special communications

An Alternate Method of Ventricular Venting—The Pulmonary Artery Sump*

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The need for venting the heart during cardiopulmonary bypass has been the topic of continued debate. Potential disadvantages and drawbacks have been noted with traditional modes for venting. A technique for venting the heart is presented using a pulmonary artery catheter. The relative advantages and merits of this approach are discussed.

Prior to the widespread use of hypothermic cardioplegic techniques for myocardial preservation, the merits and drawbacks of left ventricular (LV) venting were debated extensively. Several earlier studies demonstrated physiologic benefits of venting, particularly for revascularization procedures carried out in the setting of induced ventricular fibrillation.1,2 Fear of air embolism, postoperative hemorrhage, or late aneurysm formation,3,4 as well as the failure to demonstrate convincingly the clinical advantage of venting,5,6 perpetuated this debate about the need for LV vents. To decrease the possibility of complications from the apical LV vent, other approaches have been described. These include the superior pulmonary vein, the left atrium, and the ascending aorta.5,7 Each method, however, has potential risks and drawbacks.

With the development of more sophisticated means of myocardial preservation including cold cardioplegia, continuous topical cooling, and systemic hypothermia, the issue is perhaps more clouded. Recent studies have yielded conflicting results.8,9 Potential advantages of venting during aortic cross clamping include decreased distention with decreased elevation of end-diastolic pressure, decreased myocardial rewarming, and decreased blood return to the operative field. During reperfusion, a vent may decrease myocardial oxygen consumption, improve subendocardial blood flow, and again avoid the potentially harmful effects of distention.

We have adopted a method of venting the heart which offers these advantages while avoiding almost all of the disadvantages of venting.

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METHOD

Prior to cardiopulmonary bypass, a No. 14 Robnet catheter with a vacuum relief valve is introduced into the main pulmonary artery 1 to 2 cm distal to the pulmonary valve. This is then secured with a previously placed pledgeted suture using a "sleeve and snare" technique. Alternatively, a small Argyle LV vent catheter with a sump is used and is kept in place by the internal and external bumpers. The catheter is attached to tubing used for cardiotomy suckers and continuous suction is maintained (Fig 1). Flows range from 50 to 250 ml/min for routine cases. In revascularization procedures, suction is maintained on the pulmonary artery vent throughout aortic cross clamping and during the early period of reperfusion. When the proximal anastomoses have been completed and the heart has resumed spontaneous contractions, the suction is discontinued and the catheter is removed. The vent site is closed by tying the previously placed pledgeted suture, or by using a running 4-0 prolene suture. When the vent is used during valve replacement, enough suction is maintained to decrease or almost halt collateral circulatory return to the operative field. While closing the atriotomy or aortotomy, the sump is temporarily turned off to allow the heart to...
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by aortic, vent, left atrial or ventricular vent, or for left ventricular venting; observations in humans. Ann Thorac Surg 1975; 20:418
ventricular aneurysm repair. In such cases, one can hypothesize the possibility of introducing increased air into left heart or pulmonary vasculature with suction on a PA sump. In practice, however, we have not found this to be the case. The risk of air embolism in revascularization cases using this mode of venting is negligible. Bleeding from the PA vent site has not been a problem even where severe pulmonary hypertension has been present, and, to our knowledge, no late complication has occurred at the vent site. The ease with which this vent can be placed is marked when compared to the sometimes troublesome insertions of apical or superior pulmonary vein vents. This is especially true for patients having repeat cardiac procedures. Access and control are likewise simplified if hemorrhage is noted after removal. Anecdotally, we have even been informed of one pulmonary artery embolism which was diagnosed and treated by removing the clot found in the pulmonary artery at the vent site.

This technique of venting has been used by our group in over 1,000 adult patients undergoing cardiopulmonary bypass with no complications. We are not certain that venting through the pulmonary artery provides the same decompression of the left heart as an aortic, left atrial or ventricular vent, but are presently investigating this question in the laboratory. Obviously, acute LV distention from significant aortic regurgitation will not be prevented by a pulmonary artery vent. In case of mild aortic insufficiency, however, we have not had problems.

While the precise physiologic effects of the pulmonary artery vent have not been completely defined, we have found it to be a very simple and safe means of limiting left heart distention, rewarming, and collateral blood flow to the surgical field with virtually no risk of morbidity or mortality.

REFERENCES
1 Zwart HHJ, Brainard JZ, DeWall RA. Ventricular fibrillation without left ventricular venting; observations in humans. Ann Thorac Surg 1975; 20:418
2 Buckberg GD. The importance of venting the left ventricle. Ann Thorac Surg 1975; 20:488
4 Lee SJK, Ko PTH, Hendin D, Sterns LF. False left ventricular aneurysm as a complication of open heart surgery. Can Med J 1976; 115:45
8 Siderys H. The superior approach for operative decompression of the left side of the heart. Ann Thorac Surg 1979; 17:277