

A Report of the Treatment of Coronary Artery Aneurysm Without Cardiopulmonary Bypass

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INTRODUCTION

Coronary artery aneurysm (CAA) is a fairly rare pathologic entity whose exact incidence is unknown but has been reported from 1.4% in autopsy series [Daoud, 1963] to 4.9% in the Coronary Artery Surgery Registry [Swaye, 1984]. While atherosclerosis is the most common cause of true coronary artery aneurysms, pseudoaneurysms most often occur as complications of percutaneous transluminal coronary angioplasty (PTCA) or directional atherectomy [Dralle, 1995]. We report the successful treatment of a coronary artery aneurysm with concomitant coronary revascularization without the use of cardiopulmonary bypass in a patient with impaired pulmonary and myocardial function. The use of an intracoronary shunt, previously described by one of the authors (EW), facilitated the surgical procedure [Franzone 1977].

CASE REPORT

In 1990, a 50-year-old male presented with an acute anterior myocardial infarction and underwent PTCA of a mid-left anterior descending (LAD) lesion. He was readmitted in 1993 with chest pain and a myocardial infarction was ruled out. Cardiac catheterization demonstrated an ejection fraction of 45% and the LAD had a 95% stenosis at the site of the previous PTCA. The location of the stenosis was in proximity to the origin of the second diagonal, and a septal perforator. A 1.5 mm saccular aneurysm was noted just distal to the LAD stenosis (see Figure 1). The coronary angiogram from 1990 was not available but there was no mention of a CAA in the catheterization report. PTCA of the lesion was again performed. In 1997 the patient presented with chest pain and associated shortness of breath. There

were no EKG changes, cardiac enzymes were negative, and a myocardial infarction was ruled out. The ejection fraction was 24% and the left ventricular end-diastolic pressure was 32 mm Hg. There was a 99% stenosis of the LAD at the site of the previous PTCA. The saccular aneurysm had enlarged to approximately 2.5 mm (see Figure 2). The patient reported symptoms of pleuritic chest pain and hemoptysis. A pulmonary angiogram failed to demonstrate a pulmonary embolism. A venous duplex scan revealed a left common femoral venous thrombosis. Anticoagulation with warfarin was begun and continued for three months. At that time a repeat venous duplex Doppler scan demonstrated resolution of the thrombus. Due to a history of long-standing asthma, pulmonary function tests were obtained and revealed a mixed ventilatory defect. The diffusion capacity was 18.9 ml/min/mm Hg, decreased from 26 ml/min/mm Hg one year previously.

Because of systolic and diastolic dysfunction, as well as the patient's impaired pulmonary function, coronary artery bypass grafting and repair of the CAA were carried out without cardiopulmonary bypass. The internal mammary artery was not suitable and a reverse saphenous vein was chosen as the conduit. Under general anesthesia, with hemodynamic monitoring, and the patient fully anticoagulated, a median sternotomy was performed. There was global hypokinesia of the left ventricle and scarring of both the anterior and inferior walls. The LAD was approximately 1.5 mm and the saccular aneurysm approximately 3 mm. First, the proximal aortic anastomosis was constructed using standard partial occlusion techniques. The anterior surface of the heart was then rotated into the operative field by packing sponges laterally and posteriorly, allowing excellent visualization of the LAD and the CAA. Neither hemodynamic instability nor arrhythmia occurred and vasoactive drugs were not employed. The LAD was opened distal to the stenosis and a soft, medical grade silastic intracoronary shunt, with a tie secured around its middle, was placed into the coronary artery. This technique allowed

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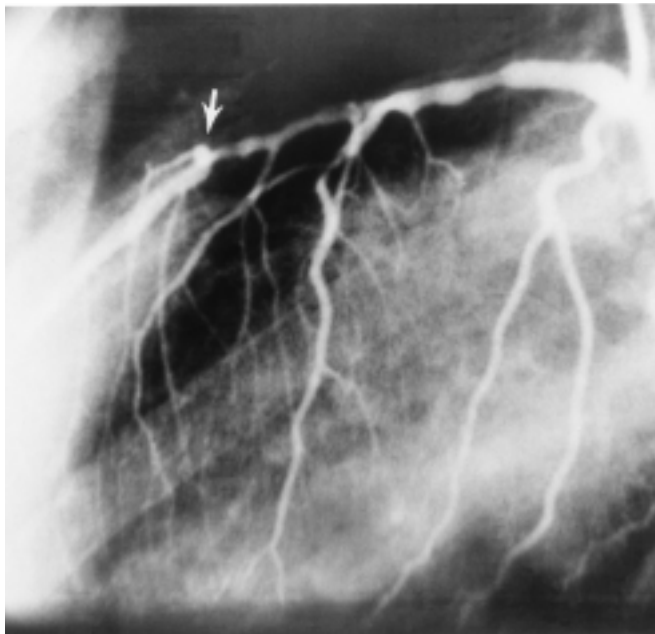


Figure 1. 1993 coronary angiogram in the left anterior oblique projection demonstrating the LAD aneurysm (arrow). Note the proximity of the diagonal and septal branches.

