QMJ
A peer reviewed journal
QATAR MEDICAL JOURNAL

4th Annual ELSO-SWAC Conference Proceedings

Anticoagulation on extracorporeal membrane oxygenation (ECMO)

Praveen Khilnani

Address for Correspondence:
Praveen Khilnani
HOD, Pediatric ICU, Mediclinic City Hospital, Dubai, UAE
Email: khilnanip@hotmail.com

http://dx.doi.org/10.5339/qmj.2017.swacelso.20

Cite this article as: Khilnani P. Anticoagulation on extracorporeal membrane oxygenation (ECMO), Qatar Medical Journal, 4th Annual ELSO-SWAC Conference Proceedings 2017:20 http://dx.doi.org/10.5339/qmj.2017.swacelso.20

QSCIENCE.com
An Initiative of Qatar Foundation

Introduction: Extracorporeal circulation has been around for more than half a century, but many questions remain regarding how to best achieve anticoagulation in a patient on extracorporeal membrane oxygenation (ECMO). Although unfractionated heparin is the predominant agent used for cardiopulmonary bypass, the amount required and how best to monitor its effects are still unresolved. Extracorporeal circulation is associated with the activation of clotting cascade upon contact with a foreign surface of the ECMO circuit; therefore, heparin or a heparin-bonded circuit is used for anticoagulation.
Objectives: To describe commonly used tests to monitor anticoagulation status and ways to maintain a clot-free circuit with least damage to circulating platelets.
Methods: A literature search was conducted on PubMed for articles published in peer-reviewed medical journals in English in the past 10 years.
Results: Various evidence-based facts emerged. Upon initiation of ECMO flow, there is a strong inflammatory response almost similar to systemic inflammatory response syndrome (SIRS) with the release of various cytokine mediators such as interleukins and tumor necrosis factor as well as a trigger to arachidonic acid metabolism with the release of prostaglandins and destruction of platelets.[1] Monitoring of anticoagulation status requires close monitoring of activated clotting times (ACTs), a close watch of platelet count, looking for evidence of heparin-induced thrombocytopenia (HIT), and finally, greater use of thromboelastogram (TEG) for precise analysis of coagulation status (Figs. 1 and 2). The ECMO circuit needs to be physically monitored (lines, pump head, oxygenator) for any clots as well as the values of the pre- and post-membrane pressures to detect clots in the membrane oxygenator. In view of a higher duration of

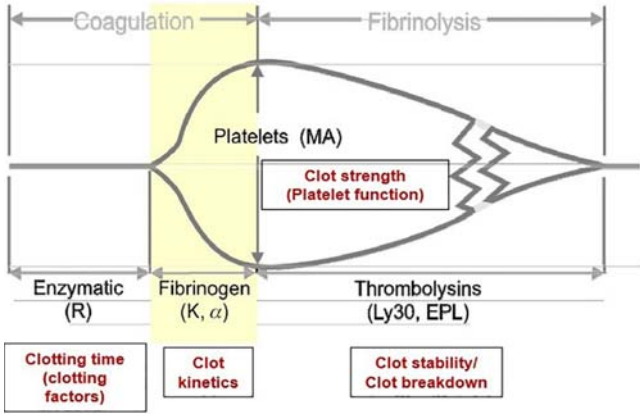

Figure 1. TEG report on clot characteristics (http://marylandccproject.org/core-content/utility-teg-blood-component-therapy/).

ECMO run when compared with cardiopulmonary bypass, it is particularly challenging to achieve an optimal anticoagulation keeping in mind inflammation, disseminated intravascular coagulation, as well as side effects such as HIT.[2] Treatment of bleeding/clotting emergencies involves early detection and use of anticoagulation reversal agents with or without transfusion of blood or blood products with full round-the-clock support by blood bank. Although heparin-coated circuits have been safely used for extracorporeal lung assist with little or no systemic anticoagulation,[3] prospective studies are clearly needed to determine whether this approach is advantageous, and it would seem appropriate to develop heparin coating for silicone-based membrane oxygenators.

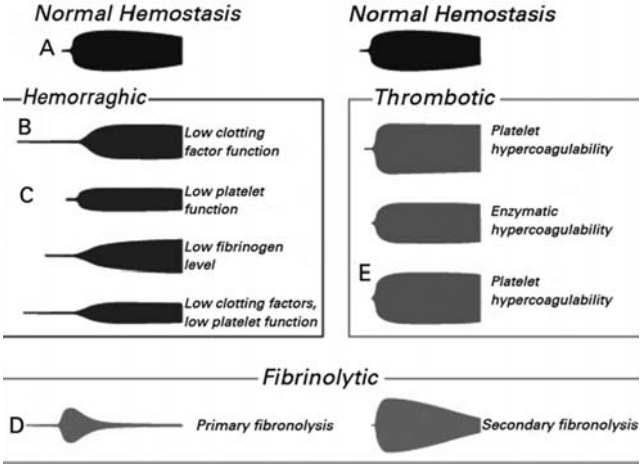

Figure 2. Interpretation of thromboelastogram.[4]

Conclusion: Various tests are available to monitor the anticoagulation status of a patient on ECMO with bedside availability. It is important to perform physical inspection of the ECMO circuit as well as to monitor pre- and post-membrane pressures frequently, in order to detect clots in the circuit, and to further regulate heparin therapy. Activated clotting time (ACT) by far remains the most commonly used monitoring tool at most ECMO centers.

Keywords: ECMO, anticoagulation, activated clotting time, thromboelastogram, heparin-coated circuit, bleeding, disseminated intravascular coagulation

REFERENCES

1. Millar JE, Fanning JP, McDonald CI, McAuley DF, Fraser JF. The inflammatory response to extracorporeal membrane oxygenation (ECMO): A review of the pathophysiology. *Crit Care.* 2016;20(1):387.
2. Sniecinski RM, Levy JH. Anticoagulation management associated with extracorporeal circulation. *Best Pract Res Clin Anaesthesiol.* 2015;29(2):189 – 202, DOI:10.1016/j.bpa.2015.03.005
3. Gravlee GP. Heparin-coated cardiopulmonary bypass circuits. *J Cardiothorac Vasc Anesth.* 1994;8(2):213 – 222.
4. da Luz LT, Nascimento B, Rizoli S. Thromboelastography (TEG®): Practical considerations on its clinical use in trauma resuscitation. *Scand J Trauma Resusc Emerg Med.* 2013;16:21 – 29.