If it ain't broke don't fix it

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Antifibrinolytics and TEG

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Despite evidence of associated morbidity and mortality, blood products are administered to over half of cardiac surgical patients, accounting for approximately 20% of their worldwide use[1,2]. These statistics attest to the ubiquitous and refractory nature of bleeding after cardiac surgery. In an attempt to curb the excessive use of blood products after cardiac surgery viscoelastic testing in the form of thromboelastography (TEG) and rotational thromboelastometry (ROTEM) have been increasingly utilized. Rapid intraoperative assessment allows for targeted correction of coagulopathy due to residual heparinization, coagulation factor deficiency, hypofibrinogenemia, and platelet dysfunction. Hyperfibrinolysis can also be assessed, although management is rarely altered as the *routine* administration of lysine analog antifibrinolytics has been given a class I recommendation by the Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists and has become the standard practice at most cardiac surgical centers.

Cardiopulmonary bypass is known to result in transient t-PA and subsequent d-dimer level elevations (a marker of hyperfibrinolysis)[3,4]. The efficacy of the lysine analog antifibrinolytics, tranexamic acid and

ε-aminocaproic acid, have been extensively studied in this setting. D-dimer levels are significantly blunted by antifibrinolytics, and an abundance of literature demonstrates reductions in chest tube bleeding, blood product use, and reoperation for bleeding with the use of these agents[4-6]. A similar amount of evidence points to their safety, with no increase in thrombotic complications, including stroke, myocardial infarction, graft closure, or mortality seen[5-7]. A higher risk of seizures is noted with tranexamic acid, although this appears to be dose dependent and nonexistent with ε-aminocaproic acid[2]. If the ultimate goal is to reduce bleeding and blood product usage, it would seem that antifibrinolytics offer one way to do this safely.

In the current manuscript, Sussman et. al. retrospectively analyze 78 cardiac surgical patients who had an intraoperative TEG performed with the goal of describing the distribution of fibrinolytic phenotypes in this population[8]. Forty five percent demonstrated physiologic fibrinolysis, 32% *hypo* fibrinolysis, and 23% hyperfibrinolysis (LY30 <0.8%, 0.8-3%, >3%). Forty seven percent received antifibrinolytic agents. Outcomes including "morbidity" and time with chest tube were higher in those who received antifibrinolytics. This is a perhaps the first study of its kind to describe the prevalence of hyperfibrinolysis in cardiac surgical patients as measured by point of care testing. It is also a very relevant study in an era in which the benefits of targeted therapy for coagulopathy are increasingly recognized.

The current data suggests that half of patients undergoing cardiac surgery demonstrate physiologic fibrinolysis and a third demonstrate*hypo* fibrinolysis (a theoretically *pro* thrombotic state)[8]. The worse outcomes seen in patients receiving antifibrinolytics suggests that their administration in the setting of a potentially prothrombotic state was to blame. However, several limitations merit mention. It appears that TEG is not routinely performed on all patients. The population under study may therefore reflect one undergoing more extensive surgery with more coagulopathy in whom TEG is more likely to be performed. Since the actual timing of the TEG is not detailed, the true baseline fibrinolytic phenotype of patients treated with antifibrinolytics is not clear as the TEG results may have been obtained after the initiation of antifibrinolytics. Furthermore, while surgical procedures performed weren't delineated, patients receiving antifibrinolytics more frequently had "valve disease" and "heart failure" and underwent on-pump surgery. Patients receiving antifibrinolytic therapy were therefore sicker and likely underwent more extensive on-pump valve surgery, while patients who did not receive antifibrinolytics were most likely undergoing off-pump coronary bypass surgery. Finally, the increased "morbidity" in patients receiving antifibrinolytics appear to be bleeding related (thrombotic complications were not listed separately). Perhaps additional antifibrinolytics were needed.

The authors are to be commended for recognizing a lack of complete understanding of coagulation in the cardiac surgical population and attempting to determine the benefit of targeted antifibrinolytic therapy. Any time a practice is performed indiscriminately, there is room for improvement. However, before we contemplate altering an evidence-based practice that reduces bleeding, we need to demonstrate a benefit for such a change. Not all bleeding is purely surgical or purely medical; there is overlap. Few areas of medicine highlight how much art prevails over our current scientific understanding. Too many times since the introduction of point-of-care testing, the surgeon and anesthesiologist battle over the merits of administering blood products to a clinically bleeding patient with a normal coagulation profile. Targeted correction of coagulopathy is conceptually attractive, but the reality is not as clearly defined. Reductions in bleeding seen with antifibrinolytics occur both in on-pump and off-pump surgery which should be enough proof to continue its application until better evidence and understanding emerges[6]. Certainly, there is more work to be done, but with regard to antifibrinolytics it seems fitting to recognize: If it ain't broke, don't fix it.

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