Extracorporeal Life Support (ECLS) Initiation

Quicklinks

Site Applicability

VGH Acute Care Areas primarily: OR, ICU, Cardiac Cath Lab, CSICU and Emergency Department

Practice Level

Profession	Basic Competency	Advanced Competency (with Additional Education)
Perfusionist		After completion of Advanced Orientation ECLS Course: • Assist with initiation of ECLS
• **Critical Care RN** • **Emergency RN** • **OR RN**	**After completion of critical care, emergency or operating room specialty education where the following are core competencies and expectations of the role:** • Assist with initiation of ECLS as outlined in this document	
• **RT** • **AA**	• Assist with initiation of ECLS as outlined in this document	

Requirements

- ECLS initiation shall take place in the operating room, or critical care areas whenever possible.
- ECLS initiation is an urgent situation and must be completed by two perfusionists.
- Perfusionists are responsible for all circuit manipulation / interventions.
- ECLS specialists' primary responsibility during ECLS initiation is patient monitoring.

Need to Know

- Extracorporeal support may be provided in two principle ways, venovenous (VV) and venoarterial (VA)
    - Venovenous ECLS provides only respiratory support
    - Venoarterial provides both cardiac and respiratory support
- The ECLS circuit remains the same for VV and VA ECMO, mode of support depends on cannulation configuration
- ECLS initiation should be undertaken in a sterile manner
- Adequate preparation & efficiency are paramount to safety
- ECLS therapy is an advanced life support mechanism for which complications are numerous and, in some cases serious.
- Patients selected to undergo ECLS therapy should have a reasonable anticipation of survival if the original cardiopulmonary insult can be successfully supported with ECLS therapy.
- Considerations for ECMO cannulation are:

Normothermic Cases (Core temperature 35˚C and above) **Potential Candidates**
• Witnessed cardiac arrest, refractory to conventional advanced cardiac life support measures for 20 minutes or more. • Reversible etiology (e.g. acute coronary syndrome, refractory dysrhythmia, pulmonary embolus, structural cardiac disease, cardio-toxic ingestion). • Age less than 65 years. • Refractory cardiogenic shock or recurrent cardiac arrests in patients satisfying criteria 2 and 3.
Normothermic Cases (Core temperature 35˚C and above) **Relative Contraindications**
• Delay in CPR (no flow time) for 5 minutes or greater. • Duration of resuscitative efforts for 45 minutes or greater. • Significant pre-existing organ failure, active malignancy, or verified do not resuscitate order. • Active hemorrhage.
Hypothermia Cases (Core temperature below 35˚ C) Refer to the Accidental Hypothermia Clinical Practice Guideline for British Columbia and follow consultation process in Appendix A.

Equipment, Supplies, and Medication

- New ECLS circuit (primed with plasmalyte A and ready for use)
- Heater-cooler with sterile water set to 37 degrees
- Personal protection (PPE): Unsterile gloves, gowns, and masks with face-shield
- Sterile drapes (medium) x 2 or physician preference
- Sterile tubing clamps x 6

- Sterile tubing (heavy) scissors x 2
- Needle drivers
- 0-Silk sutures x 2
- Unsterile tubing clamps x 4
- Bedside table or OR sterile back table
- 1L bag of plasmalyte connected to new circuit via quick prime line
- Sterile bulb syringe and basin filled with crystalloid solution
- Cannulae chosen to suit patient needs
- Sterile dressing
- Imaging/Fluroscopy/Ultrasound (As per MD)
- Cannulating MD (or designate) will order medications, on an individual basis, to be available during ECLS initiation.
- A designated RN will administer medications as directed by the cannulating MD, during the procedure.

Procedure

A. If cannulation takes place in OR, standard OR setup will be used along with preferences of cannulating physician. (Refer to Appendix D)

B. If cannulation takes place in ED please refer to Appendix A.

Room Setup

1. Assemble patient care team once the need for ECLS therapy has been established
2. Remove any unnecessary equipment or items from the room
3. Rearrange equipment in the patient room in order to facilitate the ECLS circuit, including bed if required
4. Bring ECLS circuit into room and place in a position such that the new patient lines are easily accessible to the cannulating physician for later connection to the patient
5. Ensure adequate floor space available for mobile fluoroscopy if necessary (Dual lumen cannula insertion)
6. Instruct any unnecessary staff members to leave the area

Procedure

Note: Multidisciplinary (RN, RT, AA, MD, perfusion) review of patient should be completed prior to ECLS initiation. Sedation, analgesia, paralysis, and anticoagulation should be considered and implemented as ordered by the physician.

