

A Simple Method of Treating Coronary Air Embolism After Cardiopulmonary Bypass

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Coronary air embolism is a potential complication of cardiac operations performed with cardiopulmonary bypass, especially open heart operations. There are many recommended methods described in the literature to treat the sequelae of coronary air embolism, none universally

effective. We describe a simple and safe method to treat the condition, which we have found very effective in our practice.

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Coronary air embolism is a recognized complication after cardiac operations performed with cardiopulmonary bypass, especially open heart operations [1]. It can result in cardiac arrhythmia, myocardial infarction, decreased myocardial contractility and consequent low cardiac output syndrome, intractable ventricular fibrillation, and even death [1, 2].

Current management concentrates on prevention of air embolism by mechanically removing air from the heart and great vessels before the aortic cross-clamp is released. However, use of intraoperative transesophageal echocardiography has revealed that it may not always be possible to completely remove air from the heart by careful standard methods, and air embolism might still occur from the delayed release of air trapped in the pulmonary veins [3].

In an experimental study, pretreatment with a perfluorocarbon emulsion has been shown to protect the heart from the effects of coronary air embolism [4]. On a more practical perspective, current literature advocates the use of mechanical systole or inotropic and vasopressor drugs, increasing pump flow rates, and even constricting the aorta distal to the aortic cannula to try and dislodge the air embolus. Whereas some of these techniques are not very effective, others are potentially dangerous. Others advocate complex methods of air removal using retrograde coronary perfusion techniques [2, 5]. We describe a simple and safe technique of removing air from the coronary circulation by using an antegrade perfusion technique.

Technique

After weaning from cardiopulmonary bypass but before decannulation, if there is reduced cardiac contractility, frequent ventricular extrasystoles or other new cardiac arrhythmia, or acute electrocardiographic changes sug-

gestive of ischemia, coronary air embolism is assumed in the absence of any other obvious cause. We are not always able to see air in the coronary arteries. In such situations we restart full extracorporeal circulation. Then a 50-mL disposable syringe with a Luer-Lok is attached either to the aortic root cannula or the aortic root vent (Fig 1). Keeping the syringe vertically upwards the plunger is gently withdrawn, filling the syringe with



Fig 1. Using a 50-mL syringe with a Luer-Lok attached to an aortic root cannula proximal to the aortic cross-clamp to remove air from the coronary circulation after an open heart procedure.

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blood. After it is completely filled the aortic cross-clamp is reapplied and the plunger is gradually depressed, emptying the syringe into the proximal aorta. This increases the flow rate and perfusion pressure in the coronary circulation, clearing any air in the vessels in an antegrade manner. Occasionally, the procedure needs to be repeated. In pediatric patients, a proportionately smaller syringe is used.

If the heart was in atrial fibrillation or a bradycardia was present, we have often noted a spontaneous return of sinus rhythm at this stage. Any ischemic change in the electrocardiogram usually disappears. The cross-clamp is removed, and the heart can be seen to be contracting much better, reflected by an improved cardiac output and lack of any visible air in the coronary circulation.

The technique described above is very simple, and as the flow pressure is easily controlled by the rate of depression of the plunger, it is much safer than methods that advocate cross-clamping the aorta distal to the aortic cannula.

Comment

Our method of treating coronary air embolism is a simple technique usefully performed at the time of discontinuing cardiopulmonary bypass. It has been shown that after coronary artery bypass grafts, air emboli occur in the

period between cross-clamp removal and termination of cardiopulmonary bypass [3]. In open heart operations, although air emboli were found even up to a half hour after the operation, most emboli occurred between release of the cross-clamp and termination of cardiopulmonary bypass.

In our experience, we have not had any complications from using this procedure. However, caution needs to be exercised in re-clamping a calcified or atheromatous aorta.

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