

covered with waterproof tape and a dampened right atrial waveform was seen on the monitor. The catheter was then removed. With the fracture occluded, the proximal port was flushed and 0.5 ml of clotted blood was recovered. We were unable to determine from examining the catheter how it came to be damaged. The patient appeared to have suffered no ill effects.

On reviewing the incident, we felt that there was a potential for two pathophysiologic events. The first was that of repeated clot formation and release into the central circulation with repeated flushing of the catheter. The second was the potential for entrainment of air through the fractured catheter and into the right atrium.

We report this as an uncommon cause of pulmonary artery catheter failure. This occurrence re-emphasized the teaching that assessment of "a problem with a waveform" should begin with a careful inspection of the patient end of the system first.

Valerie Suderman MD
Resident
Edward Crosby MD FRCPC
Department of Anaesthesia
Ottawa General Hospital
University of Ottawa
501 Smyth Road
Ottawa, Ontario K1H 8L6

Rate-pressure product

To the Editor:

What an interesting paper by Miller and Martineau¹ on the therapeutic effect of esmolol in patients with intraoperative myocardial ischaemia. However, it was such a pity that such an innovative paper was marred by repeated references to rate-pressure product as a derived index of myocardial oxygenation. As they correctly state, coronary filling time is dependent on heart rate. Rapid heart rate may thus shorten this period and interfere with myocardial oxygen delivery. This is a distinct discreet physiological phenomenon. Systolic blood pressure is one of many factors determining myocardial oxygen demand. It is also a discreet physiological phenomenon. Nobody, as yet, has provided a mathematical relationship between these two phenomena. It is therefore unscientific to multiply them together, divide them into each other or offer other arithmetical manipulation until an arithmetical relationship has first been proven. I do concede that when both these variables reach their upper limits the temptation to multiply them together and produce a figure of

many thousands seems irresistible. Physiology is difficult enough to understand when each phenomenon is considered on its own. It is time that nonsense like "rate-pressure product" was dropped from anaesthetic parlance.

Breffni O'Sullivan MB BCH BAO FFARCSI
Apartment 1,
Newtown Wood,
Newtown,
Waterford,
Ireland

REFERENCE

- 1 Miller RD, Martineau RJ. Bolus administration of esmolol for the treatment of intraoperative myocardial ischaemia. *Can J Anaesth* 1989; 36: 593-7.

REPLY

We are grateful for the thoughtful comments expressed by Dr. O'Sullivan regarding our use of rate-pressure product (RPP) as an index of myocardial oxygen consumption (MVO_2).¹ We would concur that RPP is only an indirect estimate of MVO_2 , which may be misleading when either component of the product of heart rate (HR) and systolic blood pressure (SBP) diverges from the other. For example, a similar RPP will result with a HR of 200 bpm and SBP of 50 mmHg, as would occur with a HR of 50 bpm at a SBP of 200 mmHg. Despite its limitation, we disagree with several points raised by Dr. O'Sullivan.

First, MVO_2 is not determined by as many factors as was suggested, but rather is a function of three primary determinants: heart rate, contractility, and ventricular wall tension. The RPP incorporates two of these factors: one directly (HR), and the other indirectly (SBP as an estimate of afterload). Secondly, we do not feel it is entirely unscientific to multiply these two indices. The RPP has been used by cardiologists during exercise tolerance testing, where it has been shown that RPP correlates well ($r = 0.83$) with MVO_2 during exercise in patients with coronary artery disease (CAD).² A RPP greater than 20,000 has also been shown to correlate with ischaemic ST-segment changes,³ as it did in the patient described in our study.¹ Treatment of intraoperative myocardial ischaemia was associated with a significant decrease in RPP, as a result of parallel decreases in HR and SBP.

Unquestionably, a simple and accurate technique for estimating myocardial oxygen consumption with easily measured, non-invasive variables would be desirable for perioperative monitoring of patients with coronary artery disease or those with CAD risk factors. In the past several years, the RPP has tended to fall into disfavour as an estimate of MVO_2 because of its sensitivity to inverse relationships of HR and SBP. In our patient, the changes in these two variables occurred in parallel, and therefore probably reflected the trend towards decreasing MVO_2 following treatment. Others have recently proposed the pressure-rate quotient (PRQ) as an alternative index, and have shown that the PRQ effectively predicts myocardial ischaemia in an animal model of coronary stenosis.⁴ Any indirect index of MVO_2 will always have limitations, but if interpreted in the

context of the clinical situation, may not be as "nonsensical" or difficult to understand as Dr. O'Sullivan might suggest.