1. Obtain informed consent.
2. Don Personal Protective Equipment (PPE).
3. Timeout to discuss:
    a) Cannula size
    b) Cannulation strategy
        - Roles
        - Order of procedure
    c) Anticoagulation
4. Open Sterile supplies (sterile drapes, sterile tubing clamps, sterile tubing (heavy) scissors) beginning with drape for bedside table

5. Turn RPM on ECLS pump and sweep gas to zero and set ECLS FiO_2 to 100%
6. Clamp return and access lines on the unsterile portion near the reservoir as well as near the oxygenator inlet and outlet, 4 clamps total

Sorin Circuit

7. Unwrap patient return line from sterile sleeve, ensuring sterility
8. Have cannulating physician use a sterile tubing clamp to clamp return line on the unwrapped sterile portion and cut with sterile scissors, using the sterile clamp to maintain control of the line once cut
9. Repeat step 6 & 7 with patient access line

CardioHelp Circuit

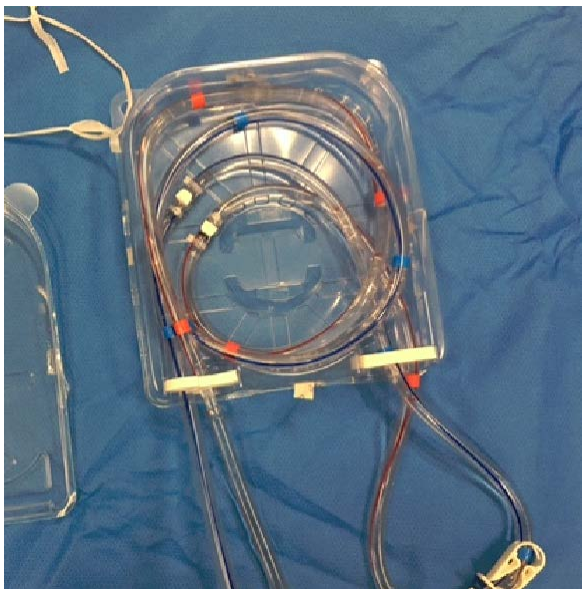
10. Open the AV loop, ensuring sterility
11. Have cannulating physician remove access/return lines, clamp proximal to the connectors and cut off connectors with sterile scissors (leave as much length as possible)
12. Have cannulating physician secure lines in the sterile field using a tubing clamp

