after having been completely dipped in water. The foam material in our gas diffuser is hydrophobic. Because of its elastic properties, the foam does not collapse even if it is soaked, and as the gas is blown through the diffuser large parts of its cell structure will remain clear. If the gas diffuser gets partly covered with tissue or blood, the carbon dioxide gas will, according to the law of least resistance, automatically be redirected inside the diffuser foam to exit through a clear part, and its function will remain. Thus the hydrophobic and elastic properties of the gas diffuser enable it to function well even if it is in direct contact with the wet inner wound. Although the foam material is hydrophobic, the foam may absorb and store a liquid by capillary forces if it is completely drowned and at the same time compressed in the liquid, just as a car wash sponge would. If the gas diffuser unexpectedly becomes soaked through with blood or water, a short compression with the tip of a finger will evacuate the fluid and restore full function. The same does not hold true for a wet gauze sponge because of its lack of hydrophobic and elastic properties.

To sum up, the gauze sponge has inherent properties that make it unsuitable for carbon dioxide deairing. It stops functioning as a gas diffuser when it gets wet.

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References

1. Martens S, Dietrich M, Doss M, Wimmer-Greinecker G, Moritz A. Optimal carbon dioxide application for organ protection in cardiac surgery. *J Thorac Cardiovasc Surg.* 2002;124:387-91.
2. Svenarud P, Persson M, van der Linden J. Efficiency of a gas diffuser and influence of suction in carbon dioxide deairing of a cardiothoracic wound cavity model. *J Thorac Cardiovasc Surg.* 2003;125:1041-7.
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Reply to the Editor:

We appreciate the comments of van der Linden and Persson. They report their own experiences with carbon dioxide protec-

tion, which support our intraoperative findings and conclusions drawn from measurements of intrathoracic gas concentrations. They promote the use of a self-designed tool to insufflate carbon dioxide with the argument that a sponge used as a diffuser could get wet and lose its diffusing properties. In our experience, a sponge-covered infusion line sutured to the side of the pericardium (as described in our article) does not get wet; if it were to do so, it could easily be replaced with a dry one.

However, avoidance of gas jets to reach high and stable concentrations of carbon dioxide can be achieved with other diffusion devices as well, as we have shown with a commercially available perforated drain, with which we measured $93.7\% \pm 6\%$ at 4 L of flow. Regarding minimal invasive procedures, the sponge-covered, reusable Veress needle performed excellently (reaching a mean concentration of $97.5\% \pm 2\%$), and problems related to wet sponges were not observed. But of course, there is plenty of room for new developments.

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Thromboembolic complications after beating heart coronary artery bypass operations

To the Editor:

Beating heart coronary artery bypass surgery (OPCAB) is gaining wider acceptance because of the potential benefits of eliminating cardiopulmonary bypass and its deleterious effects. The report of Cartier and Robitaille¹ is therefore interesting and adds to the genuine perturbations of this technique. However, some aspects of the study raise concern.

Cartier and Robitaille conducted a retrospective study of the thromboembolic complications after OPCAB and compared it with a selected group of patients who had coronary artery bypass grafting using cardiopulmonary bypass (CABG). They reported the incidence of thrombotic complications as 1% in 500 OPCAB patients in a 4-year period and 0.5% in 1476 CABG patients selected from the latter 2 years of

the study period. Admittedly, 3 of the 5 OPCAB patients in whom thrombotic complications developed had predisposing factors. Two had deep vein thrombosis ipsilateral to the leg where a preoperative intra-aortic balloon pump was inserted. The third had chronic renal failure and was being treated by hemodialysis.

No prophylactic regimen for preventing thromboembolism was adopted in the OPCAB patients in this study.

The retrospective study of the prevalence of postoperative thromboembolic complications is hindered by the nature of the investigation. There are many symptom-free patients with thromboembolism (up to 44.8% of patients have deep vein thrombosis after CABG)² that will be missed. Also, there are patients with mild symptoms who would not have been investigated appropriately, and yet others who have thromboembolic complications after hospital discharge and receive treatment at a different facility.

The selection of the CABG patients for comparison with the OPCAB group is worrisome. The CABG patients were chosen from a fraction of the study period for the OPCAB patients, and little is known about the patient characteristics and operative and postoperative variables of the two groups. Comparing these unmatched heterogeneous groups of patients who had different surgical myocardial revascularization techniques, operating times, and intraoperative and postoperative management, without controlling for effect modification by these variables, will prejudice the result.

It has been suggested that patients who have leg vein harvest demonstrate circulatory disturbances in the venous system of the donor legs.³ This, combined with leg wound problems and, sometimes, delayed mobilization, distinguishes the patient with saphenous vein harvest from the patient whose leg veins were not harvested. This also adds to the heterogeneity of the groups.

Thromboembolic prophylaxis is effective in patients undergoing cardiac surgery⁴ and is commonplace. The authors eruditely enunciated a formidable and impressive discussion of the hypercoagulability of major tissue trauma and median sternotomy, which are integral to cardiac surgery. It is therefore intriguing that the OPCAB patients did not receive any prophylaxis