

Temporary Axillo-femoral Bypass for Abdominal Aortic Aneurysm Repair in High Risk Patients

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Abdominal aortic aneurysm (AAA) is sometimes associated with coronary artery and valvular disease. We report the successful treatment of a 76-year-old woman diagnosed with an infrarenal AAA, associated with severe mitral regurgitation and double-vessel coronary artery disease. First, AAA repair, using temporary axillo-femoral bypasses on both sides was done. Second, after 77 days, we simultaneously undertook coronary artery bypass grafting (CABG) and mitral valve repair. This staged operation achieved an excellent result. This rarely used abdominal aortic surgical procedure contributed to minimizing variations in afterload, an important consideration in high risk cardiac patients. (Ann Thorac Cardiovasc Surg 2006; 12: 71–3)

Key words: abdominal aortic aneurysm, mitral regurgitation, axillo-femoral bypass

Introduction

Patients with abdominal aortic aneurysm (AAA) may have significant coronary artery and valvular disease, which increases the risk of perioperative myocardial ischemia and death.¹ Patients with AAA and abnormal left ventricular ejection fraction are more likely to suffer an adverse cardiac event, exceeding 60% in patients whose left ventricular ejection fraction was less than 35%.² Even with good preoperative medical management, optimal fluid-loading and pharmaceutical afterload reducers, some patients retain a high risk for life-threatening cardiac events.

Temporary shunting has been shown to offer hemodynamic stability with lowered blood pressure and cardiac afterload, resulting in less cardiac workload and decreased myocardial oxygen demands.³

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Case Report

A 76-year-old woman presented with a palpable pulsatile abdominal mass. Physical examination at presentation revealed a normotensive healthy female. Other than a systolic ejection heart murmur at apex (Levine III/IV) and palpable AAA, no other significant findings were present. A chest X-ray film showed a cardiothoracic ratio (CTR) of 59%, vascular redistribution and mild heart failure. Computed tomography showed a nonruptured infrarenal AAA, 72 mm in maximum diameter (Fig. 1). Echocardiography revealed severe dilation of the left ventricular dimension, severe mitral regurgitation, and anterior leaflet prolapse of the mitral valve. An electrocardiogram showed sinus rhythm and left ventricular hypertrophy. Coronary angiography revealed double-vessel coronary artery disease involving a 75% stenosis of the left anterior descending artery (LAD) and a 90% stenosis of the circumflex coronary artery (Cx). Left ventricular angiography revealed severe mitral regurgitation and globally depressed left ventricular function. We thought that there was a possibility of rupture at the early stage because this AAA was large, and surgical treatment was immediately necessary. Endovascular surgery with a stent graft was considered, but the degree of artery meander was a contraindication. Therefore, we thought AAA repair to be undertaken prior to cardiac surgery.



Fig. 1. Computed tomography showing an infrarenal AAA, 72 mm in maximum diameter.

Preoperatively, a Swan-Ganz catheter and arterial line were inserted. Upon induction, the pulmonary artery (PA) pressure was 46/8 mmHg and artery pressure 100/48 mmHg. Cardiac output was 5.4 L/min. This patient received heparin systemically during the operation as well as the AAA repair without a temporary bypass. The bilateral temporary axilla-femoral bypass was created with a woven Dacron graft, 8 mm diameter (Hemashield; Boston Scientific Corp., Boston, Mass, USA). The grafts lay outside the body, traversing the sterile drapes (Fig. 2). PA pressure rose temporarily immediately after the cross clamp. After the cross clamp had been applied, PA pressure was 61/13 mmHg and artery pressure 102/50 mmHg. Cardiac output was 6.9 L/min. Ten minutes after the clamp, PA pressure was 42/11 mmHg and artery pressure 97/43 mmHg. The infrarenal AAA was resected with a woven Y graft (18×9 mm, Gelweave, Sulzer Vascutek Ltd., Renfrewshire, Scotland). After declamping, the temporary axillo-femoral bypass grafts were removed and a small cuff of graft was left on each vessel. After the aortic clamp was released, PA pressure was 35/10 mmHg and cardiac output 6.2 L. Arterial pressure remained steady at 93/54 mmHg. There were no technical or thrombotic complications on placing or removing the temporary grafts. Heart rates were within normal limits when the grafts were functional.