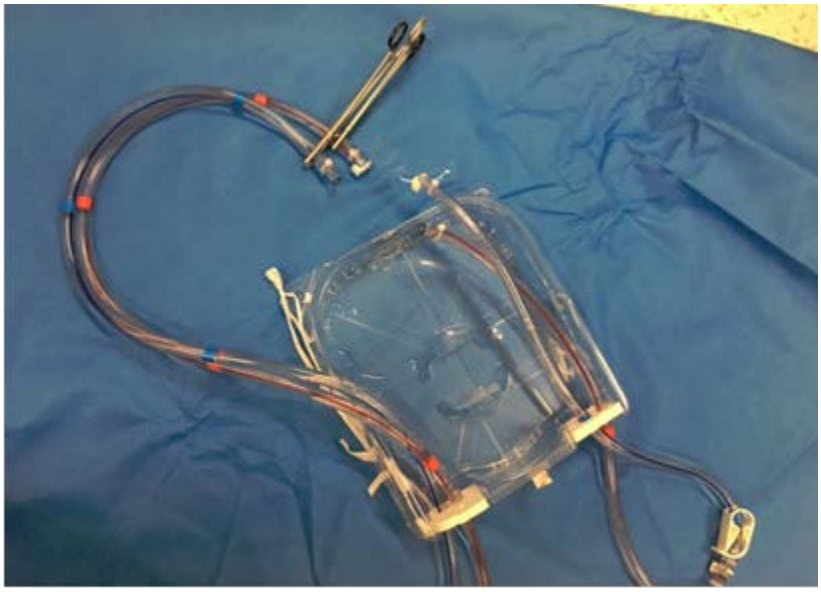
Both ECMO circuits

13. Secure lines to bed with a tubing clamp on unsterile portion
14. Ensure 1L plasmalyte is in a pressure bag and connected to pre-membrane stopcock via quick-prime line +/- perfusion adaptor
15. Ensure stopcock is turned off to the patient and clamped on quick prime line
16. Open stopcock on quick prime line from 1L bag of plasmalyte leaving tubing clamp in place
17. Remove tubing clamp from return line on sterile field
18. Remove tubing clamp from quick-prime line and outlet side (clamp control) of the oxygenator upon physician request to facilitate air-free connection of line to cannula. Replace clamps once connection is made on the unsterile portion only.
19. Visualize and inspect connection for air as well as correct sequence (i.e. return cannula-return line) and verbally confirm connection with physician
20. Repeat steps 17 & 18 with access line
21. Turn stopcock off to the prime line to allow pressure transducer to read accurately
22. At physician request for initiation, increase RPM to 1000, remove clamp from patient access line then remove clamp from patient return line to initiate forward flow
23. Turn on sweep gas flow to value half that of blood flow or physician requested value
    a. Slow correction of pCO2
24. Increase RPM slowly to increase pump flow to achieve target blood flow and/or hemodynamic support, as per physician request
25. Obtain ABG as soon as possible and titrate sweep gas, unless otherwise directed by a physician
26. Remove quick-prime line and cap stop-cock with a sterile red dead end cap
27. Have RT review ventilator settings and adjust according to pathology, mode of ECLS and as per physician request.

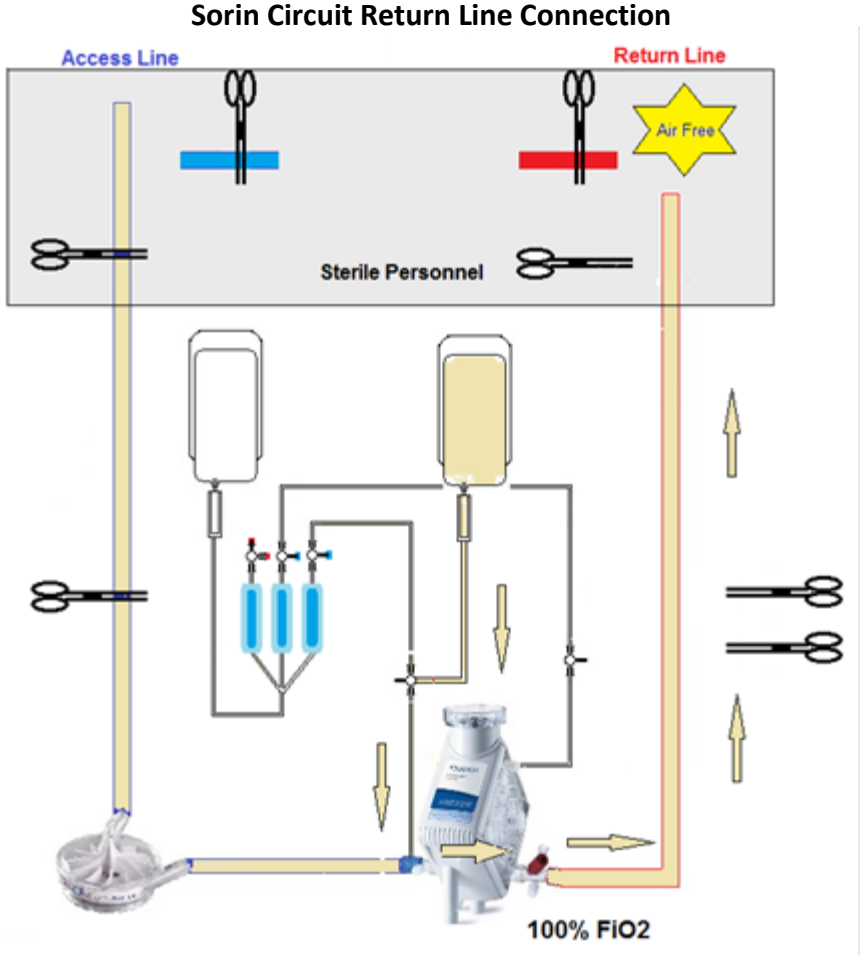
Note: Ventilator settings should be adjusted according to physician order and may include lung protective ventilation strategies.

