TECHNIQUE

Dynamic Assessment of Mitral Valve Repair by Directing Pump Blood into the Left Ventricle

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Abstract

Intraoperative testing has a major role in the evaluation of the results of mitral valve repair. Static evaluations are possible by inspecting the valve. Once the patient is weaned from cardiopulmonary bypass, dynamic assessment can be done by digital palpation through a partially closed left atriotomy or pressure monitoring or by transoesophageal or epicardial echocardiography. Before weaning off cardiopulmonary bypass, dynamic assessment is possible by injection of cold saline or cardioplegic solution into the left ventricle either by a catheter advanced through the aortic valve or through a left ventricular apical vent. Another method is by connecting the apical vent to the arterial line of the cardiopulmonary bypass by short side tubing. Repeated clamping and unclamping of this side tubing and the vent suction tubing will divert the arterial blood into the left ventricle under adequate pressure to test the dynamic function of the valve. This method leads to sudden partial diversion of the pump flow towards the left ventricle and absent vent flow. The perfusion technologist should be aware of this method and make appropriate adjustments in the pumping procedure.

Introduction

In selected patients, mitral valve repair gives better long term results and quality of life than valve replacement. After meticulous repair, intraoperative testing has a major role in the evaluation of the results before coming off bypass. Static evaluation by inspection of the valve is possible but gives little indication of the competence of the valve. Dynamic assessment includes digital palpation through a partially closed left atriotomy, left atrial pressure monitoring and transoesophageal or epicardial echocardiography. All these methods can only be used once the patient is weaned off cardiopulmonary bypass. Another possibility is the injection of cold saline or cardioplegia solution into the left ventricle either directly through the mitral valve or by a catheter advanced through the aortic valve or through a left ventricular apical vent.

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An alternative method is the injection of blood from the arterial line through the apical vent (1). This method has the advantage of obtaining rapid rises in ventricular pressure that can be easily repeated. The perfusion technologist should be aware of all these methods of testing the mitral valve closure mechanism.

Method

Standard cardiopulmonary bypass with an arterial cannula and single or double venous cannulae are used. A left ventricular apical vent is connected to the vent suction. This suction line is connected to the arterial line by a side tubing which is double clamped (Figure 1). Cardioplegic arrest is achieved with cold crystalloid cardioplegia solution infused through a wide bore needle into the aortic root under pressure. The left atrium is opened, along the right interatrial sulcus. Different types of mitral valve repair are performed. Static evaluation of the repair is done. The dynamic assessment of the mitral valve is carried out as follows:

The cardioplegia needle at the proximal end of the aorta is opened to avoid air trapped in the left ventricle or ascending aorta from entering into the coronary arteries. The clamps from the side tubing are transferred to the vent suction (Figure 2). This leads to diversion of blood from the arterial line under the same pressure into the left ventricular cavity, thus enabling the surgeon to assess the adequacy of the mitral valve closure. Care is taken not to pull the atrial retractor too hard to avoid distortion of the annulus and leaflets and induce false regurgitation. In combined aortic and mitral valve surgery, the aortic root is temporarily occluded with an obturator of the appropriate size, introduced into the aortic valve area. Once the assessment of mitral valve repair is over, the clamps are transferred from the suction tubing to the side tubing. If necessary, further surgical maneuvers are carried out on the mitral valve and the testing procedure is repeated as before. If required, further cardioplegia can be given through the same needle in the proximal aorta, but only after ensuring that the cardioplegia line is free of air.

