- 4 Carpenter RL, Quinn HH, Liu SS, Crane B, Moore J. Lumbosacral cerebrospinal fluid volume is the primary determinant of sensory block extent and duration during spinal anesthesia. *Anesthesiology* 1998; 89: 24–9.

Temperature measurement during cardiac surgery

To the Editor:

We read with interest the paper by Robinson *et al.* that addresses the *best* site for temperature monitoring during cardiac surgery.¹ Although the authors succeeded in determining how various temperature sites compare with the still debatable 'gold standard' pulmonary artery (PA) site and concluded that oesophageal temperature is *most accurate*, this does not necessarily mean that it is the *most appropriate* temperature monitoring site during cardiac surgery. The true *best* site is determined by the balance of its precision and accuracy with its clinical utility. That is, does it accurately reflect the temperature in the organ system(s) of interest. For example, if one is interested in whole-body cooling and heating, then PA or oesophageal sites may well be appropriate. However, if one is interested in the cerebral thermal environment, particularly during rapid temperature fluxes (as during CPB), then an alternative site (tympanic or nasopharyngeal) may be better. Also, the authors mention their lack of nasopharyngeal monitoring due to the risk of epistaxis during systemic heparinization. We accept their concern but have used (and advocate) this site with no reported complications in many thousands of cases.

Finally, how one uses the temperature information to guide clinical management is equally, arguably more, important than the measurement itself. For example, the patient outlined in their Figure 1 had temperatures > 40°C during rewarming. Strategies such as slower rewarming, limiting inflow temperature, and accepting lower maximum temperatures seem prudent considering the indisputable data implicating hyperthermia in propagating cerebral ischemic injury.²

Hilary P. Grocott MD FRCPC
Mark F. Newman MD
Department of Anesthesiology
Duke Heart Center
Durham, NC

REFERENCES

- 1 Robinson J, Charlton J, Seal R, Spady D, Joffres MR. Oesophageal, rectal, axillary, tympanic and pulmonary artery temperatures during cardiac surgery. *Can J Anaesth* 1998; 45: 317–23.

- 2 Busto R, Dietrich WD, Globus MY, Valdés I, Scheinberg P, Ginsberg MD. Small differences in intraischemic brain temperature critically determine the extent of ischemic neuronal injury. *J Cereb Blood Flow Metab* 1987; 7: 729–38.

REPLY:

We agree with Drs. Grocott and Newman that our study did not address the best site for monitoring temperature while the patient is on cardiopulmonary bypass (CPB). The reason for this is that our standard (pulmonary artery temperature) could not be used while the patient was on CPB and we chose not to select another site as an alternative standard. The temperature in the hypothalamus is more relevant than is the temperature of the rest of the body during CPB. Data is conflicting as to which site correlates best with hypothalamic temperature. Mariak found that readings from a probe on the tympanic membrane corresponded more closely to readings from the deep brain than did readings from the oesophagus, rectum, or skin.¹ However, Stone found that with rapidly induced hypothermia, nasopharyngeal, oesophageal, and pulmonary artery temperatures all tracked deep brain temperature better than did a tympanic probe.² It would be helpful to replicate these studies using an infrared tympanic thermometer rather than a tympanic probe.

Nasopharyngeal probes appear to be safe in the population we studied. However, there is conflicting data as to the accuracy of readings from this site.^{2,3} Grocott and Newman's own study suggests that nasopharyngeal probes may be slow to track rise in temperature using jugular venous bulb temperature as the standard.⁴ It would have been interesting had they compared other sites with the nasopharyngeal in this study.

We agree that avoidance of hyperthermia with rewarming during cardiac surgery is a worthy goal.

Joan L. Robinson MD FRCPC
Robert Seal MD FRCPC
Department of Pediatrics
University of Alberta
Edmonton, Alberta

REFERENCES

- 1 Mariak Z, Lewko J, Luczaj J, Polocki B, White MD. The relationship between directly measured human cerebral and tympanic temperatures during changes in brain temperature. *Eur J Appl Physiol* 1994; 69: 545–9.
- 2 Stone JG, Young WL, Smith CR, *et al.* Do standard monitoring sites reflect true brain temperature when profound hypothermia is rapidly induced and reversed? *Anesthesiology* 1995; 82: 344–51.
- 3 Matsukawa T, Sessler DI, Ozaki M, Hanagata K, Iwashita H, Kumazawa T. Comparison of distal