Detecting Malocclusion of the Aorta after Cross-Clamping

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Abstract

(J. Extra-Corp. Technol. 19[2] p. 231-232 Summer 1987). The aortic cross-clamp, when applied, may not, for a variety of reasons, totally occlude the aorta. Leakage during cardioplegic infusion increases the volume required for effectiveness. Between infusions, systemic perfusate can warm the heart. Such leakage can lead to more frequent infusions of greater volume while minimizing myocardial protection. Described is a simple technique to assess the quality of occlusion immediately after the application of the aortic cross-clamp.

Introduction

Malocclusion of the aorta may remain after application of cross-clamp for a number of reasons, including misapplication of the clamp, a faulty clamp, and irregular aortic walls that cannot approximate. When malocclusion persists, cardioplegic solution administered via the aortic root may be diluted during infusion; after infusion, blood escaping through the nonocclusive clamp can wash out the cardioplegic solution and warm the heart. The abolition of electrochemical myocardial activity may require excessive amounts of cardioplegic solution.

We have devised a simple, quick procedure to evaluate the adequacy of aortic occlusion following the application of the aortic cross-clamp.

Materials and Methods

Administration of the cardioplegic solution is by pump. The administration kit has a connector with a luer port distal to the pump header; a manometer is attached to the luer port via large bore monitoring tubing with an integral hydrostatic bacterial filter. This apparatus facilitates monitoring of the pressure in the administration line.

The cardioplegia administration cannula is placed in the aorta prior to cross-clamping and an approximation of the aortic pressure is observed on the manometer on the bubble trap. As the clamp is applied, the pressure on the manometer drops. To test the occlusiveness of the clamp, the perfusionist, while observing the manometer, quickly drops the arterial blood flow by about 50% for a moment, and then returns it to its proper level. This is accompanied by a drop in the arterial pressure; if the aorta is not adequately occluded, a commensurate fluctuation, albeit damped,

Figure 1: A diagram of the cardioplegic infusion circuit and the applied aortic cross-clamp. The technique described in the text utilizes the manometer in the infusion circuit to detect malocclusion of the aortic cross-clamp. A sharp, downward "spike" in flow will usually cause a corresponding deflection of the manometer needle if malocclusion exists.
may be observed on the manometer on the cardioplegic administration line during this maneuver (Figure 1).

Results

During 100 consecutive surgeries involving cardiopulmonary bypass with cardioplegic arrest, each perfusionist noted the presence or absence of malocclusion on the pump record. Malocclusion occurred in four cases, for an incidence of 4%. It was resolved by re-applying the clamp or by using a different clamp in all cases.

Discussion

The incidence of malocclusion is small—so small, it is often obscured by the task at hand, going unnoticed until more frequent increments of greater volumes of cardioplegic solution are required. This simple technique detects malocclusion early, before the surgeon is involved in the procedure.

If malocclusion is due to an irregular layer of atherosclerotic plaque lining the aorta, adequate occlusion may not be possible. In this instance, it may be necessary to use a different route for cardioplegic administration, such as retrograde infusion via the coronary sinus. However, we have not had this need arise in the four years we have used this technique.

Reference