hematoma greater with Lovenox than with other effective forms of anticoagulant DVT prophylaxis? Is it safe to leave an indwelling epidural catheter for postoperative analgesia or to remove it during Lovenox therapy? Although we are now aware of the seven cases of epidural hematoma reported by Rhone-Poulenc Rorer in the past 2 yr, we cannot estimate the incidence of epidural hematoma formation in patients receiving Lovenox and have an epidural catheter, because the number of patients receiving intraoperative and/or postoperative epidural anesthesia and/or analgesia is unknown. The perceived "high" incidence of epidural hematoma formation in patients receiving Lovenox may be explained by the increased use of epidural analgesia after total joint replacement surgery. Therefore, it may appear that specifically having a catheter in place increases the risk of epidural hematoma formation.

We must identify whether the risk of epidural hematoma formation is related to the timing of epidural catheter insertion or catheter removal, or related to the duration of catheter indwelling; whether there is a relation between the administered dose of Lovenox and epidural hematoma formation. Information regarding the circumstances under which epidural hematoma occurred in the reported cases is lacking or incomplete. A cause–effect relation cannot be established at this time. A prospective determination of the incidence of epidural hematoma formation in patients with epidural catheters removed at the end of surgery and in patients whose catheter is left in place for postoperative analgesia is needed. There is no evidence in the literature that removal of an epidural catheter portends greater risk of epidural hematoma formation than does epidural catheter insertion.

Finally, further studies are needed to delineate the role and effectiveness of epidural anesthesia and analgesia in improving outcome. Postoperative epidural analgesia is an excellent method for providing postoperative pain control, particularly in patients undergoing total hip and knee joint replacement. It would be unfortunate to abandon this form of postoperative pain management without further elucidation of the risk:benefit profile for Lovenox and epidural anesthesia and analgesia.

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In Reply:—Rhone-Poulenc Rorer (RPR) Pharmaceuticals Inc. thanks Weitz and Chan for the questions they have raised concerning the risk of epidural hematoma formation in patients who have received anticoagulation after neuraxial anesthesia. These questions are important and remain unanswered. Recent reviews[1–5] discussed the use of postoperative indwelling catheters in anticoagulated patients. Rhone-Poulenc Rorer has received approximately 14 worldwide reports of epidural hematoma, which have been shared with worldwide regulatory authorities and expert anesthesiologists in the United States and Europe, including board members of the American Society of Regional Anesthesia (ASRA) and the Anesthesia Patient Safety Foundation (ASPF). We asked these experts for their analysis and advice, and encouraged them to disseminate this information in their literature and presentations.

We agree with Weitz and Chan that the often sketchy information we can obtain from spontaneous case reports limits our analyses, but some consistencies emerge from the cases we were able to review in depth and in conversations with the involved anesthesiologists.

First, we discovered that many anesthesiologists were unaware of the postoperative administration of anticoagulants in their patients, nor were they aware of the differences in the pharmacokinetics of low molecular weight heparins and customary anticoagulants such as warfarin or heparin. A survey done in 1995 with U.S. anesthesiologists who frequently care for hip and knee replacement patients revealed that only 14% knew about low molecular weight heparin (LMWH), and only 4% could name enoxaparin sodium as a marketed LMWH. Although understandable, because anesthesiologists do not prescribe these agents, this survey illustrates an information gap that might have contributed to the problem.

Second, almost all of the cases involved postoperative indwelling epidural catheters. This was also noted in Dahlgren and Tornebrandt's retrospective review of one hospital's experience.[5] Also emphasized by Dahlgren and Tornebrandt, delayed diagnosis of the hematoma was noted in many of the cases we reviewed.

Perhaps most importantly, the majority of the reported cases involved dosing the anticoagulant either preoperatively or close postoperatively (including an intraoperative dose in one case). Spinal puncture or catheter manipulation during times of anticoagulant activity has been linked to the formation of epidural hematoma.[1,2,5] The three hematomas (noted in 9,000 cases) reported by Dahlgren

each had close perioperative dosing of differing anticoagulant regimens.

In addition, many of these patients also were prescribed anti-platelet agents during the same period as the anticoagulant. The approved labeling for heparin, warfarin, and LMWHs all contained cautions concerning the concomitant use of medications that affect other arms of the coagulation cascade.

The noted reviews addressed the use of neuraxial techniques and anticoagulation, and proposed fairly consistent guidelines. Careful timing of any invasive technique, including spinal catheter insertion and manipulation in patients who receive any form of anticoagulation, may minimize the risk of bleeding. The pharmacodynamics of LMWHs are different than heparin or warfarin, and include onsets of approximately 90 min and half lives of more than 4 h, with antithrombotic effects that last approximately 12 h. Vandermeulen recommends that no procedure, including withdrawal or manipulation of epidural catheters, occur within 12 h after a dose of LMWH, and that the next dose be delayed at least 2 h after a clean insertion.

RPR has undertaken a program to inform the clinician community: Our labeling was further modified with advice from expert anesthesiologists and orthopedists, and approved by the Food and Drug Administration in January 1996, to improve the visibility of the warning, as follows:

WARNINGS

Neuraxial Anesthesia and Post-operative Indwelling Epidural Catheter Use: Spinal/Epidural Anesthesia: As with other anticoagulants, there have been rare cases of neuraxial hematomas reported with the concurrent use of enoxaparin and spinal/epidural anesthesia resulting in long-term or permanent paralysis. The risk of these rare events may be higher with the use of post-operative indwelling epidural catheters.

ADVERSE REACTIONS

Ongoing Safety Surveillance: There have been rare reports of neuraxial hematoma formation with concurrent use of enoxaparin and spinal/epidural anesthesia, and post-operative indwelling catheters. These events resulted in varying degrees of neurologic injuries including long-term or permanent paralysis.

We sent correspondence to 40,000 anesthesiologists, Certified Registered Nurse Anesthetists, directors of pharmacy, and orthopedic surgeons in the United States, to alert them to these issues.

We asked our field staff to alert physicians to the occurrences of epidural hematoma. We also asked our representatives to remind these physicians of the differing pharmacology of LMWH and to specify the recommended dosing of enoxaparin. We also asked our staff to call on anesthesiologists to advise them on the issue, regardless of the fact that anesthesiologists do not prescribe LMWHs.

We asked ASRA and APSF to print alerts in their newsletters, and encouraged anesthesiologists to disseminate the information at national meetings. In addition, we encouraged the preparation of case reports for publication in the anesthesia literature.

Our intent is to inform orthopedic surgeons and anesthesiologists so that they will choose the appropriate deep vein thrombosis prophylaxis and postoperative analgesic technique for each patient. Only the informed practitioner can make such choices. We agree with Weitz and Chan that the practitioner should not blindly discard any technique without a thorough analysis of all available information. We will continue to make additional information known to these groups and to regulatory authorities worldwide as it becomes available, and continue to work with the anesthesia and orthopedic communities to improve the overall health of their patients.

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Intraoperative Disarticulation of a Triple-lumen Central Catheter

To the Editor:—There have been reports of the separation of the Teflon® catheter from the hub of an intravenous catheter assembly during its insertion.[1] We had a similar experience with a central venous catheter, in which the dislodgment was discovered intraoperatively.

A 35-yr-old, 76-kg man presented for posterior decompression craniectomy, with multiple level cervical laminectomies for Arnold-Chiari Syndrome, type 1. The neurosurgeons at our institution prefer to perform these procedures with the patient in the sitting position. This position places the patient at risk for venous air embolization