Technique

Gravity Venting of the Left Ventricle: A Useful Adjunct

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ABSTRACT

Venting of the left ventricle helps in decompressing the heart and improves visibility during surgery. Venting may be performed by direct cannulation of the left ventricle or the pulmonary veins. It may also be performed indirectly from the aortic root or pulmonary artery. We describe a method of left ventricular venting, by gravity, using the venous return of the heart.

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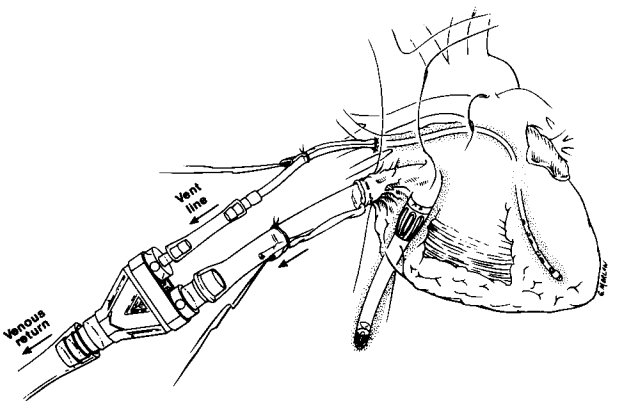
Figure 1
Circuit for gravity drainage of left ventricle using the venous return cannula



INTRODUCTION

Venting the left ventricle (LV) during cardiac surgery is performed by most surgeons (1). The method of venting the left ventricle is by either direct cannulation of the left ventricular apex (2) or with a cannula introduced through either the left atrium (3) or right superior pulmonary vein (4) across the mitral valve. Indirect venting of the left side from the pulmonary artery (3) or aortic root (5) has also been described as affording equal protection with less complications. In our unit, gravity venting of the left ventricle by connecting the vent cannula to the venous return on the cardiopulmonary bypass circuit has been favored in coronary bypass surgery. An extensive literature search has revealed that this method has not been previously reported. The circuit and its benefits are described.

METHODS

Standard cardiopulmonary bypass circuitry is used. High aortic cannulation is performed with arterial cannulae. Cannulation for venous return is performed with a two-stage Sarns cannula[a] through the appendage of the right atrium.

This cannula is connected to the venous return tubing through a 1/4 x 1/2 x 1/2" connector with a 1/4" tubing extension which is filled and kept clamped. Once on bypass, a 3-0 Prolene[b] purse-string suture is placed on the right superior pulmonary vein junction with the left atrium. A left ventricular vent cannula with an obturator[c] (Model #W410-62) is introduced into the right superior pulmonary vein and guided into the LV across the mitral valve. Crossing the mitral valve orifice is occasionally difficult and requires the help of the right hand to direct it into the left ventricle. This maneuver is helped by palpation of the posterior wall of the left atrium by the surgeon's right hand while his left hand manipulates the vent with the obturator. The obturator is then removed and the vent cannula clamped to avoid suction of air while the heart is still beating efficiently. The LV vent catheter is connected through a 1/4 inch tube to a 1/4 x 1/2 x 1/2 inch connector and the two-stage venous return cannula is connected to the venous return tubing from the pump through the 1/2 inch port of the connector (Figure 1). The cannula is then unclamped. The vent drainage is entirely by gravity.

a Sarns, 3M Health Care, Ann Arbor, MI 48103
b Ethicon, Somerville, NJ
c Sorin, Irvine, CA

DISCUSSION

The advantages, both in terms of immediate and long-term preservation of left heart ventricular function, in venting or not venting the LV is still a controversial issue. Some surgeons never vent, others routinely vent all patients (1). A third group vents the LV in selected patients.

Venting keeps the field relatively bloodless, improving visibility, especially with increasing use of continuous warm blood cardioplegia. It also keeps the heart empty and prevents distention, which can be detrimental to the myocardium. These factors assume importance with increasing use of normothermic cardiopulmonary bypass using warm blood cardioplegia. Distention occurring in the absence of venting is perhaps not of great importance when cold cardioplegic arrest is employed (6).

