de-airing ventricular support systems. Dr. Denton Cooley, in an accompanying editorial comment, tended to dismiss the current need for carbon dioxide displacement. I disagree. It is a remarkably effective, very simple tool to lessen the chance of air embolism to both heart and brain. Others may find it similarly useful.

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12/8/59362

Surgical glove perforation during cardiac operations

To the Editor:

Dr. Underwood and others¹ reported on glove perforations occurring during cardiac operations. They detected the perforations by filling the gloves with water and squeezing them to look for jets. I think they may have underestimated the number of surgical glove perforations by using this technique, which was described by Church and Sanderson.²

The size of the perforation is dependent on the degree of distention of the glove. As either water or air is injected into the glove, the palm distends more rapidly than the digital part of the glove. The tip of the finger, where the majority of the perforations are,³ distends least because the radius is least at the fingertip. This is an example of an important physical principle, the law of Laplace, which states that the distending pressure in a distensible hollow object is equal to twice the wall tension divided by the radius.

The accuracy of the test should be defined. Perforations should be made at various points on the glove with a needle of known size, and then either water or air should be injected into the glove to a known pressure, rather than volume, to detect these perforations. I evaluated the accuracy of the test described by Church and Sanderson² by perforating the tip of the index finger with a 2-0 gauge needle. I was not able to demonstrate a leak. This prompted me to modify the technique described by Ballbach, Beavin, and Walters.⁴ I set the accuracy of the test by, first, perforating the palm of the glove with a 7-0 gauge needle (diameter 220 μ m). The glove was sealed with a tie around the cuff and submerged under water. About 500 ml of air, corresponding to a pressure of about 0.29 kPa, was necessary before any streams of bubbles could be detected coming from the palm. Then 30 to 40 ml of air, corresponding to a pressure of about 0.74 kPa, had to be injected into each finger before any punctures in the fingertip could be detected. A control sample of 20 pairs

of gloves was tested with this method and they were all found to be leak proof. By modifying the technique originally described by Ballbach and associates,⁴ I have therefore devised a test that is standardized and reproducible and thereby minimizes both interoperator and intraoperator variation. Thirty-six pairs of surgical gloves were tested during six cardiac surgical procedures. Twenty sites of leakage were found, 19 in the fingers (eight in the tip) and one in the palm when the first part of the test was performed. However, an additional 29 sites of leakage were found during the second part of our test. Twenty-two of these were found in the fingertips. I used 10 pairs of unused gloves as controls, and they were all found to be intact during both parts of the test.

I suggest that the test originally described by Church and Sanderson² is inaccurate. In the future, the method of detecting glove perforations ought to be better defined.

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Classification of variant courses of the posterior descending artery

To the Editor:

I was interested in the anatomic study on the posterior descending artery performed by Arsiwala and Panday (*J THORAC CARDIOVASC SURG* 1993;105:952-3) and the surgical inferences drawn.

I was taught about this anatomic variation in the branching of the right coronary artery by John E. C. Wright of the London Chest Hospital. We subsequently did a small study to define the prevalence of different branching patterns (Adams and Treasure, *Thorax* 1985; 40:618-20). We studied angiograms ($n = 100$), the coronary anatomy as displayed at operation ($n = 100$), and postmortem dissections ($n = 22$). We classified them into three patterns (Fig. 1): bifurcation at the crux (*A*), at the acute margin (*B*), or in an intermediate position (*C*). The frequencies are given in Table I.

Table 1. Coronary artery patterns seen in angiograms, at operation, and in dissections

	Percent of cases (70% confidence limits)		
	Angiograms (n = 100)	Operations (n = 100)	Dissections (n = 22)
Dominant left coronary artery	11 (8-15)	5 (3-9)	14 (7-26)
PDA at crux	57 (51-62)	63 (57-68)	50 (37-63)
Early PDA	32 (27-38)	32 (27-38)	36 (25-50)
At acute margin	13		27
Intermediate	19		9
Total	100	100	100

PDA, Posterior descending artery. (From Adams J, Treasure T. Variable anatomy of the right coronary artery supply to the left ventricle. *Thorax* 1985;40:618-20. Published with the permission of BMJ Publishing Group).

Fig. 1. Anatomy of the right coronary artery as seen at operation, with the inferior surface displayed by turning the apex upwards. **A**, The "normal" anatomy of a dominant right coronary artery (*rca*) with the posterior descending coronary artery (*pd*) arising at the crux (*x*). **B**, The acute marginal artery (*am*) itself reaching the inter-ventricular groove. **C**, The right coronary artery bifurcating about two thirds of the way from the acute margin to the crux. (From Adams J, Treasure T. Variable anatomy of the right coronary artery supply to the left ventricle. *Thorax* 1985;40:618-20. Published with the permission of BMJ Publishing Group.)

Our conclusions were the same as those reached by Arsiwala and Panday.

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12/8/50726

Dynamic cardiomyoplasty at 5½ years: Russian clinical experience

To the Editor:

In the July 1993 issue of the *JOURNAL* (1993;106:42-54), Carpentier and colleagues presented their data on dynamic cardiomyoplasty performed on 52 patients with end-stage heart disease. Cardiomyoplasty with stimulated skeletal muscle was first performed by Carpentier at Hôpital Broussais in Paris in 1985. Hôpital Broussais has done the largest number of these operations in the world. In this article the authors mentioned that an additional 130 cardiomyoplasties have been performed worldwide. In Moscow, Russia, my colleagues and I began to perform dynamic cardiomyoplasty in 1988. Until March 1993, 35 such operations had been performed. Unfortunately, we published our complete results only in Russian journals and this information was not made readily available to centers where there are programs for clinic cardiomyoplasty.

The general program for skeletal muscle assistance was evaluated at Bakulev Institute for Cardiovascular Surgery in Moscow, Russia (director academician Vladimir Bourakovsky; 4000 operations on the heart, aorta, and its branches every year, including 2000 cardiopulmonary bypass procedures) in 1985. The first patient was operated on in October of 1988. We also taught this operation at the Siberian Scientific Investigation Institute of Cardiology, Tomsk, Russia (1990), Escort Heart Institute, New Delhi, India (1990), and Cumballa Hill Institute, Bombay, India (1991). In this letter I will discuss only 25 patients who were operated on before April 1992 and on whom were performed carefully comparative preoperative and postoperative studies.

Twenty-one patients had ischemic cardiomyopathy and four had dilated cardiomyopathy. Four patients were in New York Heart Association class III and 21 in class IV. Exercise thresholds ranged from 25 to 50 watts, with an average of 30.5 watts. End-diastolic volume of the left ventricle was from 264 to 420 ml with a mean of 310.2 ± 4.6 ml. Left ventricular ejection fraction varied from 18% to 38% with a mean of $30.2 \pm 2.6\%$. The range for left ventricular end-diastolic pressure was from 16 to 32 mm Hg with a mean of 22.8 ± 1.2 mm Hg. A median sternotomy, in four patients, was used as the operative approach in 1988 and 1989. Since 1990 the exposure of choice has been left anterolateral thoracotomy through the fourth intercostal space. Thirteen patients received