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**ARTICLE OF THE MONTH**

Forkin KT, Colquhoun DA, Nemergut EC, Huffmyer JL. The Coagulation Profile of End-Stage Liver Disease and Considerations for Intraoperative Management. *Anesth Analg*. 2018;126(1):46-61.

**Abstract:**

“The coagulopathy of end-stage liver disease results from a complex derangement in both anticoagulant and procoagulant processes. With even minor insults, cirrhotic patients experience either inappropriate bleeding or clotting, or even both simultaneously. The various phases of liver transplantation along with fluid and blood product administration may contribute to additional disturbances in coagulation. Thus, anesthetic management of patients undergoing liver transplantation to improve hemostasis and avoid inappropriate thrombosis in the perioperative environment can be challenging. To add to this challenge, traditional laboratory tests of coagulation are difficult to interpret in patients with end-stage liver disease. Viscoelastic coagulation tests such as thromboelastography (Haemonetics Corporation, Braintree, MA) and rotational thromboelastometry (TEM International, Munich, Germany) have helped to reduce transfusion of allogeneic blood products, especially fresh frozen plasma, but have also lead to the increased use of fibrinogen-containing products. In general, advancements in surgical techniques and anesthetic management have led to significant reduction in blood transfusion requirements during liver transplantation. Targeted transfusion protocols and pharmacologic prevention of fibrinolysis may further aid in the management of the complex coagulopathy of end-stage liver disease.”

COMMENTS MADE BY SCHLICHTING, NICOLETTE MD

**Summary:**

This article, from the January 2018 issue of Anesthesia & Analgesia, was chosen along with one supporting article to highlight the topics of coagulopathy in patients with end stage liver disease (ESLD) and perioperative coagulation management during liver transplantation. ESLD is associated with a rebalanced hemostasis whereby both pro- and anti-coagulant pathways are disrupted. As a result, patients may present with bleeding, clotting, or both. It is critical that transplant anesthesiologists have an understanding of the disturbances that lead to this rebalanced hemostasis and know how to tailor their intraoperative management accordingly.

Bezinover et al (1) wrote an excellent review article that outlines the cell-based model of coagulation and the changes that occur as a result of ESLD. Additionally, the authors provide recommendations for administration of blood products and factor concentrates, monitoring and treatment of intraoperative thrombosis, and management of patients on anticoagulation or antiplatelet therapy during liver transplantation based on extensive review of the current literature.

In our main article, Forkin et al discuss coagulopathy of ESLD and describe the specific changes that affect platelets, coagulation factors, and fibrinolysis. The authors emphasize that traditional laboratory tests, e.g. international normalized ratio (INR), may not be adequate for assessing a cirrhotic patient’s risk of bleeding versus clotting, and alternative methods, such as viscoelastic testing, may be superior, however more research is needed. They describe the stages of liver transplantation and associated disturbances in coagulation that are superimposed on the baseline coagulopathy of ESLD. Finally, they discuss intraoperative administration of blood products, antifibrinolytics, and recombinant factor VIIa, as well as utilization of viscoelastic testing to assess coagulation status and guide treatment.

These two articles provide a comprehensive overview of the coagulation disturbances that occur in patients with ESLD and how they may predispose this population to hemorrhage, thrombotic events, or both. While recommendations for perioperative assessment and treatment strategies are suggested based on current literature, it is clear that further research is needed to develop better algorithms to guide coagulation management in this complex patient population.

**References:**

1. Bezinover D, Dirkmann D, Findlay J, et al. Perioperative Coagulation Management in Liver Transplant Recipients. *Transplantation*. 2018;102(4):578-592.

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