CardioHelp AV loop





Sorin Circuit Return Line Connection



Expected Patient Outcome

ECLS therapy is initiated safely. Complications are minimized or avoided.

Patient/Client/Resident Education

Patient/client/family members will understand the benefits and risks of ECLS therapy.

Documentation

The following information should be documented in the perfusion services ECLS Record as well as the nurses' notes:

- Reason for ECLS initiation
- Time of initiation of ECLS therapy
- Patient's response to initiation of ECLS therapy
- Any complications encountered during ECLS initiation
- Disposition of patient following initiation

Related Documents

- D-00-12-30025: Extracorporeal Life Support (ECLS) Circuit Change-Out
- D-00-12-30026: Extracorporeal Life Support (ECLS) Intra Hospital Transport
- D-00-12-30027: Assessing Extracorporeal Life Support (ECLS) Oxygenator Function
- D-00-12-30235: Extracorporeal Life Support (ECLS) External Pump Drive Failure
- D-00-12-30374: Extracorporeal Life Support (ECLS) Wall-Gas Failure
- Emergency De-Airing (Massive Air) of Extracorporeal Life Support (ECLS) Circuit
- Extracorporeal Life Support Separation and Decannulation *(awaiting approval)*

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8. Gravlee et al, Cardiopulmonary Bypass: Principles and Practice (Lippincott Williams & Wilkins, Pennsylvania, 2008), (third edition)

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Owners: *(optional)*	VCH
	Development Team Member(s): • Clinical Nurse Educator, Critical Care ICU VGH • Medical Director Critical Care/ICU, VGH • BSc.Kin, RRT, CPC, Perfusion Services, VGH • BSc, MSc, CCP, CPC, Supervisor of Perfusion Services, VGH • Clinical Nurse Specialist, Intensive Care and High Acuity, VGH • Respiratory Therapist / Practice Leader, Respiratory Services, VGH • Nurse Clinician, Emergency Department, VGH

Appendix A: Initiation ECLS in the Emergency Department

When an ECLS candidate is identified in the ED:

- EP to call Intensive Care Unit (ICU) staff physician on call
- EP to notify ED Head/Charge Nurse
- ICU staff physician will make determination if patient is a candidate for ECLS
- ICU staff physician will coordinate additional resources required:
    - Perfusion
    - Cardiac Surgery
    - Interventional Cardiology
- ICU staff physician will inform the ED as soon as possible if a patient will be seen / treated in the ED or directed to the cardiac catheterization lab based on respective resource availability.

Roles and Responsibilities for ECLS in the ED:

All Team Members:

- Protect yourself, don appropriate Personal Protective Equipment (PPE)
- Introduce yourself to your team and don identification sticker
- Establish roles and responsibilities
- Participating in pre-briefing
- See Appendix B for ECLS Team positioning.

Head/Charge Nurse:

- Assemble the required ED RN resources
- Ensure ECLS patient is in appropriate bed space. Move other patients if necessary
- Discuss with team if ED requires other resources
- Ensure the automated chest compression device is at the bedside prior to ECLS being initiated. This piece of equipment is essential for patients at risk for cardiac arrest
- Liaise with security
- Liaise with ICU Charge Nurse

Bedside Nurse Lead (BNL):

- Identified on daily assignment sheet
- Overviews patient care; visualizes patient and all ECLS team members
- Maintains close-loop communication by ensuring:
    - All tasks are communicated to the team
    - Acknowledged by the individual who will perform the task
    - Completion of task is communicated back
- Time keeper, notifies the team of time points key to patient care and decision making.
- Documents in the Emergency Nurse Record.
- In conjunction with EP, ICU physician, and perfusionists summarize findings and plan with team pre / post cannulation

Registered Nurse (RN) 1:

- Identified on daily assignment sheet
- Initiates peripheral IVs as ordered. Ensure established IVs are patent.

- Administers medications as ordered.
- Applies monitor and initiates vital sign monitoring.
- Assisting physicians as directed with sterile procedures.
- Acknowledges all orders received and clarifies if necessary, and verbalizes completion of tasks (closed loop communication).