Donald R. Miller MD FRCPC
Raymond J. Martineau MD FRCPC
Department of Anaesthesia
Ottawa General Hospital
University of Ottawa
Ottawa, Ontario

REFERENCES

- 1 Miller DR, Martineau RJ. Bolus administration of esmolol for the treatment of intraoperative myocardial ischaemia. *Can J Anaesth* 1989; 36: 593-7.
- 2 Gobel FL, Nordstrom LA, Nelson RR. The rate pressure product as an index of myocardial oxygen consumption during exercise in patients with angina pectoris. *Circulation* 1978; 57: 549-56.
- 3 Cokkinos DV, Vouridis EM. Constancy of rate-pressure-product in pacing induced angina pectoris. *Br Heart J* 1975; 38: 39-42.
- 4 Buffington CW. Hemodynamic determinants of ischemic myocardial dysfunction in the presence of coronary stenosis in dogs. *Anesthesiology* 1985; 63: 651-2.

Anaesthesia and medico-legal concerns¹

To the Editor:

It is now becoming more obvious that proper communication with the patient is an essential component in the provision of complete medical care. This issue is raised and further discussed in the above editorial. Throughout my career as an anaesthetist, it had always been my feeling that the preoperative visit made to the patient in hospital, the evening before surgery, was generally equally unsatisfactory to both patient and anaesthetist. For the most part, it would be ludicrous and inappropriate to assume that proper informed consent could be obtained after such brief encounters.

My practise has now changed and is mostly to do with diagnostic and therapeutic anaesthesia. All patients are seen initially as a consultation during which treatment is planned. Full disclosure is made to the patient with respect to planned therapy, indications, contraindications, and risk. Patients are thus informed and educated about anaesthesia. It is my opinion that for the patient who is contemplating surgery involving the administration of anaesthesia, after he/she has consulted with the surgeon, the next stop should be at the office of a consulting anaesthetist. This should be well in advance of the date of surgery. It is obvious that practising in this manner provides better patient care, decreases the likeli-

hood of an uninformed and disgruntled patient, and raises the level of professionalism for the anaesthetist.

Edward J. Sheffman MD FRCPC DABA FACA

REFERENCE

- 1 Anaesthesia and medico-legal concerns. *Can J Anaesth* 1990; 37: 1-3.

Epidural air-filled bubbles and unblocked segments

To the Editor:

I read with interest the letter by Boezaart and Levendig¹ reporting an unblocked segment due to epidural air-filled bubbles demonstrated by peridurography. While this may serve to illustrate one of the problems of using loss of resistance to air instead of saline, it also illustrates a consequence of injecting an unnecessarily large volume of air. I estimate from the peridurogram that at least 5 ml had been injected. Was this necessary? Furthermore, I would question the suggestion that the catheter migrated into the subarachnoid space some distance from the site of entry into the epidural space as illustrated. It has been shown that migration of the catheter through the dura is very unlikely to occur, if at all, unless the dura has already been breached by the needle.² How was the "CSF" tested? The commonly used method in this situation is to test for glucose. It is not uncommon to be able to aspirate fluid from the epidural space some time after a top-up, and if tested, this fluid will be positive for glucose due to diffusion of glucose from the tissues of the epidural space into the top-up solution.³ As further evidence in support of subarachnoid placement of the catheter, the authors cite the "unexpected behaviour of the block." I suggest that satisfactory analgesia after 8 ml of 0.25 per cent bupivacaine at the second lumbar interspace is entirely to be expected. Had the block lasted for three hours or more, or the spread been extensive, then subarachnoid placement may have been a possibility. Neither of these factors was mentioned. I submit that this was a completely normal epidural complicated only by an unblocked segment due to the use of an excessive amount of air.

Boyd H. Meiklejohn BSc MB ChB FFARCS
Dept. of Anaesthesia
Leicester Royal Infirmary
Leicester LE1 5WW, U.K.