweep gas should be at least 1–3 L/min before a trial.
ECMO blood flow	A stepwise reduction in ECMO blood flow to limit circuit oxygenation is another method for weaning. It can be done together with a decrease of FdO2 or as a standalone method.
Circuit FdO2	Reduce with flow or maintain at 100%, depending on the program. Titrate oxygenation to the agreed SpO2 goal. Typical goal is to maintain an SpO2 of greater than 92% with minimal to no increase of ventilator FIO2.

04

VV ECMO

Oxygen challenge: the Cilley test (University of Michigan)

Desired eligibility: sweep <4 L/min and FdO2 < 70%. Assess each shift.

01 Challenge	Set ventilator FIO2 to 100% for 5 minutes. Keep ECMO settings unchanged.
02 Observe	The draft describes an immediate SpO2 increase to 100% as an initial positive response.
03 Sample	After a positive response, obtain an ABG at FIO2 100%. The PaO2 goal is > 150 mmHg.
04 Restore	Return the ventilator to its previous settings.

05

VV ECMO

VV trial-off initiation and monitoring

Initiation	At the start
The team confirms readiness at the lowest planned gas-support settings.	Record time, assessment, and vital signs.
Trained staff stop sweep gas using the approved circuit procedure.	Document ventilator respiratory rate, tidal volume, and minute ventilation.

1 hour	Draw ABG timing after trial initiation, if the patient continues to tolerate the trial.
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06

VV ECMO

VV tolerance and pulmonary recovery

Signs of intolerance

Tachycardia or tachypnea
Diaphoresis
Increasing anxiety
Labored breathing

Recovery measures

Improved static and dynamic compliance
Tidal volume and plateau pressure
CXR recovery and improved aeration

If intolerance develops

Restore the previously effective ECMO settings at any time. Reassess before another weaning attempt or trial.

07

VV ECMO

VV trial duration and decannulation

ABG assessment

The provider and ECMO specialist review acceptable pH, PaCO₂, and PaO₂ without increased ventilator support.

4–24 hours

The draft's trial-duration range depends on ECMO duration, disease process, and laboratory results.

Anticoagulation

Once decannulation timing is agreed upon, stop anticoagulation at least 3 hours beforehand.

Trial duration and anticoagulation timing are center and provider dependent.

08

VA ECMO

VA ECMO readiness

Native cardiac recovery is central to the assessment.

Cardiac and circulatory

Improved global cardiac function on echocardiography
Return of pulsatile flow
Reduced vasoactive drug requirements

Pulmonary

Improved CXR findings
Acceptable ABGs
Recovering ventilator mechanics

09

VA ECMO

VA ECMO weaning approach

Blood-flow plan	Specify blood pressure or MAP target, or a flow goal within a defined time. Use gradual, monitored reductions. The relative contribution of extracorporeal support may decline as native organ function improves.
Global function	Once the desired flow goal has been reached a bedside echo should be completed.
Persistent lung support required	Reduce sweep gas and FiO ₂ as pulmonary function permits. Assess the patient's response at each change. If gas support cannot decrease despite cardiac recovery, providers may consider transition to VV ECMO.

10

VA ECMO

VA reduced-flow echocardiography

1–1.5 L/min

The ECMO blood flow can be reduced to assess current cardiac function.

Assessment conditions

Begin after blood flow and gas support reach the lowest acceptable settings.

Evaluate global function during a supervised, protocol-defined reduction.

Special considerations

ECMO blood flow should never go lower than IFU recommendations to prevent stasis and clotting.

11

VA ECMO

VA tolerance: measures and response

Hemodynamics and perfusion

MAP >60 mmHg
Pulse pressure > 15-20 mmHg
Minimal inotropes
Stable oxygen and venous saturation

Cardiac function and trends

LVEF ≥20–25% and LVOT VTI ≥10 cm
Adequate RV function, no distension
Declining lactate
Recovering kidney and liver function

At every turnaround Document time, vital signs, and respiratory status. If intolerance develops, restore the last adequately supportive flow.

12

SHARED DECANULATION

Decannulation readiness and planning

Readiness decision	Confirm successful weaning and sufficient native pulmonary or cardiac recovery. Review all required parameters.
Procedure plan	Account for VV versus VA configuration, cannula type, patient condition, closure technique, and procedural setting.
Anticoagulation	Heparin must be stopped prior to decannulation. The time off anticoagulation is typically provider and center dependent. Time can range from just before decannulation to multiple hours.

13

DECANULATION

VV decannulation techniques

Preparation	Bedside removal is often feasible. Confirm the anticoagulation order and address residual coagulopathy as needed.
Cannula removal	At decannulation, trained staff stop circuit blood flow and clamp drainage and return lines. The provider removes sutures and cannulas. Each line will be removed carefully to not damage vessel walls. Manual compression should be applied for 30–60 min over puncture sites. Valsalva maneuver help prevent possible air embolism. Purse-string suture help facilitate hemostasis in larger cannulas. Key considerations: maintain dependent patient position, monitor for venous air embolism, correct residual coagulopathy if needed.

14

DECANULATION

VA decannulation techniques

Closure options	Hemostasis and support
Open surgical repair for selected arterial cannulas	Optimize ACT, aPTT, and platelet parameters under the local protocol.
Percutaneous closure devices when appropriate and expertise is available	Confirm the anticoagulation plan.
Manual compression when feasible	Protamine use requires a provider decision.

Arterial removal may require an operating room or ICU with surgical backup.

15

DECANNUATION

Post-decannulation surveillance

VV: venous complications

Bleeding or hematoma

Venous air embolism around removal

VA: arterial complications

Bleeding or hematoma

Limb ischemia or arterial thrombosis

Pseudoaneurysm

Arteriovenous fistula

Risk factors in the source

Large cannulas, prolonged ECMO duration, calcified vessels, and coagulopathy warrant careful planning and surveillance.

16

CLOSING SUMMARY

Coordinated decisions at each stage

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|------------------------|---|
| 01 Readiness | The team confirms native-organ recovery and agrees on measurable assessment criteria. |
| 02 Tolerance | VV gas-off trials and VA reduced-flow assessments use distinct monitoring and failure criteria. |
| 03 Removal | The team agrees on timing, anticoagulation, technique, and the required procedural support. |
| 04 Surveillance | Clinicians monitor vascular and clinical status and respond promptly to complications. |

18