Registered Nurse (RN) 2:

- Identified on daily assignment sheet
- Functions as a 'Circulating Nurse' assisting RN 1.
- Responsible for preparing and administering medications ordered.
- Announces need to deliver ordered PRN medications.
- Awaits affirmation for need of medication from RTL and verbalizes completion of order once completed.
- Runner, obtains drugs, other required supplies and equipment

ED RN Roles and Responsibilities for ECLS Transport:

The Perfusionist is the transfer leader and will direct the intra-hospital transfer.
Individuals must always be present in the transport of the ECMO patient includes:

- ED RN
- ICU physician
- Perfusionist(s) two
- Respiratory Therapist
- Support Staff (i.e. porter, security, PCA)

See D-00-12-30026: Extracorporeal Life Support (ECLS) Intra-Hospital Transport for more information.

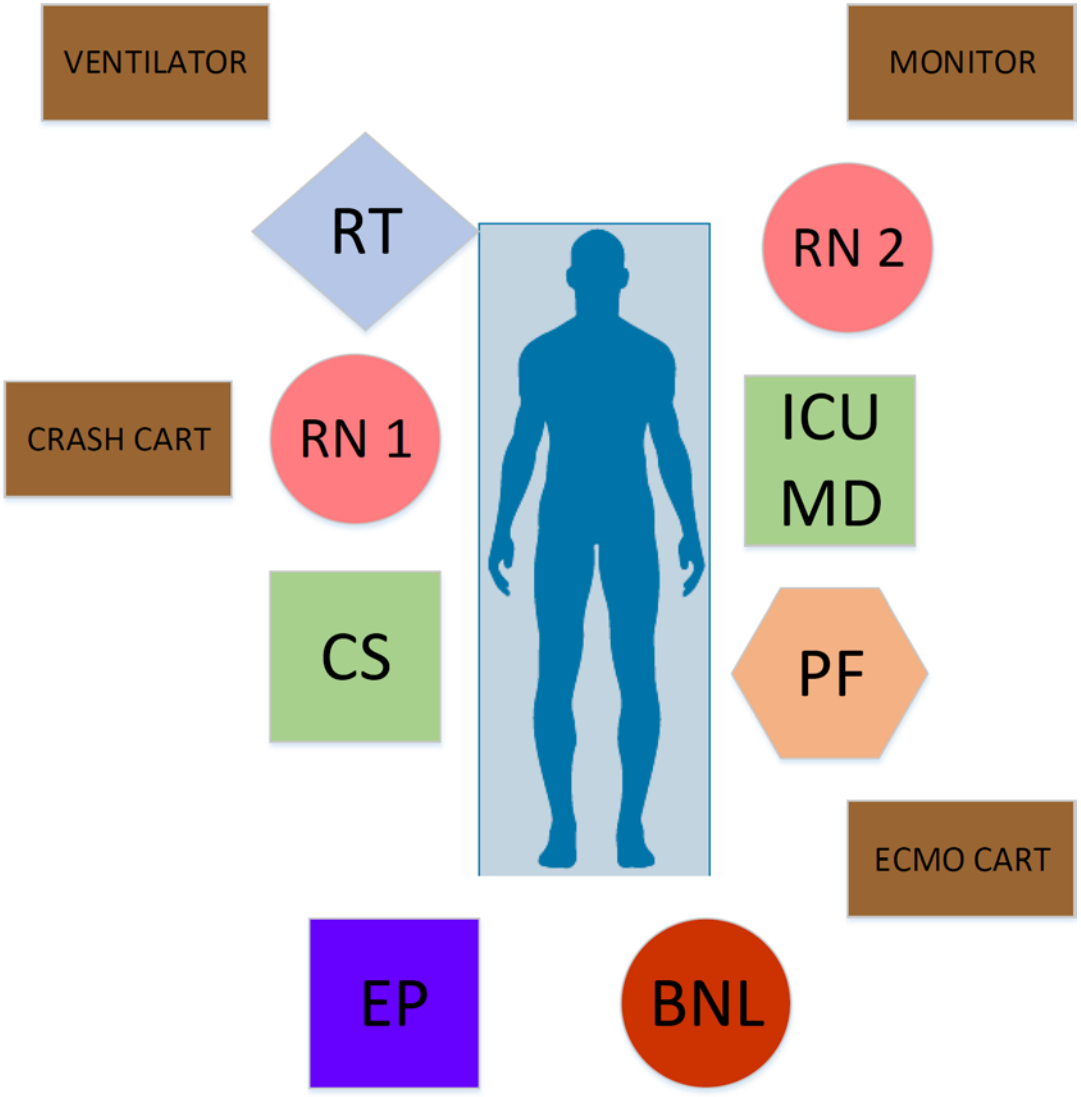
Discontinue ECLS

- If decision is made to discontinue on the ECLS treatment (see Extracorporeal Life Support (ECLS) Separation and Decannulation *(awaiting Approval)* for more information) while patient still the ED, consideration for should first be made for potential organ donation.
- Family meeting / discussion on goals of care
- Liaise with ED social worker
- Contact BC Transplant 1-877-DONOR BC

