

## REFERENCES

1. Cook RI, McDonald JS, Nunziata E: Differences between handwritten and automatic blood pressure records. *ANESTHESIOLOGY* 71:385-390, 1989
2. Helsinki II Declaration, quoted in Silverman WA: Human Experimentation: A guided Step into the Unknown. New York, Oxford University Press, 1985, p 156

Anesthesiology  
72:578, 1990

*In Reply:*—We appreciate Dr. Solonuk's comments and agree that ethical standards are important and should receive the careful attention of all behavioral researchers. We did not observe the anesthesiologists' behavior but rather examined their records and, as we pointed out, took care to keep the identifiable characteristics of the data secure. There is a potential problem in detailed behavioral studies: were we to undertake a similar study today we should wish to make complete records of the anesthesiologist's behavior and we would obtain their consent in their role *qua* subjects. Our institutional review committee does not generally require informed consent for review of patient records, providing that appropriate safeguards are taken concerning con-

Anesthesiology  
72:578, 1990

3. Lowe DU, Alexander DF: Informed consent and the rights of research subjects, *The Social Context of Medical Research*. Edited by Wechsler H, Lamont-Hawes RW, Cahill GF Jr, Cambridge, Ballinger, 1981, p 115
4. Beecher HK: Ethics and clinical research. *N Engl J Med* 274:1354-60, 1966

(Accepted for publication December 5, 1989.)

fidentiality. The anesthetic record is part of the greater patient record and, thus, would be covered by such a general practice.

RICHARD I. COOK, M.D.  
J. S. McDONALD, M.D.  
ENRICO NUNZIATA, M.S.B.M.E.  
*Department of Anesthesiology  
The Ohio State University Hospitals  
410 West 10th Avenue  
Columbus, Ohio 43210-1228*

(Accepted for publication December 5, 1989.)

## Humidification of Inspired Gas

*To the Editor:*—We read the article by Bissonnette *et al.*<sup>1</sup> and are concerned that both the temperature and absolute humidity of inspired gas were not considered by the authors. When artificial methods of humidification of inspired gas are considered, it is essential to think in terms of absolute humidity (the mass of water vapor in unit volume at given temp) and temperature.<sup>2</sup> Relative humidity is the amount of water vapor present in a gas at any given temperature expressed as a percentage of the amount of water vapor that the gas would hold if fully saturated at that temperature. The relative humidity of inspired gas was at 90% with active airway humidification. When the heat and moisture exchangers (passive humidification) were used, relative humidity was 50% at the beginning of anesthesia and gradually increased to 80% after 90 min. Since temperature of inspired air was not mentioned, it is reasonable to assume that it was 37° C and 25° C with active and passive humidification, respectively. The mass of water vapor in inspired gas would be 39.6 (44 × 0.90) mg/l with active humidification and 18.4 (23 × 0.8) mg/l with passive humidification after 90 min of anesthesia.<sup>2</sup> The water content in the inspired gas with active humidification is twice that with passive humidification. This demonstrates that absolute humidity in the inspired gas with active humidification was significantly greater than that with passive humidification and it is incorrect to conclude heat and moisture exchangers "after

approximately 1.5 h of anesthesia, provided nearly as much airway humidification as active systems."

JOHN S. T. SUM-PING, M.D.  
*Visiting Assistant Professor*

MAHESH P. MEHTA  
*Associate Professor*

*Department of Anesthesia  
University of Iowa College of Medicine  
Iowa City, Iowa 52242*

## REFERENCES

1. Bissonnette B, Sessler DI, LaFlamme P: Passive and active inspired gas humidification in infants and children. *ANESTHESIOLOGY* 71:350-354, 1989
2. Barnes PK: Principles of lung ventilators and humidification, *Scientific Foundations in Anaesthesia*. Edited by Scurr C, Feldman S. London, Heinemann 1982, pp. 533-544

(Accepted for publication December 6, 1989.)

Anesthesiology  
72:578-579, 1990

*In Reply:*—Drs. Sum-Ping and Mehta are mistaken in stating that "it is essential to think in terms of absolute humidity." Clinicians may humidify respiratory gases to: 1) prevent tracheopulmonary damage; and 2) minimize hypothermia. Tracheal ciliary function is well preserved when relative humidity is >50%, at a wide variety of inspired gas temperatures.<sup>1-3</sup> Ciliary function is minimally dependent on absolute

humidity.<sup>4</sup> Furthermore, inspired gas temperatures sufficient to provide the highest absolute humidities actually decreases mucociliary function, functional residual capacity, and pulmonary compliance.<sup>5,6</sup>

Heat and moisture exchangers warm inspired gases as well as humidifying them (because the heat of condensed expired steam is absorbed and returned to inspired gas when the water evaporates).<sup>7,8</sup>