HYPOTHERMIA AND POSTOPERATIVE OUTCOMES: ASSOCIATION OR CAUSATION? To the Editor:

We read with interest the thought-provoking contribution from Hannan and associates¹ regarding surgical outcomes as they relate to temperature. It is our opinion that the conclusions of this retrospective observational study may not be supported by the data presented.

The authors attempted to evaluate the impact of temperature on arrival in the intensive care unit on the outcomes for patients undergoing off-pump coronary artery bypass grafting. However, the design (a retrospective observational study) has a serious limitation: the association between temperature recorded in the intensive care unit and subsequent in-hospital morbidity and mortality does not establish causality. Thus, the conclusions of this particular study are unfounded given the information provided.

It remains plausible that both the impaired temperature regulatory mechanisms and the subsequent postoperative complications have common causes. For example, both hypothermia and postoperative morbidity may stem from intraoperative hypoperfusion, low cardiac output syndrome, hypotension, and under-resuscitation, among other possible factors.²⁻⁵ In the absence of data regarding perfusion indices (pH, bicarbonate and lactate levels, blood pressure, and

cardiac index), both intraoperatively and in the intensive care unit, to correlate with the recorded temperatures, hypoperfusion and under-resuscitation cannot be eliminated as a potential reason underlying both the hypothermia and a complicated postoperative course.

To further confound the issue, data are missing regarding the management of intraoperative temperatures. Were any attempts made to rewarm hypothermic patients intraoperatively? It is easy to speculate that such attempts were probably made (ie, it is implausible that the patients were left hypothermic without any intervention), but were effective only to a degree commensurate with the preservation of peripheral perfusion, accounting for a correlation between the severity of hypothermia and postoperative morbidity. In such circumstances, immediate intensive rewarming may be of dubious value, if not actually harmful.⁶

Patients at risk for intraoperative hypoperfusion and hypotension during off-pump coronary revascularization (such as those who are elderly, anemic, or have congestive heart failure) were also found postoperatively to be more often hypothermic and had higher in-house morbidity and mortality rates. That observation could hardly be attributed to hypothermia per se; at best, that indicates a significant etiologic heterogeneity in the hypothermia group. The final answer may only come from a randomized prospective clinical trial.

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Reply to the Editor:

We thank Drs Gologorsky and Salerno for their comments regarding our recent study that identified higher adverse outcome rates for patients undergoing off-pump coronary artery bypass graft surgery with higher and lower than normal temperatures on transfer from the operating room.¹

We agree with Drs Gologorsky and Salerno that the results of our study do not imply causation, but we do believe the results establish a strong association. The purpose of studies like ours that examine large observational databases is to generate testable hypotheses that can be used to ultimately improve quality of care and outcomes. Our study demonstrates that patients who are cold (or very warm) in the operating room experience worse results even if the mechanism (eg, low cardiac output, hypoperfusion, or just low temperature) is not known.

We are hopeful that these findings will establish a hypothesis-generating foundation for future studies that will shed more light on the causes of inferior outcomes for hypo- and hyperthermic patients. However, it is not clear that a randomized prospective clinical trial is a panacea because the other possible explanations posed by Drs Gologorsky and Salerno (low

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output, hypoperfusion) may very well have occurred or been exacerbated intraoperatively. It may be that observational studies with additional intraoperative data elements may be as effective in enhancing our knowledge base about the relationship between temperature and outcomes in patients undergoing coronary artery bypass surgery.

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SPONTANEOUS RUPTURE OF THE DIAPHRAGM: A DIAGNOSTIC ENIGMA

To the Editor:

We read with great interest the recent article by Losanoff and colleagues¹ on spontaneous rupture of the diaphragm (SRD), a rare condition accounting for less than 1% of diaphragmatic ruptures.² Delayed or inaccurate diagnosis remains its most challenging feature with a number of reports of inadvertent perforation of the stomach or bowel from tube thoracostomy after its wrongful interpretation on chest radiograph as pneumothorax or pleural effusion.

The difficulty in achieving early, accurate diagnosis is partly due to the sometimes innocuous cause of SRD and the nonspecific symptoms and signs associated with its occurrence. In addition, there is often a symptom-free interval between the precipitating events and the presenting symptoms, thus further complicating the diagnosis. Coughing, vaginal delivery, vomiting,

massage, and dynamic physical exercise are recognized etiologic factors. Static sporting activity (Pilates) has also recently been reported as a cause of SRD.³

Plain chest radiograph and in some cases routine computed tomography (CT) scans are easily misinterpreted, as was the case in a child who presented with SRD after pertussis.⁴ A barium meal gives the diagnosis, but this investigation is often only resorted to once there is a high index of suspicion and in addition provides limited information to aid treatment. Contrast-enhanced coronal multiplanar reformatted images of multidetector CT scans has been shown to be an optimum diagnostic tool.⁵ This modality facilitates detection of the typical collar sign between the body of the stomach in the abdominal cavity and the herniated gastric fundus. Furthermore, by identifying the degree of enhancement in the herniated bowel, a decision on the operative approach to management can be made. The intraabdominal approach is chosen as the optimal operative method for rupture of the diaphragm where the contrast-enhanced chest CT scan shows poor enhancement of the herniated gastric fundus. This finding is suggestive of the presence of strangulation in the herniated bowel. Choosing a transthoracic approach in such a case may not provide the surgeon with a wide enough operative field for the resection of strangulated bowel.

Admittedly, multiplanar reformatted images are not performed on routine CT scans, but when a high index of suspicion of diaphragmatic rupture is attained on the basis of history or chest radiography, then this modality should be used.

The key message though is that SRD remains a real and potentially life-threatening condition if missed or misdiagnosed. It should thus be paramount in the mind of any clinician reviewing a patient who has epigastric pain or dyspnea after an apparently in-

nocuous Valsalva maneuver or contemplating tube thoracostomy in a questionable pneumothorax or pleural effusion.

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Reply to the Editor:

We appreciate the comments expressed by Drs Bello and Sarkar regarding our recently published review article on spontaneous rupture of the diaphragm (SDR).¹ Challenges of this topic include the extreme rarity of the condition, preponderance of literature based on case reports, and low index of suspicion.

We partially agree with Bello and Sarkar that plain chest radiograph can easily be misinterpreted as pneumothorax that requires tube thoracostomy; hollow organ injury has so far been described twice (7%) in this rare clinical scenario.^{2,3} It must be noted, however, that in the majority