ED RN Documentation

- Documents as per Emergency Department standards of practice for an ongoing resuscitation
- Document transfer and handover
    - Date and time
    - Who accompanied the patient on transfer
    - Destination

Appendix B: ECLS Team Positioning in the ED



Appendix C: ICU Bedside Cannulation Checklist

Vancouver General Hospital Intensive Care Unit

ECLS Cannulation Procedure

Bedside Resource

ECLS Steering Committee

Contacts: V Harris (ECLS Coordinator), S Kalan (ICU CNE), Dr. H Kanji (Intensivist), , A Wnuk (RT Practice Lead)

Pre-Cannulation	Cannulation	Post-Cannulation
Intensivist: - Arranges time and equipment with 1st on-call Perfusionist - Confirms: o Need for Fluro and organizes with IR for: OR table, lead, sterile drape o Need for TEE and requests necessary equipment and personnel - Instructs room set up and position	**TIME OUT PROCEDURE:** - Led by cannulating MD - Staff introduced and roles identified - Plan reviewed - Confirms equipment, meds, & current cross match - Don personal protective equipment **Intensivist/Surgeon:** - Performs cannulation with one other MD - Connects ECLS circuit to cannulas	**Intensivist:** - Secures cannulas - Orders x-ray to confirm cannula location - Completes *Critical Care ECLS Maintenance PPO* - Completes ECLS Patient: Daily Goals - Completes debriefing
Perfusionist: - Coordinates with cannulating MD - Brings ECMO circuit, cannulas and additional cannulation equipment to bedside - Confirm cannula sizes	**Perfusionist:** - Hand cannulas, guide wires, connectors and ECMO lines to sterile field. - Initiates ECLS and confirms flows and ECLS settings with team o FiO2 100% o Sweep 1LPM (slow correction of CO2) - Assists with crowd control	**Perfusionist:** - Manages circuit and adjusts to achieve desired patient goals - Documents ECLS initiation time on ECLS Assist Record - Checks distal pulses to cannulated limbs with RN - Completes patient circuit checklist - Completes daily database entry - Review *Critical Care ECLS Maintenance* PPO - Reviews ECLS Patient: Daily Goals - Ensures contact number located on circuit and displayed in room
RT: - Run pre ECLS ABG - Ensure CXR has been done and ETT in correct position - Ensure one O2 and one air outlet available for ECLS machine	**RT:** - Standard patient monitoring and documentation - Adjusts ventilation as per MD direction: suggest ultra-protective lung strategies - Communicates all changes to ventilator during procedure with MDs and perfusionist. - Assist with crowd control	**RT:** - Standard patient monitoring and documentation - Documents ECLS sweep, flow, and FiO2 on Critical Care Flowsheet - Reduce ventilation settings to rest settings as per MD direction - Review *Critical Care ECLS Maintenance PPO* - Review ECLS Patient: Daily Goals

