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Carbon dioxide embolism induced by endoscopic saphenous vein harvesting during coronary artery bypass grafting

To the Editor:

We read with great interest the article by Dr Kypson¹ reporting a case of carbon dioxide embolism during saphenous vein harvesting for coronary artery bypass grafting (CABG) in a 43-year-old woman. Saphenous venous conduits were harvested by the endoscopic method with carbon dioxide insufflation. On weaning from cardiopulmonary bypass (CPB), the endoscope was reinserted to control hemostasis and a massive gaseous embolism occurred that did not respond to pharmacologic resuscitation, leading to the need for reinstitution of the CPB. Direct inspection revealed a torn saphenofemoral junction that was resected. Finally, air locks in the venous circulation and right side of the heart disappeared and the hemodynamic parameters returned to normal.

Our group^{2,3} has previously reported on 2 cases that have occurred in more than 1000 procedures to date. We would like to raise some issues concerning this observation.

First, although carbon dioxide embolism is clearly due to direct entry into the injured vein, the cause of this lesion was not discussed in the article. Reintroduction of the scope and gas reinsufflation in the operating tunnel at the end of the operation to secure hemostasis when liquid and blood accumulation may have occurred over several hours appear, at best, of little use owing to poor visualization, and they may be potentially dangerous as this maneuver was likely responsible for the tear. Hemostasis is best secured at the time of harvesting and

may be revised by direct visualization of each venous end ligation through the skin incisions. We routinely wrap the tunnel site with circular bandaging immediately after vein extraction and for the duration of the cardiac procedure, after which the bandage is removed, hemostasis double checked by evacuation (if necessary) of liquid from the tunnel, and elastic bandaging for 24 hours postoperatively. Need for direct revision of leg hemostasis is rare in our experience of more than 1000 endoscopic vein harvestings.⁴

Second, although quickly suspected, the diagnosis of carbon dioxide embolism was not made before CPB reinstitution, since at the time of the gaseous reinsufflation, the transesophageal echocardiographic (TEE) monitoring was discontinued. Since it has been shown to be the most effective method for detection of gaseous embolisms,⁵ TEE should always be available during insufflation.

Last, the author states that this complication was "unanticipated."¹ Although massive gaseous embolism with significant clinical implications is anecdotal,⁵ it has now been well described by our group² and other authors. Moreover, since the total incidence of introduction of carbon dioxide in the venous circulation reaches a 17% rate,⁵ physicians should certainly be aware of this risk, search and take into account eventual predisposing factors,² provide TEE monitoring during the whole procedure, and avoid repeated gas insufflations. Endoscopic venous harvesting is a safe procedure so long as the necessary precautions are taken.

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Reply to the Editor:

I thank Drs Mommerot and Perrault for their contributions to the literature regarding endoscopic vein harvesting and for their comments regarding my recent case report. I would also like to point out the following issues in response to their comments.

The cause of the lesion was not discussed in the article; however, injury to the saphenofemoral junction consisted of a partial tear occurring at the time of initial vein harvest and not at the conclusion of the operation, when the scope was reintroduced into the leg. Nevertheless, carbon dioxide entry into the vascular space was the result of reinsufflation at the conclusion of the case. Drs Mommerot and Perrault are correct in stating that hemostasis is best secured at the time of harvesting and reintroduction of the scope should be minimized. However, if necessary, we do re-examine the tunnel after protamine administration, albeit carefully.

Intraoperative transesophageal echocardiography (TEE) has become a valuable tool for patients undergoing cardiac surgery. We use this technique on all such procedures and do not discontinue its use until the patient is ready for transport to the intensive care unit. In this case, TEE monitoring had been discontinued because the sternotomy incision had been closed. Drs Mommerot and Perrault are correct that TEE is the most effective method for detection of gaseous embolisms. Had the probe been in place during reintroduction of the scope, it might have sooner revealed the impending problem.

In conclusion, endoscopic vein harvesting is a safe procedure with a very low complication rate. Although the incidence of introduction of carbon dioxide into the venous circulation reaches 17%, the inci-

dence of clinically significant outcomes as a result of this remains low. Massive carbon dioxide embolism causing sudden cardiac arrest is highly unusual. Nevertheless, all cardiac surgical teams should be aware of such unlikely events.

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Are absorbable sutures inadequate to close the sternum?