Decompression of the left ventricle may be achieved in many ways, all of them equally effective for the purpose that they are used for. Though a left ventricular apical vent is the most direct method, it may cause mechanical injuries to the LV or mitral valve 91) and can also disrupt collaterals in the apex resulting in an akinetic area (7). An ascending aortic vent, effective while the the aorta is cross-clamped, is not effective when the aorta is unclamped and the heart is still cold and incapable of ejection. Even when clamped, if too much suction is applied to it, air can be suctioned into the aortic root around the needle or through the opened coronary arteries (3). Late complication of ascending aortic aneurysm at the vent site has been reported (8).

Inserting an ascending aortic vent would also be problematic in the elderly with a fragile or calcified aorta. Venting through the pulmonary artery is an indirect, retrograde method which avoids the potential complications of direct LV apical venting and is considered to be adequate (3). LV venting through the pulmonary vein has the advantage of an apical vent but with fewer complications. The incidence of complications from venting the left ventricle through the pulmonary vein is low.

Most cardiopulmonary bypass circuits involve the vent being connected to a roller pump (2). This, in addition to requiring a supplementary roller pump, can cause suction of air (1,9), increasing the potential for air embolism and red blood cell and platelet destruction, due to exposure of blood to negative pressure. The circuit that we employ does not have these disad-

vantages as it depends on gravity and to some extent on the Venturi effect caused by the venous return in the two-stage cannula. It avoids excessive negative pressure in the ventricular chamber while adequately draining it. We have employed this method of draining the LV during the past seven years in patients undergoing coronary bypass procedures with no complications to date.

It cannot be used when the left heart cavities are opened as this would lead to air in the venous circuit and, therefore, it is used only in coronary artery bypass grafting. This also should not be employed with simultaneous ascending aortic suction as it reverses flow from the venous return. It has a definite advantage over the ascending aortic vent when the aortic clamp has been released and the contractions are neither efficient nor strong.

We describe above a technique of venting the left ventricle by gravity drainage utilizing the venous limb of the bypass circuit, which is safe and effective.

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REFERENCES

1. Little AG, Lin CY, Wernly JA, et al. Use of pulmonary artery for left ventricular venting during cardiac operations. J Thorac Cardiovasc Surg. 1984;87:532-538.
2. Roberts AJ, Faro RS, Williams LA, et al. Relative efficacy of left ventricular venting and venous drainage techniques commonly used during coronary artery bypass graft surgery. Ann Thorac Surg. 1983;36:444-452.
3. Heimbecker RO, McKenzie FN. A new approach to left heart decompression. Ann Thorac Surg. 1976;21:456-457.
4. Vucins EJ, Rusch JR, Grum CM. Vent stitch entrapment of Swan-Ganz catheters during cardiac surgery. Anesth Analg. 1984;63:772-774.
5. Schneider B, Conti VR, Kurusz M. A technique for cardioplegic infusion and left heart venting during coronary artery bypass grafting. Ann Thorac Surg. 1983;36:105-106.
6. Breyer RH, Meredith JW, Mills SA, et al. Is a left ventricular vent necessary for coronary artery bypass operations performed with cardioplegic arrest? J Thorac Cardiovasc Surg. 1983;86:338-349.
7. Shaw RA, Kong Y, Pritchett ELC, Warren SG, Oldham HN, Wagner GS. Ventricular apical vents and postoperative focal contraction abnormalities in patients undergoing coronary artery bypass surgery. Circulation. 1977;55:434-438.
8. Stassano P, De Amicis V, Gagliardi C, Di Lello F, Spampinato N. False aneurysm from the aortic vent site. J Cardiovasc Surg. 1982;23:401-402.
9. Laughlin LL, Holland DL, Wareham EE. Left heart decompression via the pulmonary artery. Thorac Cardiovasc Surg. 1983;31:117-118.