PRE-Cannulation	Cannulation	Post-Cannulation
RN: - Ensure cannulating leads identified (intensivist/surgeon) - Pre ECLS BW: CBC, coags, extended lytes, ionized Calcium, lactate. - Ensures current Group and Screen - Room preparation/Positioning: o **Call main OR at 66310** & ask for **Radiolucent OR Table** to ICU bed#____. o **Call X-ray 66353** & ask for **ECMO Cannulation Equipment** to ICU bed#___ (after 2000 & weekends call 62520). o Obtain **Fluro Arm Drape** from ECLS circuit room behind bed #8. o TEE and/or bedside ECHO from ICU supplies o Remove unnecessary equipment - Hold tube feeds prior to procedure; NG connected to low suction - Stop insulin infusion with feeds. - Transfer patient to OR table, position supine; table pulled away from wall - Ensure monitoring equipment is applied (NIBP q 1min or art line, ECG, SaO2) - Ensures IV access is established - Preps meds for procedure (paralytics, sedation, analgesia as per MD) - Levophed should be primed and ready in pump - Have syringe of phenylephrine drawn and ready - Confirm dose of heparin with MD (usually 5000 Units) and have ready to administer - Have ACLS cart readily available.	**RN:** - Standard patient monitoring as with all procedures - Monitors level of sedation - Administers meds as ordered by MD o Have heparin bolus ready to administer as soon as MD calls out for it during cannulation - Documents medications on PAD record - Document in NN pre-procedure status, personnel present and VS - Documents in NN patient response to procedure and ECLS initiation - Obtains equipment/supplies as requested by perfusion team and/or MD - Assist with crowd control	**RN:** - Standard patient monitoring and documentation - Monitor temp until normothermic or temp goal achieved - Document procedure in NN – ECLS cannula location, cannula size, mode (VA/VV) and current VS. - Check cannula drsg o Reinforce but DO NOT disturb drsg. - Maintain target RASS - Position patient as per orders - Check distal pulses to cannulated limbs with Perfusionist - Transfer patient back onto ICU bed and call OR (66310) to pick up OR Table, Fluro, and Lead - Review *Critical Care ECLS Maintenance PPO* - Review *ECLS Patient: Daily Goals*

Appendix D: Initiation of ECLS in OR*

When an ECLS candidate identified for the OR:

- Surgeon (Cardiac, Thoracic or Trauma) will call the OR Control Desk to book case
- Surgeon will speak to D1/N1 Anesthesiologist
- OR Control Desk Coordinator/Charge Nurse will coordinate additional resources:
    - Perfusion
    - Anesthesia Assistant (AA)
    - OR Nursing
    - Perioperative Assistant (PA)
    - MDRD (for case cart)
    - Cardiac Assistant PRN

Roles and Responsibilities:

All Team Members:

- Protect yourself, don appropriate Personal Protective Equipment (PPE)
- Establish roles and responsibilities
- Participate in pre-briefing

OR Nursing:

- Set up room and sterile back table as per ECMO Cannulation Resource Book (located at the OR Control Desk)

Perioperative Assistant:

- Ensure standard OR table in the required OR
- Assist with transfer of patient to the OR table
- Assist nursing and AAs as required

Anesthesia Assistant:

Setup

- Confirm Initiation plan with lead Anesthesiologist

- Confirm Standard cardiac setup
    - Prepare standard cardiac setup medications
    - Prepare Equipment
        - Cerebral oximeter
        - Ultrasound
        - Echo
        - Sterile Tray with extra drape
    - Prepare Lines
        - Arterial Line
        - IV/ Blood infusion set

Patient Preparation and Procedure:

- Transfer patient to OR table, patient in supine position
- Applies monitor and initiates vital sign monitoring
- Setup cerebral oximeter monitoring
- Initiates peripheral IV and Arterial Line
- Provide airway management and intubate patient as requested by physician
- Ensure ETT in correct position and adjust ventilation as necessary
- Assist with Echo insertion and setup
- Maintain hemodynamic stability of patient and administer medications as needed.
- Monitor depth of anesthesia
- Adjust ventilator support as needed
- Run pre-ECLS ABG
- Confirm size of cannula with Anesthesiologist, Perfusion and Surgeon.
- Assist with sterile procedure.
    - Setup percutaneous sheath set on sterile tray
    - Obtain correct size cannula from perfusion
    - Ensure Heparin bolus(5000 units) is prepared and administer as per physician request
    - In Lung Transplant cases-> Run heparin infusion (25000units/500ml)-obtain from PACU omnicell
- Maintain close-loop communication with all team members

- Summarize findings and plan with team post cannulation
- Adjust ventilation post cannulation: suggest ultra-protective lung strategies
- Communicate changes with physician and perfusion

Roles and Responsibilities for ECLS Transport:

The Perfusionist is the transfer leader and will direct the intra-hospital transfer.
Individuals must always be present in the transport of the ECMO patient includes:

- RN
- Physician
- Perfusionist(s) two
- Anesthesia Assistant
- Support Staff (i.e. porter, security, PCA)

See D-00-12-30026: Extracorporeal Life Support (ECLS) Intra-Hospital Transport for more information.

*ECLS can be started in many different areas and many different circumstances. The AA will support the Anesthesiologist with ECLS starts in all areas of the hospital.