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

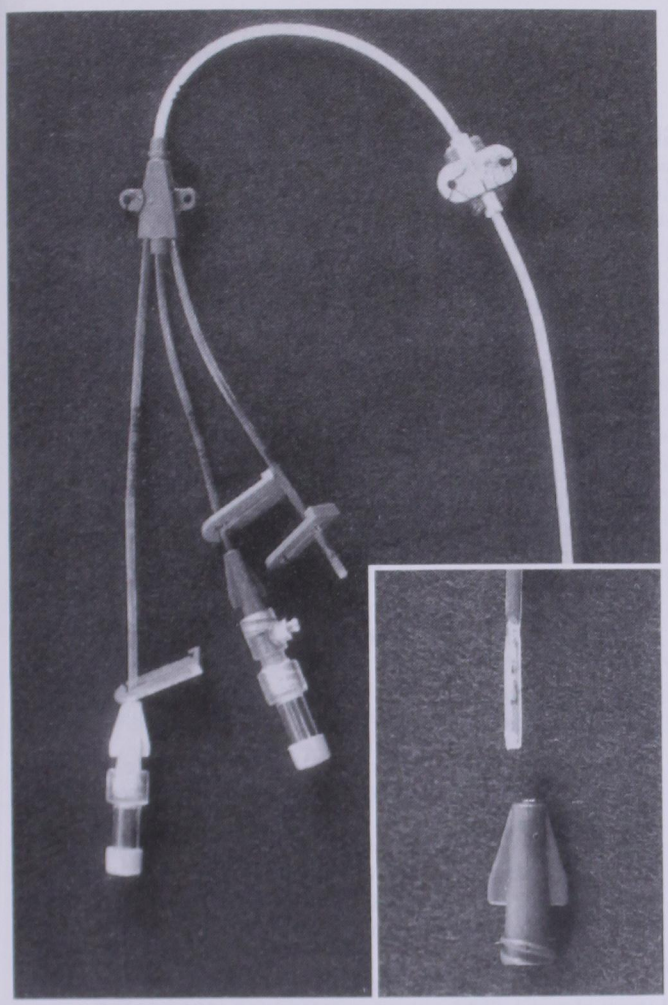

**Fig. 1. Triple lumen catheter. Inset: The clear plastic tubing has separated cleanly from the hub.**

(VAE). Therefore, our anesthetic plan included the insertion of a central catheter for intravenous access, aspiration of air bubbles, and monitoring of central venous pressure. After the induction of general anesthesia, a triple-lumen catheter (Arrow-Howes Multilumen Catheter, Arrow International, Reading, PA) was atraumatically inserted into the right internal jugular vein, using Seldinger's technique. The tip of the catheter was advanced into the right atrium, using electrocardiographic guidance. All three ports were aspirated and flushed with normal saline. The patient was placed carefully into the sitting position, and surgery commenced uneventfully.

Approximately 3 h after the start of surgery, a small amount of blood was noted on the patient's chest. The blood was seeping from the connection between the blue (medial) hub and the clear tubing connected to it. The clear tubing was immediately crimped off, and during this manipulation, the hub detached completely from the tubing. The total amount of blood loss from this catheter was less than 10 ml, and there was no evidence of VAE by precordial Doppler or end tidal nitrogen analysis. The surgery was completed without further incident, and the catheter was removed after patient emergence from anesthesia. The patient suffered no sequelae from the catheter hub dislodgment, and recovered uneventfully.

This hub would not have been subject to possible damage during insertion of the catheter, because the guide wire passes through the distal (brown) hub. Also, aside from the initial aspiration and flushing, this lumen was unattached to any intravenous tubing that may have placed shearing forces on it. The central venous pressure at the time of the incident was 5 mmHg (zeroed at the level of the right atrium). We credit this for the retrograde flow of blood through the catheter, rather than an occult entrainment of air into the patient's vascular system. Had this occurred, it would have been extremely difficult to determine the source of the air, and the patient may have been at significant risk for VAE or for the premature conclusion of surgery.

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*In Reply:*—Hub separation in Arrow's triple lumen catheter is an extremely rare occurrence, as documented by our statistical quality assurance data and by the millions of multi-lumen catheters used successfully each year. Arrow encourages immediate reporting of any incidents involving our products and the return of the product for analysis, so that the appropriate engineering or manufacturing intervention can be made as quickly as possible.

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