junior house staff. The largest of these (450 subjects) had incidences in the landmark group of carotid artery puncture (10.6%), hemothorax (1.7%), and pneumothorax (2.4%) greater than most anesthesiologists would accept. Thus it is not surprising that meta-analysis of these disparate studies (which have not been scored by traditional methods to assess for bias and scientific rigor) would find statistical significance only in success of line insertion.

Given this weak supportive evidence, it is further surprising to conclude that ASA members "agree" with the presented recommendation (table 5). In fact, only 48.2% agree in any form with the statement that real-time ultrasound should be used (table 3, item 35), which even by partisan estimation is not a majority. The vigorous discussion at the 2010 and 2011 ASA House of Delegates and reference committees, including more anecdotal comments than evidentiary discussion, is testimony to the discomfort that many ASA members have with the supportive level of evidence.

As users of ultrasound for central line insertion when indicated by prudent physician judgment and experience, we call for additional quality prospective, randomized investigations of ultrasound use for internal jugular placement by the anesthesia community before uniform adoption of guidelines based on data from nonanesthesiologists.

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Removal of Central Venous Catheters

To the Editor:

The recently published Practice Guidelines for Central Venous Access provide a valuable resource for anesthesiologists and others who insert and maintain central venous catheters (CVCs).[1] We commend the members of the American Society of Anesthesiologists Task Force on their efforts.

Although the guidelines deal extensively with insertion and maintenance of CVCs, there is no discussion of removal of those CVCs. There is considerable anecdotal evidence and a plethora of published case reports highlighting the occurrence of adverse events during CVC removal, including bleeding and venous air embolism.[2,3] Venous air embolism, which occurs as a result of entrainment of air when an open vein is above the level of the heart, has the potential to result in cardiorespiratory compromise, devastating neurologic sequelae, and death.[4–10] A failure to appreciate the potential for, and cause of, venous air embolism may result in improper practices during CVC removal. In some circumstances, inexperience, unfamiliarity, and lack of education or training may play a role.

Although there are many steps in the process of CVC removal, essential elements of the procedure include (for internal jugular and subclavian CVCs), positioning of the patient in the head down (Trendelenburg) position, having the patient perform a Valsalva maneuver as the catheter is being withdrawn, application of pressure to the catheter-entry site as the catheter is being withdrawn, placement of an air-occlusive dressing over the site after removal, and a period of postprocedure monitoring.[11] If VAE occurs, interventions should include placement of the patient in the head-down, left-side-down position, administration of 100% O_2, and appropriate cardiopulmonary resuscitation.[3,12]

As part of an initiative to optimize and standardize practice with a goal of improving patient safety, our institution – similar to other medical centers – has developed and implemented a policy for removal of CVCs.[13] In addition to the placement of written practice guidelines in appropriate locations on our internal Web site, a mandatory educational module for those who remove CVCs has been developed. Furthermore, we have incorporated essential supplies and informational materials into a "CVC removal kit." These initiatives are being incorporated into our institutional global "CVC educational module" targeted at those who insert CVCs, but are also independently directed at those who remove but do not insert CVCs.

We appreciate the efforts of those involved in the production of the Practice Guidelines. We respectfully suggest that, when the guidelines are revised and updated in the future, a section relating to safe removal of carefully placed and carefully maintained CVCs be included.

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In Reply:

We thank Pivalizza *et al.* for their comments on the Practice Guidelines for Central Venous Access.[1] We acknowledge that data from nonanesthesiologist practitioners were used in our analysis for the utility of real-time ultrasound; however, at this time there is insufficient published evidence that directly assesses whether anesthesiologists perform the task of catheter insertion better – or differently – than physicians in other specialties.

Pivalizza *et al.* are correct that the meta-analytic data report heterogeneity for successful internal jugular (IJ) line insertion when using real-time ultrasound guidance as compared with the landmark technique. However, other Category A1 outcomes, such as first-attempt success rate, reduced access time, and decreased rate of arterial puncture, are homogeneous. Regarding hemothorax and pneumothorax, the few randomized controlled trials reporting these outcomes demonstrated lower frequencies for real-time ultrasound.[2,3] In addition to the cited randomized controlled trials, we took into consideration studies with observational findings showing high rates of success when using ultrasound.[4–8]

Regarding the survey information, Pivalizza *et al.* neglected to note that more than 75% of the expert consultants agreed, and less than 10% disagreed, that real-time ultrasound should be used with the IJ. Although 48.2% of the randomly selected members agreed, less than 29% disagreed. These findings likely represent a gap in practice between expert practitioners and the random sample of American Society of Anesthesiologists members.

The value and enhanced safety that real-time ultrasound affords is most likely because the operator can look beneath the skin at the anatomy and the relationship of the IJ to the carotid artery. Significant anatomic variation in the relationship of the IJ to the carotid artery has been documented[9–12]: 1–5% of the time, the IJ lies medial to the carotid; 3–18% of IJ veins are absent or thrombosed; and in more than half of patients, 50–75% of the surface of the vein overlies the carotid.[9–12] These anatomic variables cannot be ascertained *via* the landmark approach. Using real-time ultrasound, one can see the anatomy and direct the needle away from the carotid artery.[13]

Regarding "studies not being scored by traditional methods to assess for bias and scientific rigor," we use a standard analytical (statistical) approach, and our review process and basic classification system has been in place for more than 20 yr. The review procedures we have in place to control for bias surpass most, if not all, other literature assessment methods in use today.

The American Society of Anesthesiologists guidelines are consistent with other organizations in recommending real-time ultrasound. The Society of Cardiovascular Anesthesiologists, along with the American Society of Echocardiography, recently published their own guidelines, recommending "that properly trained clinicians use real-time ultrasound during IJ cannulation whenever possible to improve cannulation success and reduce the incidence of complications associated with the insertion of large-bore catheters."[14] In 2001, the Agency for Healthcare Research and Quality identified the use of real-time ultrasound guidance during central venous catheter insertion as one of the patient safety practices with the greatest strength of supporting evidence.[15] Other societies and organizations have also recommended it.†[16]

Within our specialty, the Society of Cardiovascular Anesthesiologists, the Society of Critical Care Anesthesiologists, and the Society of Pediatric Anesthesia have endorsed the American Society of Anesthesiologists guidelines.[1] We are delighted that the American Society of Anesthesiologists House of Delegates approved these recommendations and hope the members of our specialty will embrace these enhanced safety practices.

We thank Keegan and Mueller for their thoughtful and informative letter detailing the potentially grave risks associated with removal of central venous catheters. In our guidelines, we were explicitly focused on the events and practices to improve safety at the time of central venous catheter placement. Their letter serves to remind all of us that there is a comprehensive set of considerations for maintenance and access of indwelling central lines. Although these issues were beyond the scope of our endeavor, we will add them to the list of potential topics to be included in a future update to the guidelines.

† http://www.facs.org/fellows_info/statements/st-60.html. Accessed June 16, 2012.