

Perioperative Coagulation and Coagulopathy

2016

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Dr. Alan Jay Schwartz: Hello. This is Alan Jay Schwartz, Editor-in-Chief of the American Society of Anesthesiologists' 2016 *Refresher Courses in Anesthesiology*, the latest research and education information. The focus of the new online format of the *Refresher Courses in Anesthesiology*'s CME program, and the modules featured, is to educate learners on current developments in the science and clinical practice of the specialty of anesthesiology, critical care medicine and pain management. For the first time ever, we will be speaking directly with individual authors to learn about their expertise, perspective and insight regarding their featured module.

Today, we are pleased to present the following one-on-one conversation with fellow *Refresher Courses in Anesthesiology* Editor, Dr. Amanda Burden, and author Dr. Linda Liu. They will be highlighting the module titled, "Perioperative Coagulation and Coagulopathy."

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Dr. Amanda Burden: Hi. I'm Amanda Burden, Associate Professor of Anesthesiology at Cooper Medical School of Rowan University, and I'm one of the Associate Editors of the American Society of Anesthesiologists' anesthesia refresher course lectures publication, which highlights and publishes select lectures from the Annual Meeting.

With us today is Dr. Linda Liu, Professor of the Department of Anesthesia and Perioperative Care, and Director of Critical Care Medicine Fellowship, and the Medical Director of Respiratory Care at the University of California at San Francisco Medical School. She is with us today to discuss her *Refresher Course* lecture titled, “Perioperative Coagulation and Coagulopathy.”

As we know, understanding the coagulation system is critically important for us as anesthesiologists. Dr. Liu provides us with a very helpful, in-depth exploration of this system, including the mechanisms of thrombus formation and evaluation of abnormal coagulation studies; and she also reviews different challenges associated with the novel anticoagulant drugs. A particularly helpful section of her lecture is the discussion of the diagnosis and treatment of coagulopathic bleeding intraoperatively.

Her work first specifically explores a modern model of the coagulation cascade and the mechanism of thrombus formation, and she then provides advice for evaluation of this system preoperatively, as well as a helpful discussion of intraop approaches. Dr. Liu is particularly helpful in that she discusses specifically how we as anesthesiologists should approach regional anesthetic choices for our patients in this situation.

Dr. Liu, welcome, and thank you so much for joining us to shed light on this important subject. We look forward to hearing you highlight some of the critical educational points of your lecture.

Dr. Linda Liu: Thank you very much for that introduction, and I want to thank everybody for joining us and for reading this *Refresher Course*. A couple of things we wanted to highlight when we put the *Refresher Course* together. The first thing is, the current model of the coagulation cascade. So, today’s model of the coagulation cascade has shifted away from the view that there are two separate final pathways that converge to create thrombin in a fibrin clot.

And the coagulation cascade is actually a very complex interplay of platelet and factor initiation, amplification and propagation. It's all about endothelial injury that leads to exposure of von Willebrand factor and tissue factor that lead to platelet aggregation and the production of a mild thrombin burst. This burst then leads to increased factor production, which then increases production of fibrinogen, it's cleaved to fibrin, and then the platelets that are activated form the stabilization of the clot.

The other thing we want to emphasize from this *Refresher Course* is the goal of the preoperative evaluation when it relates to the coagulation system. So, what we want to do as anesthesia providers is to be able to identify patients who are at increased risk of hemorrhage intraoperatively. And for the adult population, most of these disorders are acquired. Those patients that come with a congenital coagulopathy are usually identified except in very rare cases. For adults, this coagulopathy is usually caused by medication such as heparin or warfarin, use of herbal supplements, or coexisting disease such as liver disease or hemolytic anemias.

And although there is lack of published evidence validating specific screening questions, the history, as opposed to laboratory testing, is still the best place to start. Simple questions directed at family history of bleeding, mucosal bleeding, excessive bleeding after minor procedures, or easy bruising or petechiae, will often get us quickly to focus on coagulation difficulties intraoperatively.

As anesthesia providers, we are also concerned about, how do we test for coagulation abnormalities intraoperatively? And I think, usually, in our armamentarium there is the PT—pro time; or PTT—partial thromboplastin time; along with the platelet count. But the PT and PTT really only measure the ability of plasma-based proteins to generate fibrin; but they do not reflect the cellular components of clotting. And this is where new laboratory testing

such as TEG, or thromboelastography, and ROTEM, rotational thromboelastometry, allow us to assess coagulation in whole blood along with the cellular component. These new tests measure clot firmness versus time, and they hopefully can help us tease out the roles of coagulation factor deficiency, platelet dysfunction, along with fibrinolysis.

Recent reviews of available clinical trials have found that we use less red cells, platelets and FFP when we transfuse based on algorithms following TEG or ROTEM measurements; but there's been no difference in clinical outcomes, and there's unclear if a difference in product use was compensated for by increased use of other factors such as cryoprecipitate or prothrombin complex concentrates.

Finally, the last point that we wanted to stress in this *Refresher Course* was the role of direct-acting oral anticoagulants. These agents, which include direct thrombin inhibitors, dabigatran, and factor Xa inhibitors, rivaroxaban, apixaban and edoxaban, offer a rapid onset of action after oral dosing, and they have very few drug-drug and drug-food interactions, and don't need frequent laboratory monitoring. Their use has increased in popularity for the prevention of stroke and for the treatment and prevention of DVT and PE.

In general, the data show similar to improved stroke prevention with a lower risk of major bleeding. With the recent approval of reversal agents, which is idarucizumab for dabigatran, and andexanet alfa, which is currently in development, the major drawback of these drugs is being resolved, because we have rapid reversal agents.

What's important for us as anesthesiologists is how long to withhold these drugs prior to the use of a neuraxial anesthetic. The American Society of Regional Anesthesia and Pain Medicine have published recommendations on their website in advance of the publication of their fourth edition of their Practice

Advisory. Basically, they are recommending five days of stopping medication for dabigatran and three days for rivaroxaban and apixaban; but, of course, this is always based on your patient's weight and renal function.

Dr. Amanda Burden: Dr. Liu, thank you so much. As you say, the perioperative period presents real challenges in identifying patients who are at risk of bleeding and treating blood loss. Thank you for helping us better understand the components and complexities of the coagulation system. And now, back to you, Dr. Schwartz.

Dr. Alan Jay Schwartz: Thank you for joining us today and participating in this insightful conversation with this month's featured author. Be sure to join us for next month's one-on-one author interview, presented in this new, exciting format.

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