To the Editor:

We read with interest the article by Usui and colleagues.¹ The authors conclude that polydioxanone cord is not safe to close the sternum. We have tried to address a few relevant issues on this matter.

The mechanical performance of synthetic absorbable sutures is similar to that of stainless steel.² Nonetheless, clinical use of absorbable sutures to close the sternum has not been widely reported. In 1994, we published a series of 216 consecutive sternotomies using size 1 polyglyconate monofilament sutures (Maxon, Davis and Geck) to close the sternum,³ and in the last 12 years, we adopted the same technique in every patient undergoing median sternotomy, hemiclamshell approach, or transmanubrial approach. No cases of sternal dehiscence were observed in more than 400 consecutive patients, even in the case of reresternotomy.

Preoperative risk factors for sternal dehiscence include use of thoracic grafts, diabetes mellitus, chronic obstructive pulmonary disease, obesity, and smoking.² All patients that had broken sutures in the report by Usui and colleagues¹ presented with at least one such risk factor. However, these risk factors usually lead to late complications of sternal wound healing, whereas all 3 events in this report occurred within 2 weeks postoperatively, and macroscopic findings of the broken sutures suggest that failure of polydioxanone cord might be caused by abrasion injury as a result of friction with the bone edges. In fact, early sternal disruptions shortly after surgical intervention are more likely to be related to an inappropriate closure technique or suboptimal use of suture materials. In addition, faulty sternal splitting or paramedian sternotomy can lead to improper

approximation of the sternum, the uneven margins of which can injure the sutures.

Usui and colleagues¹ did not describe how polydioxanone cord was used to close the sternum. After median sternotomy, we routinely apply only one transsternal stitch of polyglyconate to approximate the manubrium and 2 to 3 double-loop stitches that are passed through the parasternal intercostal spaces, ensuring a double ring for each space. By using this method, the suture strength and sternal stability are enhanced. Furthermore, the absorbable suture should be handled with care because the contact with surgical instruments to clamp the knot or hold the suture in place can seriously damage the monofilament and should be avoided in any circumstance.

Polydioxanone and polyglyconate are similar in performance with respect to bursting strength.³ Both have high tensile strength, minimal tissue reaction, good memory, and elasticity (which are better than steel wire and nylon). However, negative results have been reported only with polydioxanone, and this might indicate a different clinical performance of the 2 materials with respect to sternal closure.^{1,4}

One has to consider, however, that dehiscence of a median sternotomy after cardiothoracic surgery is about 1% in the literature.² Therefore the figure of 0.8% (3/350) in the report by Usui and colleagues¹ should not be thought of as unacceptable.

In conclusion, our long-lasting experience has proved that size 1 polyglyconate monofilament sutures are safe and effective for sternal closure in noncardiac surgery, and we are convinced that monofilament absorbable sutures are at least as good as steel wire to close the sternum after complete or partial sternotomy.

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Bonnano's catheter: A less invasive and cost-effective alternative for drainage of pleural effusion

To the Editor:

We read with interest the article by Chetty and colleagues.¹ Bonnano's catheter has been proposed as a less invasive and cost-effective alternative for drainage of a pleural effusion. We congratulate them for their cost-effective and innovative approach of using a suprapubic catheter to drain the pleura.

Pigtail catheters using the modified Seldinger technique have been found to be well tolerated by the patient and are highly effective in drainage of pleural serous and chylous effusions but less efficacious in drainage of hemothorax or pneumothorax and empyema with acceptable risk of complications.²

We agree that akin to small catheters using the Seldinger technique,^{3,4} Bonnano's catheter can be used. However, with the length of the trocar and the mounted catheter being approximately 30 cm, one can lose track of the distance traveled in the thoracic cavity because there are no obvious markings on the catheter itself, and one can injure vital organs in the chest cavity, as in our institution's experience (unpublished report), in which a misplaced Bonnano's catheter pierced the left ventricle, and the tip of the catheter was found in the aortic root.

Before introduction of Bonnano's catheter into general medical and surgical use to drain the pleura, this technique needs to be validated, and the results of a prospective trial are awaited. We suggest that modifications to the catheter should include surface markings, thereby allowing the distance traveled to be gauged, and reduction of the length of the trocar, thereby reducing the risk of untoward complications.

These catheters might be useful for drainage of simple pleural effusions after surgical intervention. Complications might be related to the misplacement of the trocar because