Second, our method did not involve freezing CSF, its later reconstitution, or mixing it with solutions of local anesthetics. The quantitative analysis of solubility involved the use of buffer solutions by Britton Robinson, *p*H 6.05–9.9 and a 25% ammonia solution. The measurements of *p*H were made with an Orion® model 701 *p*H meter using a microelectrode type HA 405 MS-NS and a spectrophotometer. The method is described fully in the paper.

Third, we have never "cautioned that the injection of these drugs into the subarachnoid space might cause spinal cord damage." This warning was contained in a letter from the Astra Corporation, Germany, in 1976, as follows: "Late lesions of the spinal cord after injection of the subarachnoid anesthesia with any local anesthetic, including bupivacaine, cannot be excluded" (author's translation). This comment naturally aroused our interest and concern and gave rise to the study we conducted; it was the impetus for our study, not the conclusion of it.

In closing, we propose the following problem: Under control conditions the maximal solubility of bupivacaine is 0.83 ± 10 mg/ml CSF; it is possible that 15 mg of bupivacaine injected in the subarachnoid space would precipitate, since the subarachnoid space volume from T5 to S2 is reported to contain approximately 15 ml of CSF,[3] thus producing a bupivacaine concentration of 0.833 mg/ml. The volume of CSF is a critical question; we accepted an estimate of 15 ml, but is that accurate? We would, therefore, very much like to know of other investigations regarding the volume of the subarachnoid space which either substantiate or shed new light on the previous study.

R. M. DUDZIAK, M.D.
Professor of Anesthesiology,
Head, Department of Anesthesia
University of Frankfurt/M
Theodor-Stern-Kai 7
6000 Frankfurt/M
West Germany

REFERENCES

1. Moore DC: Precipitation of local anesthetic drugs in cerebrospinal fluid. ANESTHESIOLOGY 57:134–138, 1982
2. Dudziak R, Uihlein M: Loslichkeit von lokalanesthetika im Liquor cerebrospinalis und ihre Abhangigkeit von der Wasserstoffionenkonzentration. Anaesthesist 1:32–37, 1978
3. Stark P, Gergs P, Nolte H: Die pH-Veränderungen des Liquor cerebrospinalis durch Bupivacain. Anaesthesist 26:395–397, 1977

(Accepted for publication October 8, 1982)

Anesthesiology
58:389–390, 1983

The Optimal Test Dose for Epidural Anesthesia

To the Editor:—We read with interest the recent clinical report by Moore and Batra[1] and the subsequent correspondence from Morrison.[2]

We agree entirely with the addition of 1:200,000 epinephrine to the epidural test dose. Since this became our routine in December 1981, we have observed significant tachycardia in four patients undergoing epidural analgesia for cesarian section. We had no hesitation in resiting the epidural catheters in these patients. While its use in the hypertensive parturient perhaps is unwise, the addition of epinephrine to the epidural test dose in the normotensive pregnant woman should substantially reduce the number of inadvertent intravascular injections of local anesthetic. We would, however, dispute the use of isobaric bupivacaine as the local anesthetic test solution. Clearly, the rationale for using a local anesthetic is to test for an inadvertent subarachnoid injection. While we have no experience of injecting 0.75% solution[3] in the pregnant patient, we have studied 25 patients in whom cesarian section was conducted under subarachnoid block using 2–3 ml of 0.5% bupivacaine (specific gravity 1:007) injected at the L3–4 interspace without barbotage. We found this to be unsatisfactory for two reasons: 1) the variability in the level of block achieved; and 2) the long length of time required for the block to become fully established. One patient developed a total spinal after 3 ml of 0.5% bupivacaine: this occurred within two minutes of injection. Two other patients developed a T1 level; one patient received 3 ml while the other received 2 ml of bupivacaine; the block for the latter patient took thirty minutes to reach its maximum level.

Although 4 ml of 0.5% bupivacaine have been used successfully for subarachnoid blocks in nonpregnant patients,[4,5] we feel that this is a dangerous volume to use in the parturient, and that even 2 ml of bupivacaine injected into the subarachnoid space may produce a dangerously high block which will not always be apparent in the five minutes usually allowed to elapse before injecting the main epidural dose. Our experience suggests that there is probably little place for the use of subarachnoid isobaric bupivacaine for cesarian section and that isobaric 0.5% bupivacaine should not be used as an epidural test dose in the pregnant patient.

We agree with Moore[6] that a single-dose vial containing 2–3 ml of a rapidly acting hyperbaric local an-

esthetic solution mixed with 15 μg of epinephrine would be optimal for use as a test dose.

