Interrupting The ECMO Circuit

Mark Lucas, MPS, CCP, ECMO Coordinator
Leo Carr, MS, CCP, Lead Perfusionist
Objectives

- Discuss the need for interrupting the ECMO circuit
- Discuss the infection risks for ECMO patients
- Describe the importance of aseptic technique
- Describe the aseptic procedure interrupting the ECMO circuit
Reasons to Interrupt the circuit

Device changes
• Oxygenator – occur 13.6% all runs (ELSO)
• Blood pump – occur 7.2% all runs (ELSO)

Replace circuit
• Complete circuit exchange – occurrence unknown

Cannulation changes
• VV > VA, VVA, VAA - occurrence unknown

Emergent repair
• Broken stopcocks, connectors – occur 1.3% all runs (ELSO)
Increases Infection Risk

- Health care–associated infections (HAIs) are among the most common complications of hospital care.
- Blood borne infections are known to cause endocarditis, and other metastatic infections (e.g., lung abscess, brain abscess, osteomyelitis, and endophthalmitis).

CDC MMWR 2011
ELSO Registry - Infection

ELSO Registry Data reports 15% of patients with blood stream infections and an incidence of 68% mortality in this group.

Increased frequency of infection with
- increasing age
- support > 14 days
- VV DL cannulation

Causitive agents:
- Frequency of circuit interventions
- length of time with vascular access
- Patient deconditioning
- Nutritional status
- Mechanical ventilation
- Airway and airway management
Bloodstream infection was the most common infection

Duration of ECMO, mechanical complications, autoimmune disease, and venovenous mode seemed to be independently associated with infections.

Most common ICU room pathogens

- **Gram (+)** - Enterococcus, Streptococcus, Staphylococcus, MRSA
- **Gram (-)** – Acinetobacter, E-coli, Klebsiella
- **Fungal** – candida albicans
- **Spore forming bacteria** - C difficile,
  - Bacterial density is highest near the patient
  - Bacteria can last for months on inanimate objects such as bed rails, medical tubings and countertops
Pathogen Longevity on Inanimate Surfaces

- *Clostridium difficile* (spores) 5 months
- *Escherichia coli* 1.5 hours – 16 months
- Enterococcus spp. including VRE and VSE 5 days – 4 months
- Klebsiella spp. 2 hours to > 30 months
- *Staphylococcus aureus*, including MRSA 7 days – 7 months
- *Streptococcus pyogenes* 3 days – 6.5 months
- *Candida albicans* 4 months

Kramer How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. *BMC Infectious Diseases* 2006, 6:130
Chlorhexidine prep should be used, rather than alcohol or betadine unless there is a specific allergy or contraindication.

In general, it is recommended that the ECMO circuit be cared for like a protected central line used for hyperalimentation, such that “breaking” the line unnecessarily is strongly discouraged. This will make contamination of the circuit much less likely.
ChloraPrep® Hi-Lite Orange
Isopropyl alcohol
Chlorhexidine digluconate
FD and C Yellow No. 6

ChloraPrep antimicrobial activity is effective against microorganisms including
• gram-positive and gram-negative bacteria,
• Methicillin-resistant *Staphylococcus aureus* (MRSA),
• Vancomycin- resistant *Enterococci*(VRE),
• *Clostridium difficile*, *Acinetobacter*, and most viruses and fungi.

ChloraPrep® Solutions Safety Data Sheet 30/03/2015
Betadine Aqueous

**Drug Facts**

**Active ingredient**  
Povidone-iodine, 10% (1% available iodine)  
**Purpose**  
Antiseptic

**Uses**  
Patient pre-operative skin preparation  
for preparation of the skin prior to surgery  
helps reduce bacteria that potentially can cause skin infection

**Warnings**  
For external use only  
Do not use in the eyes  
if you are allergic to povidone-iodine or any other ingredients in this preparation  
When using this product  
prolonged exposure to wet solution may cause irritation or, rarely, severe skin reactions  
in pre-operative prepping, avoid “pooling” beneath the patient

Stop use and ask a doctor if  
irritation, sensitization, or allergic reaction occurs and lasts for 72 hours. These may be signs of a serious condition.

Keep out of reach of children. If swallowed, get medical help or contact a Poison Control Center right away.

**Directions**  
clean the operative site prior to surgery  
apply product and allow to dry  
may be covered with a bandage

**Other information**  
store at 25°C (77°F); excursions permitted between 15°-30°C (59°-86°F)  
store in original container

**Inactive ingredients**  
pareth 25-9, purified water, sodium hydroxide

**Questions?**  
1-888-726-7535 (8am-5pm, EST, Mon.-Fri.)

**Betadine skin cleanser**  
Povidone-iodine, 7.5%  
The brand used in hospitals for over 45 years

**Skin Sanitizer**  
Kills Germs Promptly

4 fl oz (118 ml)
Set Up and Good Practice

**Set up**

Sterile instrument tray with heavy scissors and (8) tubing clamps
(2) packs of blue towels (4) - 3/8”x3/8” Tubing connectors
Halyard Medium Drape #89111 76”x44”
32 oz bowl Medical Action Industries #01232
(2) 30cc saline-filled syringes or Bulb Irrigation Syringe
(2) surgical gowns, masks, caps, sterile gloves
(2) 4x4 Covidien Curly gauze sponge trays
(2) 4oz MediChoice 10% providone iodine aqueous solution
(2) 26 ml Chloraprep prep sticks
(2) bath towels or bed blankets if working over floor

**Practice**

- Place emergency resuscitation cart and ECMO cart at the room.
- Set up sterile field and work space
- Identify locations where tubings will be cut.
- One person suspends and holds tubings while one person preps tubings
- One person cuts and makes connections while one person provides saline for wet to wet connection
- Both assess for air free connection prior to reinitiating flow
Procedure

1. Prep areas to be cut
2. Perform a “Time Out” to verify the procedure and patient with the physician.
3. Establish full ventilation, inotropic and vasopressor support according to etiology of disease and patient requirements.
4. When ready and personnel positioned, reduce RPM to 1500 on physician order.
5. Clamp access and outflow tubings near pump system and away from where tubings will be cut.
6. Double clamp the tubings where the new attachments will be made and divide between the clamps with the sterile heavy scissors.
7. Connect the new circuit or component with a wet-to-wet, bubble-free connection using 3/8”x3/8” tubing connectors and the large saline-filled syringes. Make sure that the tubing is pushed over the 2nd barb on the end of the connector.
8. Resume extracorporeal support upon physician’s order with RPM starting at 1500.
9. Unclamp access and return lines and advance flows to previous settings while assessing circuit/component flow for air and patient for hemodynamic response.

• Prep areas to be cut with Providone-iodine or Chloraprep and allow to dry.
• Prep from “clean to soiled” areas taking care not to transfer microorganisms from the periphery back to the proposed incision site.
• When using betadine aqueous, “Double dipping” into the antiseptic solution with a contaminated sponge may lead to microorganisms being brought back to the proposed incision site.
• Do not “back track” over an area that has already been prepped with the same prep sponge.
Affect of Aseptics on Plastics

Toluene, Benzene, Acetone and Ammonia will affect polycarbonate.

Alcohol should not be used on polycarbonate connectors, but can be used on polyvinylchloride tubings.

References Maquet Cardiovasular – Quadroxi-adult IFU

Do not allow solvents such as alcohol, ether, acetone, or liquid inhalation anesthetics (e.g. isoflurane, Ethrane (enflurane)) to come into contact with the outside or inside of the oxygenator, as they may cause damage.

*Instructions for Use | US/CA Version | G-152 | 2011-03*