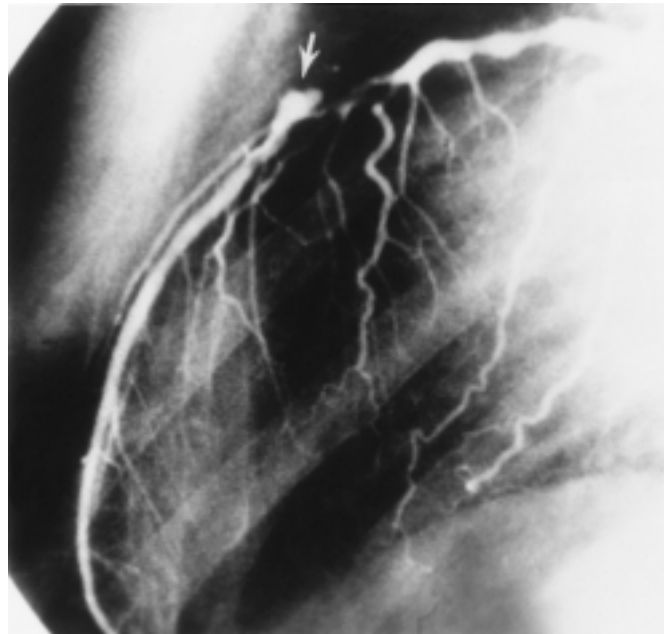


Figure 2. 1997 coronary angiogram in the same projection demonstrating the enlargement of the CAA.

uninterrupted coronary flow and construction of the distal anastomosis in a bloodless field. In the beating heart, distraction of the intraluminal shunt by grasping the tie facilitated precise suture placement. The shunt was removed by traction on the suture tie prior to placement of the final sutures, which were taken on the side of the anastomosis. Following completion of the distal anastomosis, air was vented from the vein graft prior to the establishment of graft flow.

There are several techniques reported for repair or exclusion of a CAA. Due to the location of the aneurysm at the origin of a septal perforator and diagonal branch in this case, exclusion was not considered. With local proximal and distal control using vascular bulldog clamps, the saccular aneurysm was opened; the neck was easily identified and closed with interrupted, 6-0 polypropylene sutures. A portion of the aneurysmal wall was sent for pathological examination and found to be representative of a true aneurysm. Finally, the supporting sponges were removed, anticoagulation reversed, and standard closure accomplished. The patient had an uncomplicated post-operative course and is asymptomatic eight months later.

DISCUSSION

Since the 1980's there has been renewed interest in myocardial revascularization without the use of cardiopulmonary bypass. Pfister and associates reported excellent results with this method. Their data suggests that patients with diminished left ventricular function may derive a greater benefit when this technique is employed [Pfister,

1992]. Buffolo and colleagues reported an overall mortality of 2.5% in 1,274 patients undergoing coronary revascularization without cardiopulmonary bypass, with a decreased incidence of arrhythmias, and pulmonary and neurologic complications [Buffolo, 1996]. Marked impairment of left ventricular systolic and diastolic function, coupled with compromised pulmonary function, gave clear advantage to repair of the CAA and revascularization without cardiopulmonary bypass. Construction of the distal anastomosis prior to the surgical repair of the CAA allowed distal flow and avoided myocardial ischemia. Construction of the distal anastomosis without cardiopulmonary bypass was greatly facilitated by the use of the intracoronary shunt, which allowed uninterrupted distal flow and facilitated precise suture placement in a bloodless operative field. Several factors were taken into consideration when repairing this CAA. First, distal flow had been established allowing uninterrupted coronary perfusion during the period when the CAA was opened. The saccular nature of the aneurysm allowed the neck to be closed under direct visualization and allowed for preservation of the large septal perforator arising deep to the aneurysm. Temporary interruption of coronary artery flow allowed identification of the aneurysm neck and precise, rapid repair. Adequacy of the repair of the CAA was demonstrated by excellent Doppler signals distal to the repair with the vein graft temporarily occluded.

This technique of myocardial revascularization and repair of coronary artery aneurysm without cardiopulmonary bypass, while not suitable for all patients, should be considered for those high-risk patients who have impaired left ventricular function or who are at high risk for pulmonary or neurologic complications.

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REVIEW AND COMMENTARY

1. Editorial Board Member RR54 writes:

This is an interesting case report. It must, however be explained, why no arterial graft was used which would have been more appropriate in this case, and why the MIDCAB approach was not used.

Authors' Response by James O'Connor, MD:

We wholeheartedly agree that the internal mammary artery is the conduit of choice for the LAD. Unfortunately, in this case neither mammary artery was a suitable conduit either in situ or as a free graft. Both vessels were small and atretic with monophasic Doppler signal and inadequate blood flow. For these reasons, a reverse saphenous vein graft was chosen.

Uncertainty as to the precise location of the aneurysm and its relationship to the coronary artery branches, global left ventricular dysfunction, and comfort with the

procedure all influenced the decision not to use the MIDCAB approach in this patient. In the future, we would consider this approach in appropriately selected patients.

2. Editorial Board Member SC389 writes:

I think that this case report is interesting and should be published. The author should address in more detail what he means by the patient was fully anticoagulated.

Authors' Response by James O'Connor, MD:

Anticoagulation was accomplished by 3 mg per kg of heparin administered intravenously.

3. Editorial Board Member YK794 writes:

This case report describes a surgical approach to LAD narrowing plus coronary aneurysm. The aneurysm itself looks to be quite small in Figures 1 and 2. The authors chose to resect it. This is a controversial question and should have been discussed in the paper based on previous literature.

Authors' Response by James O'Connor, MD:

The decision to repair the coronary artery aneurysm was based on several factors. There was clear angiographic evidence that the aneurysm had increased in size over several years and was approximately 3 mm on the most recent study. Given the degree of left ventricular impairment and the proximity of the CAA to the origin of a significant septal perforator, we concluded that exclusion was not an option. Anginal symptoms may well be related to the aneurysm or, clearly, secondary to the coronary artery disease itself. The symptoms may be related to one or the other or a combination of the two. It may be impossible to determine which one is the causal agent. Symptoms of myocardial ischemia, coupled with poor left ventricular function, the proximity of the coronary artery aneurysm to a large septal perforator, and the increasing size of the aneurysm all contributed to the decision to repair this particular coronary artery aneurysm.