

ELSO ID TASK FORCE Recommendation Summary

In recognizing the importance and impact of infections on ECMO, the leadership of ELSO created the “Infectious Disease Task Force” in 2008 to address issues of diagnosis, treatment, and prevention. While summarized below, the entire process, database review, and explanation and support of the committee’s recommendations are included in the new ELSO “Red Book” (2012).

Etiology The most commonly reported organisms isolated on ECMO include Coagulase negative staphylococci, Candida species and Pseudomonas, with smaller numbers of other gram negative organisms and enterococcus also reported. This should be considered when selecting antibiotics for empiric therapy. Also, because of the high incidence and mortality of Candida sepsis, it is the strong recommendation of the task force that clinicians raise their index of suspicion for yeast in significantly ill patients suspected to have sepsis on ECMO and lower their threshold for antifungal therapy. Analysis of the database also demonstrated an increasing incidence of infection with increasing patient age; increased incidence of infection with length of the ECMO run at one week, and beyond two weeks; and an increased odds ration of death with the presence of infection on ECMO.

Circuit Management:

- A) The ECMO circuit must be treated as a protected central line used for hyperalimentation, so that accessing or “breaking” the line unnecessarily is avoided. While sampling blood for calibration of monitoring technology**

is necessary, routine sampling from the circuit should be avoided when patient sites are available (e.g. arterial lines).

- B) Needleless hubs should be used for all connection, stopcocks and access sites in the circuit. Leur-Lock port access should be avoided.**
- C) Chlorhexidine prep should be used, rather than alcohol or betadine unless there is a specific allergy or contraindication.**
- D) Only continuous infusions should be administered via the circuit to minimize “breaking” the sterility of the lines, including heparin, inotropes, vasopressors, narcotics and sedation. This allows dosing changes without disconnecting and reconnecting the lines on a frequent basis. Initial connection or changing of lines should follow the strictest sterile techniques with chlorhexidine prep and needleless hubs.**
- E) Intermittent Drug and electrolyte boluses should be administered to the patient whenever possible to avoid unnecessary “breaks” to the circuit.**
- F) An attempt should be made to avoid pairing the care of ECMO patients with other patients with highly resistant organisms or with grossly contaminated wounds or serious infections, or having such patients immediately adjacent to patients on ECMO.**
- G) Frequent hand washing and easy access to cleansing solutions are essential for personnel handling circuit access, line connections, etc.**

Prophylactic Antibiotics:

- A. There is NO data to support the routine use of antibiotics for patients on ECMO support, simply for prophylaxis, without specific culture or physiologic evidence of ongoing infection.**

- B. Because of the increased risk of mediastinitis and its inherent morbidity and mortality, the use of antibiotics in patients with transthoracic cannulation through open chest wounds should be based on the clinical judgment surrounding multiple factors including the length of time the chest has been open and is expected to be open, the circumstances under which it was opened and the perceived likelihood of contamination (covered in OR versus opened urgently in ICU), the patient’s overall immune and nutritional status, as well as any pre-existing infections or skin conditions (e.g. MRSA contamination, yeast colonization, etc).**
- C. Prophylactic antibiotics for cannulation should follow standard principles of surgical prophylaxis, and a single dose, or at the most 24 hours of coverage can be justified with either open or percutaneous cannulation techniques. Additional doses are not supported by any literature.**
- D. Prophylaxis for surgical procedures while on ECMO should follow standard guidelines.**
- E. Because of the increased incidence and high mortality in ECMO patients with fungal infections, the task force recommends “cautious, but aggressive” use of antifungal prophylaxis in patients deemed to be at particularly high risk (e.g. prolonged open chest on multi-drug antibiotic therapy, or significantly immunocompromised patients).**

Prevention of Systemic Infections:

- A) Follow published guidelines whenever possible to prevent ventilator associated pneumonia including elevation of the head of the bed, oral prophylaxis, medical treatment of reflux as indicated, etc. while on ECMO.**

- B) Appropriate pulmonary toilet, suctioning and bronchoscopy should be used liberally as indicated. The small risk of anticoagulation does not preclude the use of these procedures when indicated.**
- C) Early tracheostomy should be considered in non-pediatric patients who are likely to require ECMO more than a few days, to improve pulmonary toilet, reduce the potential for GI contamination from reflux as well as reduce sedation requirements, allowing the patients to be more awake, and potentially generate a cough to help clear the airway.**
- D) Strongly consider the use of Oral and GI decontamination protocols.**
- E) Whenever possible, early and complete enteral nutrition should be used to help maintain the gut mucosa, prevent translocation, and also help avoid the use of hyperalimentation and its inherent risks of infection while on ECMO.**
- F) If hyperalimentation must be used, it is preferential to administer it directly to the patient in a clean dedicated line, rather than to the circuit because of the high glucose concentration and risk of infection.**
- G) If limited central access dictates that hyperalimentation must be given into the circuit, a dedicated site should be used without mixing of other infusions, and it should be cleaned with strict sterile technique and changed daily.**
- H) Remove all unnecessary lines, access and devices once stable on ECMO.**
- I) Peripheral IV's should be used for intermittent boluses of drugs and blood products whenever they are available.**
- J) The removal of unnecessary central access including long standing umbilical lines is NOT contraindicated because of anticoagulation.**

Generally the risk of blood stream infection and sepsis outweigh the risk of bleeding from line removal on low level anticoagulation particularly with the increased morbidity and mortality of infections on ECMO.

