

Anesthesiology  
67:146, 1987

*In Reply:*—The name *human immunodeficiency virus* (HIV) was coined by a subcommittee of the International Committee on the Taxonomy of Viruses to resolve the confusion caused by the existence of multiple names for genetic variants of the same virus.<sup>1</sup> This proposal has been widely accepted, and HIV is currently the most common term used to describe the causative agent of AIDS. This was not the case when we wrote and submitted our review, and we appreciate Dr. Freedman's clarification of this point.

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(Accepted for publication March 18, 1987.)

Anesthesiology  
67:146–147, 1987

### Central Venous Pressure Monitoring during Cesarean Section

*To the Editor:*—The letter by Drs. Robinson and Albin<sup>1</sup> addresses the appropriate management of patients undergoing cesarean section with regard to the possibility of venous air embolism (VAE). Their letter pertains to the report by Younker *et al.*<sup>2</sup> of a case of massive VAE during cesarean section in a patient suffering from massive hemorrhage. I have no disagreement with Younker *et al.* that: 1) VAE can occur during cesarean section (perhaps as frequently as 40%),<sup>3</sup> and 2) rarely, VAE can be life-threatening. However, the suggestion by Drs. Robinson and Albin "that preoperative placement of a multi-orifaced air aspiration catheter is indicated in those cases where significant risk of VAE can be identified" raises a few questions:

1. Which patients do they consider at risk for VAE? Are they referring to *all* patients undergoing regional anesthesia for cesarean section?

2. Is the time delay required to insert the CVP catheter worth the potential benefit from air aspiration?

3. If using electrocardiographic localization of the CVP catheter, where would they suggest is the optimal location for placement of this catheter?

My concerns regarding questions 1 and 2 revolve around the issue that many cesarean sections are done on an emergency basis. Placement of a central venous catheter requires 5–15 min to complete.<sup>4</sup> I am concerned that this delay in appropriate operative intervention will result in an overall greater morbidity and mortality to both mother and baby.

The value of central venous catheters as treatment for VAE remains controversial. The most lucid discussion of this controversy was in an editorial by Michenfelder.<sup>5</sup> My conclusions from his discussion are: yes, central venous catheters can occasionally be lifesaving in VAE, and more important than placement of a cen-

tral venous catheter is the detection of VAE and rapid maneuvers to halt the entrainment of air.

Before we all embark on routine central venous catheter placement for cesarean section, we should consider where we are going to place these catheters (question 3). The elegant work by Bunegin and Albin<sup>6</sup> was in a silastic model of the heart tilted so the right atrial chamber would mimic the position of the atrium in a patient in the sitting position. The results may be applicable to patients in the sitting position. However, patients undergoing cesarean section are either supine or in the Trendelenburg position. To my knowledge, there are no data to indicate the "appropriate positioning" for optimal air aspiration of any atrial or central venous catheter for patients in these positions.

In summary, I would agree with both Younker *et al.*<sup>1</sup> and Drs. Robinson and Albin<sup>2</sup> that monitoring to detect VAE in these patients may be appropriate. The placement of the precordial Doppler is inexpensive, fast, and sensitive. However, I would recommend that precautions for this event during cesarean section stop short of routine placement of central venous catheters. Placement of the CVP delays delivery of the baby, remains untested as a tool for air aspiration in patients in the supine or Trendelenburg position, and gives clinicians a false sense of security regarding their ability to manage massive VAE. To me, detection and rapid maneuvers to halt the entrainment of air are far more important and practical in the management of this dreaded complication.

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(Accepted for publication March 19, 1987.)

Anesthesiology  
67:147-148, 1987

*In Reply:*—Dr. Rupp has made a number of pertinent comments regarding our Letter to the Editor of January, 1987.<sup>1</sup>

We would like to emphasize that, under conditions of a truly emergent cesarean section, where time may be the critical factor for maternal and, particularly, fetal survival, we certainly do not advocate delaying this procedure by spending the 5 or 10 min necessary to insert a central venous catheter solely to be able to aspirate should air embolus occur.

We identify the patients at greatest risk for venous air embolism (VAE) as those with pre-existing hypovolemia due to bleeding, severe dehydration, shock, or pre-eclampsia. Clinical management of these patients is made optimal if central venous pressure is used as a guide for fluid therapy, and this can be accomplished with the same multiorificed catheter used for air aspiration.

The time for insertion and the morbidity associated with a central venous catheter are certainly critical factors. In our hands, the placement of a multiorificed air aspiration-CVP catheter *via* a vein in the antecubital fossa has a greater than 90% success rate, since a Seldinger type "J" wire is first inserted into the SVC and the catheter threaded over it.<sup>2</sup> We have seen a rare arrhythmia (catheter in RV) and no mortality in many thousands of catheter applications with insertion times ranging from 5-15 min.

Dr. Rupp indicated that the value of central venous catheters as a treatment modality for VAE therapy is "controversial," and that the emphasis should be placed on the "detection and rapid maneuvers to the entrainment of air." Recent experimental work of Colley and Artru<sup>3</sup> indicates that significant survival in dogs occurs during a constant intravenous infusion of air when air is aspirated *via* a multiorificed catheter placed in the SVC near the RA, as compared to aspiration from a single-orificed catheter or when no catheter is employed. Albin *et al.*<sup>4</sup> reported 13 cases of VAE, in which five were in the lateral, seven in the supine, and one in the

prone position, with gradients ranging from 5-18 cm, where the amount of air aspirated ranged from 2.0-200 ml. All 13 cases developed clinical symptoms immediately after air bubble detection (Doppler). Thus, it appears that one can aspirate significant volumes of air<sup>4</sup> with the patient in the supine, lateral, and prone position, even using a single-orificed catheter with the tip in the right atrium just past the junction of the SVC.

To further evaluate the optimal catheter position in a patient undergoing cesarean section, we remounted the silastic model<sup>5</sup> Dr. Rupp referred to in a position to mimic a supine patient with 15° left lateral table tilt. We observed that air arriving at the heart formed a bubble in the non-dependent dome of the right atrium above the level of the tricuspid valve orifice. We believe that a balloon-tipped multiorifice catheter may be an ideal combination to allow for easy aspiration of embolized air, as was described for the sitting position.<sup>6</sup> The dynamics of VAE for patients in the supine position using the right atrial model will be the subject of a future communication.

We feel that the central line aspiration immediately after Doppler activation has great validity as a therapeutic measure. A closer look at Michenfelder's<sup>7</sup> editorial cited by Dr. Rupp indicates that, "In the event of abrupt aspiration of large volumes of air, such as can occur with inadvertent opening of a major dural sinus, the catheter may be life saving. . . . Secondly, there is a nagging concern that some of the embolized air may cross to the systemic circulation with possibly disastrous cardiac or cerebral consequences." Michenfelder ends his editorial with the statement, "The catheter is no longer a primary diagnostic tool and now rarely plays an important role in therapy. But on those few occasions that it does become important the "bother" of a reasonable effort to place the catheter seems well worth it." As was noted in the recent paper by Younker *et al.*,<sup>8</sup> massive VAE can occur *via* lacerations of the turgid uterine sinuses, through which large volumes of air can be entrained.