JOSEPH STONHAM, M.B., F.F.A.R.C.S.
Visiting Assistant Professor
PHILIP MOSS, M.B., F.F.A.R.C.S.
Visiting Assistant Professor

Parkland Memorial Hospital
Dallas County Hospital District
5201 Harry Hines Boulevard
Dallas, Texas 75235

REFERENCES

1. Moore DC, Batra MS: The components of an effective test dose prior to epidural block. ANESTHESIOLOGY 55:693–696, 1981
2. Morison DH: Further considerations regarding the components of an effective test dose prior to epidural block. ANESTHESIOLOGY 57:140–141, 1982
3. Fargas-Babjak A, McChesney J, Morison DH: The efficacy of bupivacaine 0.75 per cent as an epidural test dose. Can Anaesth Soc J 27:500–501, 1980
4. Nightingale PJ, Martsand T: Subarachnoid anaesthesia with bupivacaine for orthopaedic procedures in the elderly. Br J Anaesth 53:369–371, 1980
5. Nolte H, Schikor K, Gregs P, Meyer J, Starr P: Zur frage der spinal anaesthesia mit isobaren bupivacaine 0.5%. Anaesthetist 26:33–37, 1977
6. Moore DC, Batra MS: Correspondence. ANESTHESIOLOGY 57:141–142, 1982

(Accepted for publication September 28, 1982.)

Anesthesiology
58:390, 1983

Blistering of Epoxy Material of Narco Airshields® Ventilator

To the Editor:—We would like to call attention to a potential problem of materials deteriorating in Narco Air Shields* ventilators. The main casting (bellows-chamber base) of the ventilator is made of aluminum, and is coated with a black epoxy-like material. The epoxy coating is said to be used in order to assure an electrically conductive patient breathing circuit. After less than three years of use, 13 out of 26 Ventimeter® Controller ventilators were found to have areas of blistering or outpouching of epoxy from the main casting, as shown in figure 1. The ventilators used most showed the largest such areas.

The epoxy which has separated from the main casting is hard and brittle to the touch. If the blisters break and the epoxy flakes, it is possible for particles to enter the patient breathing circuit. The company claims that there is little danger of this event occurring, and also suggests using a breathing circuit filter.

The company points out that in their "Operator's Manual," instructions are given that the ventilator should be disassembled and cleaned after each use. For proper cleaning of the casting, the cage, cylinder, bellows, and overflow valve must first be removed. It is the moisture and/or anesthetic agent remaining on the casting which most likely causes the epoxy to separate from the aluminum. The company has promised, however, that they will send replacements for all of the deteriorated main castings, without charge.

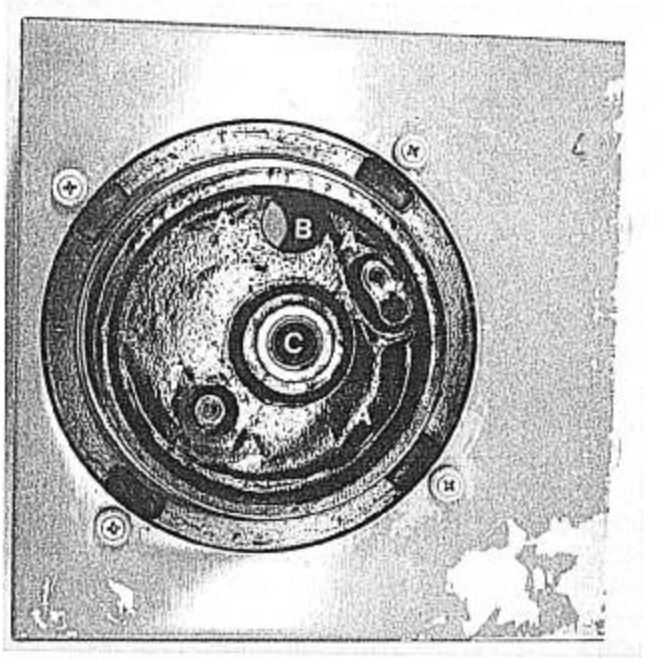

FIG. 1. Top view of Air Shields Ventimeter Controller ventilator with bellows and overflow valve removed. A = areas of epoxy blistering; B = port-to-patient breathing circuit; and C = overflow outlet port.

ALVIN WALD, PHD., C.C.E.
ANNAMARIE MERCURIO, M.S.
Department of Anesthesiology
Columbia Presbyterian Medical Center
630 West 168th Street
New York, New York 10032

(Accepted for publication October 8, 1982.)

* Narco Air Shields, 330 Jacksonville Road, Hatboro, Pennsylvania 19040.