The patient was successfully treated with the temporary bypass, and her postoperative course was uneventful, even leaving hospital once in the interim period. We did the coronary artery bypass graft (CABG) and the



Fig. 2. Operative findings. Temporary bilateral axillo-femoral bypass grafts during AAA repair.

mitral valve repair simultaneously followed by AAA repair at an interval of 77 days. The excellent result was obtained with this staged operation. We suggest that this procedure, rarely used in abdominal aortic surgery, may contribute to minimizing variations in afterload in high risk cardiac patients.

Discussion

The major cause of morbidity and mortality in patients following repair of an AAA is the presence of coronary artery disease.^{1,4)} This patient presented with an asymptomatic aortic aneurysm and nonoperable valvular disease with severe mitral regurgitation. Despite optimal medical management preoperatively, the patient remained high risk.

In such a situation, several options in treatment are available. One is undertaking heart surgery first, and the second is AAA repair. There is the further option of simultaneous surgery. However, this patient was elderly. We concluded that simultaneous surgery was not feasible. In this case, the maximum diameter of AAA was larger than 70 mm and we thought that it would rupture in the near future. Therefore, we considered that AAA repair must be undertaken first.

Though common in thoracic aortic surgery, mechanical shunts are rarely used in surgery on the abdominal aorta.⁵⁻⁷⁾ They have been described especially in patients undergoing renal re-implantation and AAA repair.⁶⁾ Giulini et al. reported the use of a temporary axillo-femoral

bypass graft for renal transplant protection during aortic aneurysm repair.⁸⁾ Neglen⁷⁾ described the use of a modified blood unit of a hemodialysis machine for temporary bypass in 10 high risk patients undergoing AAA repair. With no increase in morbidity and favorable effects on central hemodynamics and muscle metabolism, Neglen recommended temporary shunting in high risk medically optimized patients. In this group of patients, aortic clamping induced severe temporary incomplete ischemia with a 300% increase in lactate pyruvate ratio. Also, systemic vascular resistance, mean arterial pressure and left ventricular stroke work increased. Neglen concluded that extracorporeal bypass improved performance and prevented derangements of muscle metabolism.

Temporary axillo-femoral bypass was used in this patient presenting with asymptomatic AAA and poor left ventricular ejection fraction. Whether the usual preoperative and operative precautions may have been sufficient to result in a favorable outcome in this patient is unknown. However, no complications occurred due to the use of the temporary bypass. Temporary bypasses, a mechanical means of reducing afterload, are believed to be indicated in operations on AAA patients associated with cardiac disease. Early experiences with surgery of the abdominal aorta disclosed complications of myocardial infarction and congestive heart failure as prominent causes of morbidity and mortality. During infrarenal aortic cross-clamping, when the blood volume is confined to a much smaller space, systolic arterial pressure and left ventricular end-diastolic pressure can be excessive, causing sub-endocardial ischemia. Patients with large hearts caused by valvular disease, myocardial ischemia or congestive heart failure are likely to benefit by proximal decompression during abdominal aortic surgery. A conduit between the left heart or proximal thoracic aorta and the distal arterial tree is standard procedure for operations on the thoracic aorta, to avoid ill effects on the brain and heart, while preserving organ function distally "afterload" defines mean aortic pressure, which is raised by cross-clamping the aorta at any site. Increased afterload increases heart work and oxygen requirement. Afterload reduction obviates needless increases in cardiac work and oxygen consumption. Among the ill effects of cross-clamping the aorta at any level, is the hypotension that accompanies the release of aortic occlusion. Hypotension is not tolerated in patients with coronary artery stenosis. Temporary

bypass grafts can modulate or eliminate the causes and ill effects of declamping hypotension; and can also afford technical as well as physiologic advantages. Thus, the physiologic and mechanical advantages of a temporary bypass grafting are available to high risk cardiac patients. We foresee additional applications of temporary axillofemoral bypass grafts and await opportunities to implement them.

It would be difficult to obtain an adequate sample size to conduct a proper trial comparing patients with and without temporary extra-anatomical bypass. However, in this extremely high risk patient we felt that the potential benefit outweighed any potential risks. We suggest that cardiologists be aware of this optional surgical technique for patients with severe cardiac disease who require AAA repair, and who might not otherwise be deemed surgical candidates.

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