- K) Strict sterile technique is essential in changing or accessing any central line in patients when central access is required.
- L) When specific pressure monitoring (Swan-Ganz e.g.) will be required prior to weaning or discontinuation of ECMO, fresh clean lines should be inserted when they are required near the end of the ECMO course, rather than leaving lines in place for the entire run. Careful technique in the hands of skilled physicians make the risk of line insertion reasonably low, even in anticoagulated patients on ECMO, and do not outweigh the infection risk of an long term indwelling cardiac line.
- M) Avoid the insertion of new indwelling long term IV access (tunneled or cuffed catheters) while on ECMO due to the risk of hematoma formation and subsequent infection.
- N) Maintain a low threshold for removing long term access if there is any suspicion that they might be infected.

Diagnosis of Infection on ECMO: It is essential to recognize the limitations of the usual diagnostic tools for infection on ECMO, because of the impact of artificial surfaces on the humoral and cellular elements of the immune system and inflammatory response.

- A. It is generally very difficult for patients to develop a febrile response on ECMO because of the constant cooling of the extracorporeal blood.

- B. Patients who are able to generate fevers of as little as 101 or greater while on “full-flow” ECMO are likely having extremely strong inflammatory responses, and should be checked very carefully for other signs of infection and treated appropriately.**
- C. The reliability of leukocytosis and leucopenia as a predictor of infection or sepsis in patients on ECMO is poor at best. Attention should be paid to acute changes in WBC count in the absence of acute changes in the circuit (oxygenator change, etc), but the diagnosis of infection can be premature and incorrect based on WBC levels alone.**
- D. Thrombocytopenia is a common result of platelet activation by, and adherence to the circuit, and is not a reliable indication of sepsis.**
- E. The significance of inflammatory markers such as C-Reactive Protein and sedimentation rates on ECMO is unknown. While an inflammatory response to the circuit is expected, a sudden rise in an otherwise stable patient well into an ECMO course may be cause for an increased suspicion and search for an infection, but is probably not justification for initiation of treatment without other signs or evidence. Currently the routine measurement of such tests is currently not supported or recommended.**
- F. The CXR is frequently opacified due to inflammatory changes on ECMO, particularly early in the course, and is thus a poor tool for the diagnosis of pneumonia. Close observation of the quantity and quality of airway secretions becomes essential, including the liberal use of bronchoscopy to examine the airways, assist with pulmonary toilet, and obtain appropriate culture samples to guide therapy.**

- G. The suspicion and diagnosis of infections and sepsis on ECMO requires specific clinical observations of pyuria, purulent secretions at bronchoscopy, or drainage of pus from an open wound, as well as recognition of changes in the general clinical condition, signs of poor perfusion or inadequate oxygen delivery as manifested by increasing lactate levels, decreasing urine output, metabolic acidosis, rise in the hepatic transaminases, general hemodynamics, etc.**
- H. While it is recognized that the risk of surgery on ECMO is higher than in the non-heparinized patient, the task force strongly urges an aggressive approach as the morbidity and mortality of undiagnosed and untreated infections on ECMO exceeds risks and complications from appropriately managed in-hospital transports and surgical procedures. This includes the liberal use of diagnostic tests such as CT scans and bronchoscopy, and the aggressive re-exploration of wounds and body cavities that are at risk for infection, late perforations, abscess formations, etc.**
- I. The practice of routine periodic cultures of blood, urine and sputum is not supported by any published data, and is therefore discouraged. Blood, urine and tracheal cultures be obtained from patients on ECMO only when there is a significant clinical suspicion of localized or systemic infection.**

Treatment of Infections on ECMO: There are no specific antibiotic recommendations for treatment of proven infections in patients on ECMO. Drug choice should be based on the usual principles of therapy, recognizing that levels of certain drugs may be more difficult to achieve while on ECMO, and considering the increased volume of distribution, particularly in small patients.

- A) Silicon membranes are known to bind lipophilic drugs to varying degrees, and so dosing should be based on closely monitored drug levels as appropriate. This is much less of a problem with polymethyl pentene and polypropylene oxygenators.**
- B) Empiric antibiotic therapy initiated prior to ECMO for suspected or presumed infection should be continued until the pre-ECMO cultures return negative, and then discontinued exactly as if the patient was not on ECMO. If a decision was made based on clinical criteria to complete a specific course of 7-10 days for example, then that course should be continued and completed unless additional information becomes available that contradicts the original presumptive diagnosis and plan.**
- C) In choosing empiric antibiotic therapy for presumed sepsis in patients on ECMO, recognize that the most common organisms grown from the blood include coagulase negative staphylococcus, Pseudomonas, Staph aureus, and Candida albicans.**
- D) Consideration for fungal therapy in high risk patients is recommended because of the high mortality in patients on ECMO with fungal infections.**
- E) Continued positive blood cultures or clinical sepsis despite appropriate antibiotic therapy suggests either a “hidden” source not penetrated by antibiotics, or colonization of the circuit. A search for sources of infection and consideration for changing out the entire ECMO circuit are indicated.**

Pre-primed Circuits: From an ID standpoint ONLY, ECMO circuits sterilely constructed and primed with electrolyte solutions (no glucose, albumin or blood) may be safely maintained for up to 30 days, and possibly beyond, without increased risk of infection.