Prevalence and pattern of thromboelastography-based hyperfibrinolysis in children during ECMO

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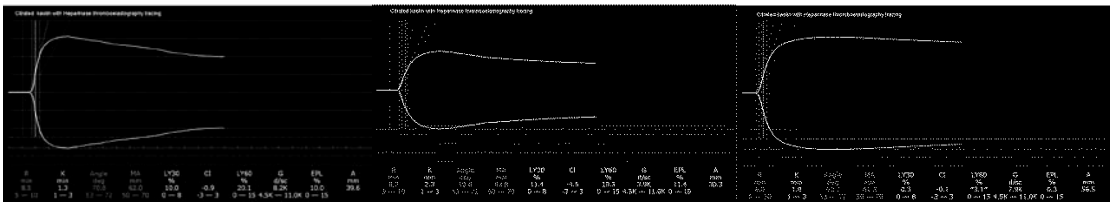
Background: Coagulopathy due to hyperfibrinolysis (HF) is not well described in patients supported on extra corporeal membrane oxygenation (ECMO) despite the known challenges of hemostasis in such patients. This is partly related to the inability of conventional laboratory tests like platelet count, fibrinogen level and fibrin degradation products including D-Dimer to quantify fibrinolysis. We hypothesized that whole blood viscoelastic coagulation testing using thromboelastography (TEG®) will identify the prevalence and pattern of hyperfibrinolysis in children supported on ECMO.

Methods: This retrospective chart review of prospectively collected data was approved by the institutional review board and included all children admitted to the pediatric critical care unit who required ECMO support since January 1, 2012 when the TEG® testing was introduced as part of hemostasis management in our institution. We collected demographic data, pediatric logistic organ dysfunction score (PELOD-2), use of blood products and antifibrinolytic agents (aminocaproic acid or tranexamic acid), mode and duration of ECMO, conventional coagulation assays, TEG® parameters (citrated kaolin with and without heparinase) and clinical outcome data. LY3-30 is a measure of fibrinolysis determined by TEG® that reflects the reduction in the tracing area 30 minutes after maximum amplitude. HF was defined as LY-30 ≥ 7.5%.

Results: There were 4168 total admissions to the pediatric critical care unit during the study period out of which 44 children (age range 1day – 18 years; 19 male: 25 female) required ECMO support with a total of 47 ECMO runs. ECMO survival was 61.7% (29/47 ECMO runs) and hospital survival was 38.6% (17/44 patients). There were 228 TEG® results available in 33 ECMO patients. LY-30 range was 0-21.9 % (median LY-30 = 0; interquartile range = 0-0.3). HF was observed in 9 out of 228 TEG® results (3.9%) and the overall prevalence of HF was 18% (6/33 patients). All patients with HF had coagulation index ≤ 1 possibly suggesting primary HF although data on D-Dimer in those patients were incomplete. We found no patient with HF and coagulation index ≥ 3 (secondary HF). On bivariate association using Fisher exact test, there was no significant difference in HF between the groups (with and without ECMO survival p = 1 and with and without hospital survival p= 0.375). By multivariate analysis of variance using Wilcoxson Rank sum test, HF was significantly associated with older age (p = 0.02), peak lactate prior to ECMO (p = 0.03) and antithrombin III administration (p = 0.005) but not with use of antifibrinolytic agents, or other blood product administration.

Conclusions: In our single center cohort of children supported on ECMO, the prevalence of hyperfibrinolysis based on TEG® testing was 18%. HF in children on ECMO was not associated with use of antifibrinolytic agents or blood product utilization except administration of anti-thrombin III concentrate. HF was not significantly different from those who survived ECMO and those had successful hospital discharge.

Figure1: **Thromboelastography tracings of ECMO patients with and without hyperfibrinolysis [Panel 1 (HF with normal maximum amplitude); Panel 2 (HF with abnormal maximum amplitude); Panel 3 (normal tracing without HF)].**



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