Fig. 1. Aprotinin plasma concentrations. The left part of the figure shows aprotinin concentrations (mean $\pm$ standard deviation) in plasma samples directly drawn from the patient and in specimens that were rotated for 10 minutes in either celite or kaolin test tubes. The right side shows the individual measurements for each patient. Aprotinin was almost undetectable in the kaolin tubes, which indicates a binding of aprotinin to kaolin.

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Use of an intraluminal shunt to repair a coronary bypass graft injury during re sternotomy

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In recent years, there has been an increase in the number of patients who are subjected to second cardiac procedures for correction of congenital heart defects, valve problems, and repeat coronary artery revascularization. Catastrophic hemorrhage is a rare complication that may occur while the sternum is being reopened. The most frequent causes include tears of the right ventricle and lesions of previous coronary bypass grafts; less common are bleeding from ascending aortic aneurysms or tears in the right atrium.

In 1985, a 66-year old patient had undergone an aortic valve replacement with a Capentier-Edwards bioprosthesis (Baxter Healthcare Corp., Edwards Div., Santa Ana, Calif.) and a saphenous vein graft to the circumflex artery with jump anastomoses to an intermediate branch, the first diagonal branch, and the left anterior descending artery. Postoperative recovery was uneventful, and the patient felt well until 1992. At this time, the patient reported having exertional dyspnea and increasing weariness. A cardiologic examination was performed and transthoracic echocardiography demonstrated degeneration of the bioprosthesis, resulting in moderate aortic stenosis (mean systolic gradient 45 mm Hg, peak-to-peak gradient 70 mm Hg, and a valve opening area of 0.8 cm²). Left ventricular function was severely depressed with an ejection fraction of 0.26. At coronary angiography, each coronary-saphenous vein anastomosis was patent but

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Fig. 1. Insertion of a silicone shunt, secured with tourniquets, between the vein graft segments.

some atherosclerotic changes were described in the proximal part of the graft.

A median sternotomy was performed with the oscillating saw; during preparation and mobilization of the sternal borders, the aneurysmal proximal part of the saphenous vein bypass graft, which was completely adherent to the sternum, was damaged. Because of the important myocardial area supplied by the graft, it could not have been occluded either with clamps or with Fogarty catheters. Therefore we elected to insert a small intraluminal silicone shunt, which is usually used during carotid endarterectomy to preserve homolateral cerebral perfusion, as a bridge between the proximal and distal vein graft segments and secured it with tourniquets (Fig. 1). With this technical assistance, the bleeding could be easily controlled and no electrocardiographic changes or hemodynamic alterations appeared.

Femoral artery cannulation was then performed, the right atrium was dissected, and a single-stage cannula was introduced into the right atrium. Extracorporeal circulation was instituted and conducted at moderate hypothermia. Myocardial protection was performed by retrograde continuous cardioplegia. After the aorta was cross-clamped, the bioprosthesis was resected and a mechanical prosthesis was inserted. A short venous graft was interposed to repair the lesion and exclude the aneurysmal segment (Fig. 2). Postoperative recovery was uneventful and no clinical or electrocardiographic signs of perioperative myocardial infarction appeared. The patient was discharged on postoperative day 10.

Several factors account for the increased risk of reoperation: age, progressive extent of coronary atherosclerosis, impairment of left ventricular function, additional cardiac procedures, technical difficulties during reentry and caused by intrapericardial adhesions, and prolonged bypass time and more difficult myocardial protection.¹

Various methods have been proposed in the past for sternal reentry. Femoral artery cannulation can be used

Fig. 2. A short vein graft was used to repair the lesion and exclude the aneurysmal segment.

when the right ventricle seems to be adherent to the sternum, when there is strong suspicion that the internal mammary artery or a venous bypass graft is crossing the midline, when the chest has been reconstructed by muscle flaps, and when an ascending aortic aneurysm is present.^{2,3}

When progressive coronary artery disease necessitates a second operation with a new graft to the anterior and posterolateral walls of the left ventricle, thoractomy may allow excellent exposure of the left anterior descending branch and obtuse marginal branches. Proximal anastomoses are then performed to the descending aorta.⁴

In the case presented here, the use of an intraluminal shunt allowed us to control the bleeding and maintain a sufficient perfusion to prevent myocardial ischemia; furthermore, it allowed controlled, unhurried institution of cardiopulmonary bypass. This elegant method, preventing bleeding and myocardial ischemia, prompted us to review the literature, and we found only one similar description.⁵

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