

anticoagulation - revised recommendations of the German Society of Anaesthesiology and Intensive Care Medicine. *Anasth Intensivmed* 2007; 48:S109-24

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In Reply:

We thank Horlocker *et al.* for their interest in our work.¹ We welcome the opportunity to reiterate the findings of our study that, in patients undergoing total joint surgery, factor VII activity within 12 h of beginning of warfarin therapy is adequate for hemostasis despite international normalized ratio (INR) values of more than 1.4. As a result, we concluded that, in the absence of other risk factors for increased bleeding, it may be safe to remove epidural catheters early after starting warfarin, despite an INR of more than 1.4. We see this statement as a refinement of, and not contrary to, the American Society of Regional Anesthesia guidelines, as do Horlocker *et al.*

We agree that we did not (prospectively) test our hypothesis that epidural catheters can be removed in patients with INR levels up to 1.9. We were not aware when our anticoagulation dosing service was conducting their quality assurance study on the levels of factor VII. Almost all of the patients that we studied had epidural catheters because, at the time of the study, we did combined spinal epidural anesthesia in all these patients except when there was a contraindication or when the patient refused. We also routinely removed the epidural catheter the next day, including for those with INR ratios greater than 1.4. We have been removing all epidural catheters for patients who had total joint surgery 1 day postoperation, or 12–14 hours after warfarin, because two patients developed a deep vein thrombosis and a pulmonary embolism (we noted these two patients in our discussion). None of these patients developed spinal hematoma. Unfortunately, we did not prospectively note the presence of increased bleeding when we removed the catheters. Prospective evaluation of this hypothesis that epidural catheters can be removed for patients with INR levels up to 1.9 in a large sample is certainly warranted.

We agree with the concern of Horlocker *et al.* in removing the epidural catheter when factor VII is just over 20%. In our article, we provided references stating that effective anticoagulation can be attained with 20% of the normal levels of the vitamin K-dependent clotting factors.^{2,3} Another study stated that a factor VII level of 10–20% of normal values is adequate to ensure normal hemostasis at the time of major surgery.⁴ The decrease in factor VII is probably offset by the decrease in the concentration of anticoagulant protein C. This decrease in protein C led investigators to warn readers regarding the potential for a hypercoagulable state during the first 36 h of warfarin therapy.⁵

We felt that we provided enough information on the 12-h interval in the journal highlight and in our article. We agree that our postoperative day 1 values can be misleading if the patients take their warfarin preoperatively. Our surgeons

stopped prescribing warfarin preoperatively after we noticed that almost half our patients forgot to take the drug, making it difficult for us to correlate INR results and time the removal of the epidural catheters with warfarin intake.

The American Society of Regional Anesthesia never recommended that the warfarin be withheld when the INR is greater than 1.4. However, we suspect that most practitioners withhold warfarin when the INR is greater than 1.4 and then remove the catheter when the INR goes down to that value. This scenario led to the two complications in the two patients we discussed. Preventing deep venous thrombosis or pulmonary embolism is important not only because of the risk of morbidity involved but also because the Centers for Medicare & Medicaid Services⁶ stopped paying for the treatment of these “hospital-acquired conditions,” which they considered “preventable.”

We agree with the cautionary note of Horlocker *et al.* on the removal of epidural catheters in patients with increased INR levels during the initial phase of warfarin therapy. We repeat our concluding statement: “If risk factors such as low platelets, advanced age, kidney failure, or intake of other anticoagulants are present then the factor VII activity should be determined.”

Honorio T. Benzon, M.D.,* Antoun Nader, M.D., Hubert A. Benzon, M.D., Misty Kirby-Nolan, R.N. *Northwestern University Feinberg School of Medicine, Chicago, Illinois. hbenzon@nmff.org

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