

sen."⁴ Our study on residual paralysis in the recovery room from 1979 did not include any patients monitored with a nerve stimulator.

It is very difficult to document an effect of any monitoring device, and our study design may not have been ideal. However, as advocates for the use of monitoring devices, it is not enough that we *claim* benefit for the patients or ourselves from the use of these devices. We do have an obligation to try to prove or disprove that we are correct in our assumptions. Our study was an attempt to evaluate the effectiveness—as opposed to the efficacy—of tactile evaluation of the TOF response in daily clinical work. Other studies in this direction are in progress.

TOM PEDERSEN, M.D.
ULLA BANG, M.D.
NIELS V. OLSEN, M.D.
ERIK JENSEN, M.D.
JENS ENGBÆK, M.D.
JORGEN VIBY-MOGENSEN, M.D.*
*Departments of Anaesthesia
Herlev Hospital and *Rigshospitalet*

Anesthesiology
74:958-959, 1991

Transesophageal Echocardiography in Dogs

To the Editor:—We read with interest the recent editorial by Vandenberg and Kerber¹ concerning the use of transesophageal echocardiography (TEE) for intraoperative monitoring of left ventricular function. The authors state that “experimental animal studies of ischemia and infarction have not been performed with TEE” because “the canine left ventricle does not image well by TEE.” We wish to call attention to the fact that high-quality TEE images of the left ventricle can be obtained in the dog. The use of a canine model offers an excellent opportunity to study TEE under conditions of altered hemodynamics or graded myocardial ischemia and thereby address some of the unresolved questions discussed by Dr. Vandenberg and Dr. Kerber.

Long-axis views of the left ventricle can easily be obtained in the dog in the same manner as they are in humans, *i.e.*, by positioning the transducer behind the left atrium and angling it in a caudad direction (toward the cardiac apex). The difficulty comes when attempting to obtain short-axis, midpapillary views analogous to those reported in the human investigations of ischemia. This is because the dog has an accessory lobe of the right lung interposed between the esophagus and the inferior wall of the left ventricle,² blocking acoustic transmission from the esophagus. We have reported a method to obtain short-axis views in the dog—by performing a right thoracotomy or median sternotomy, retracting the accessory lobe with an umbilical tape, excising the pleural attachments to the posterior pericardium, and filling the resulting space with an acoustical transmission medium (*e.g.*, saline).³ We have obtained excellent images³ and other derived data^{4,*} from dogs in this manner. From a review of the literature, we also found that other quadrupeds, many sea mammals, and primates (other than the great apes) have similar anatomy to the dog in this regard.³

*University of Copenhagen
DK-2100 Copenhagen, Denmark*

REFERENCES

1. Eriksson LI, Jensen E, Viby-Mogensen J, Lennmarken C: Train-of-four (TOF) response following prolonged neuromuscular monitoring: Influence of peripheral temperature (abstract). *ANESTHESIOLOGY* 71:A827, 1989
2. Mitterschiffthaler G, Khunl-Brady KS, Koller J, Mair P, Wieser Ch, Wierda M: Residual neuromuscular blockade: A comparison of vecuronium (Vc), atracurium (Ac), alcuronium (Alc), pancuronium (Pc), and pipecuronium (Pip). *Acta Anaesthesiol Scand* 33(suppl 91):140, 1989
3. Bevan DR, Smith CE, Donati F: Postoperative neuromuscular blockade: A comparison between atracurium, vecuronium, and pancuronium. *ANESTHESIOLOGY* 69:272-276, 1988
4. Viby-Mogensen J, Jorgensen, BC, Ording H: Residual curarization in the recovery room. *ANESTHESIOLOGY* 50:539-541, 1979

(Accepted for publication January 25, 1991.)

Short-axis imaging in dogs may actually offer advantages over human imaging. First, the wedge shape of the accessory lobe causes the apex of the dog's heart to angle away from the esophagus. This tends to make the dog's epicardial outline appear entirely within the sector of the ultrasonic scan, unlike in humans, in whom part of the epicardium often lies outside the visible sector.⁵ Having the full epicardial outline available would make it easier to assess wall thickening in conjunction with wall motion analysis. In addition, it has been our impression that the cardiac apex is more readily visualized in dogs than it is in humans.

The belief that short-axis TEE imaging of the dog's left ventricle is difficult appears to be widely held, inasmuch as we have been unable to find any publications (other than our own) in a Medline search on the subject. We hope that these observations will encourage other investigators to consider using TEE in the animal laboratory.