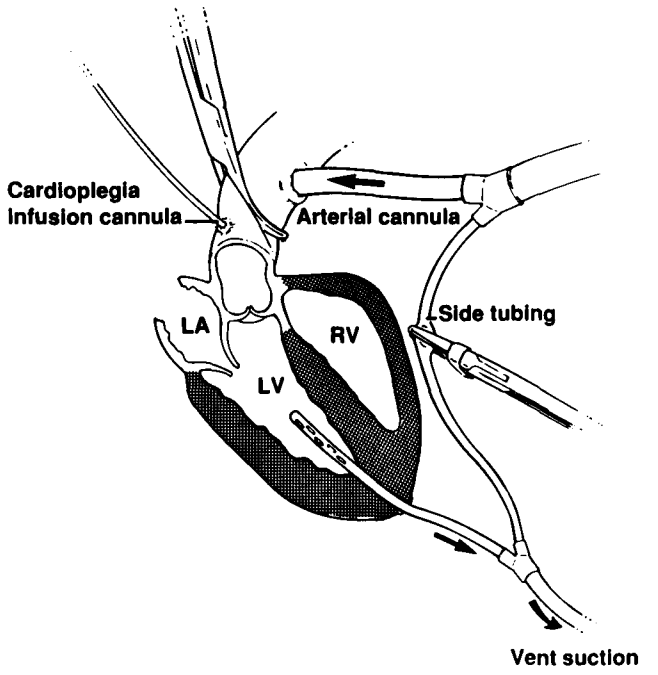

Figure 1 - Clamp on the side tubing, with the left ventricular apical vent on suction. LA - left atrium, LV - left ventricle, RV - right ventricle.

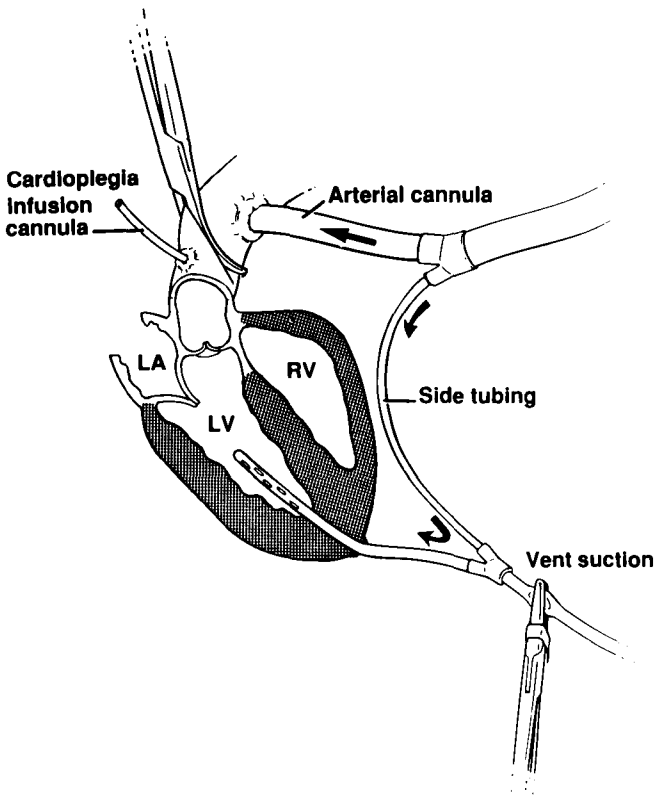

Figure 2 - Clamp on the vent suction diverting arterial blood into the left ventricle. Cardioplegia needle is open to air. LA - left atrium, LV - left ventricle, RV - right ventricle.

Comments

The sudden diversion of blood from the arterial line leads to a decrease in pumping pressure by 5 mmHg to 10 mmHg and reduction in cardiac index into systemic circulation. The reservoir blood level is down by about 100 ml each time a test is carried out. There is also a decrease in the venous return to the pump because of the sudden interruption of the vent return. Perfusion technologists should be aware of this situation and adjust the pump and vent suction. Once the test is over, readjustment has to be made when the clamps are transferred to the side tubing. A good coordination between the surgeon and the perfusion technologist is required to achieve a good result. Myocardial temperature may go up by 5 to 10°C because of the sudden surge of warmer blood into the left ventricular cavity and the surgeon can be made aware of this for necessary action.

Many surgeons carry out the dynamic evaluation of the mitral valve closure mechanism by directing pump blood into the left ventricle under the same systemic pressure with the aorta cross clamped. All the method requires is a short side tubing from the arterial line to the vent suction. There is no possibility of distending the left ventricle higher than the systemic pressure. By venting the aortic root through the cardioplegia needle, separate venting for the aortic root is unnecessary. Repeated testing for adequacy of the repair is possible without adding volume of crystalloid saline into the circulation (2).

Good coordination between the surgeon and the perfusion technologist is required to maintain appropriate cardiac output and optimum perfusion pressure. Sudden unclamping and clamping of the side tubing and the vent, diverting blood into left ventricular cavity leads to changes in the perfusion system. The perfusion technologist should be aware of this method to test the mitral valve repair and to be ready to take appropriate, immediate action to maintain optimum perfusion to the patient.

Acknowledgement

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