G. BASHEIN, M.D., PH.D.
*Associate Professor of Anesthesiology and
Bioengineering (Adjunct)*

ROY W. MARTIN, PH.D.
*Research Professor of Anesthesiology
and Bioengineering*

*University of Washington
Seattle, Washington 98195*

REFERENCES

1. Vandenberg BF, Kerber RE: Transesophageal echocardiography and intraoperative monitoring of left ventricular function (editorial). *ANESTHESIOLOGY* 73:799-801, 1990
2. Evans HE, Cristensen GC: *Miller's Anatomy of the Dog*. Second edition. Philadelphia, WB Saunders, 1979, p 540

* Martin RW, Graham MM, Kao R, Bashein G: Measurement of left ventricular ejection fraction and volumes with three-dimensional reconstructed transesophageal ultrasound scans: comparison to radio-nuclide and thermal dilution measurements. *J Cardiothorac Anesth* 3: 260-268, 1989.

3. Martin RW, Bashein G, Zimmer R, Sutherland J: An endoscopic micromanipulator for multiplanar transesophageal imaging. *Ultrasound Med Biol* 12:965-975, 1986
4. Martin RW, Bashein G: Measurement of stroke volume with three-dimensional transesophageal ultrasonic scanning. *ANESTHESIOLOGY* 70:470-476, 1989

5. Abel MD, Nishimura RA, Callahan MJ, Rehder K, Ilstrup DM, Tajik AJ: Evaluation of intraoperative transesophageal two-dimensional echocardiography. *ANESTHESIOLOGY* 66:64-68, 1987

(Accepted for publication January 29, 1991.)

Anesthesiology
74:959, 1991

In Reply.—Dr. Bashein and Dr. Martin have devised an ingenious solution to the difficulties of imaging the left ventricle in dogs using transesophageal echo techniques. Although surgery is required, the experimental model that they have developed should provide useful insights into the problems of transesophageal imaging for the detection of myocardial ischemia.

One important caveat is the requirement for thoracotomy to exploit the Bashein/Martin model. It is well recognized that thoracotomy induces abnormalities of cardiac motion at least as delineated by transthoracic echocardiography. Various explanations have been offered for these abnormalities, including alterations in intrathoracic rotational and translational motion, regional ischemia, effects of cardioplegia, and cardiopulmonary bypass.^{1,2} These thoracotomy-induced alterations may introduce an additional variable into studies of ischemic dyskinesia and must be considered by researchers performing transesophageal echos in dogs using the Bashein/Martin thoracotomy model.

RICHARD E. KERBER, M.D.
Professor of Medicine

Anesthesiology
74:959-960, 1991

BYRON F. VANDENBERG, M.D.
Assistant Professor of Medicine
Cardiovascular Division
Department of Internal Medicine
The University of Iowa
Iowa City, Iowa 52242

REFERENCES

1. Kerber RE, Litchfield R: Postoperative abnormalities of interventricular septal motion: Two-dimensional and M-mode echocardiographic correlations. *Am Heart J* 104:263-268, 1982
2. Lehmann KG, Lee FA, McKenzie WB, Barash PG, Prokop EK, Durkin MA, Ezekowitz MD: Onset of altered interventricular motion during cardiac surgery: Assessment by continuous intraoperative transesophageal echocardiography. *Circulation* 82:1325-1334, 1990

(Accepted for publication January 29, 1991.)

Hazard with Warming Lights

To the Editor.—Safety features found on equipment are often unappreciated, especially if they function only on rare occasions. We would like to call attention to an operating room situation where the protective feature of a heating lamp most likely prevented a serious untoward event. However, this safety feature alone may not always offer full protection against the failure conditions for which it was designed.

A 21-yr-old man was undergoing retroperitoneal lymph node dissection for a metastatic testicular seminoma. All measures were taken to preserve his body heat, including the use of an Emerson 96-HB warming light (J. H. Emerson Co., Cambridge, MA). This device supplies radiant heat by means of two 250-W infrared producing light bulbs. A safety feature of the warming lights consists of a double layer of wire mesh around the sides of each bulb and a single layer on the front. The wire mesh is made from strands 0.5 mm in diameter and consists of a grid 6 × 6 cm.

During the case, the warming light was directed at the head of the patient from a distance of 72 cm, as determined by an integral measuring rod. The light was positioned so that the bulbs were directly below an intravenous (iv) fluid bag and administration set on an IV pole (fig. 1). During one of the frequent replacements of the iv fluid bag, several drops of residual solution fell onto one of the heat-producing light bulbs. The resultant thermal shock on the glass bulb caused it to explode. The wire mesh around the bulb prevented glass shards



FIG. 1. Bag of fluid hanging directly over warming lights. Note protective wire mesh over the front of the lights.