

# Endarterectomy and Surgical Angioplasty Without Cardiopulmonary Bypass

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**ABSTRACT** Surgical angioplasty for ostial stenosis of the major coronary arteries is a well-established treatment modality. Management of discrete stenoses of distal coronary arteries in the presence of mild proximal disease is a challenging task. Percutaneous intervention or grafting beyond the diseased segment may be limited by size of the target vessel, whereas endarterectomy followed by graft placement may result in graft occlusion due to competitive native flow. Patch angioplasty with or without endarterectomy is an effective option in this setting, which can be performed without cardiopulmonary bypass in the appropriate group of patients. A patient with triple vessel coronary artery disease and a discrete lesion in the posterior descending artery underwent off-pump endarterectomy with vein patch angioplasty in combination with bypass grafting to left anterior descending and obtuse marginal arteries. Operative technique and intraoperative strategies are discussed. doi: 10.1111/j.1540-8191.2007.00537.x (*J Card Surg* 2008;23:351-353)

Coronary bypass grafting in an area of discrete coronary artery stenosis with a normal or mildly diseased proximal segment may result graft occlusion secondary to competitive flow and grafting beyond the stenotic area may not always be technically possible in small caliber distal vessels. Endarterectomy with surgical patch angioplasty is an effective option in these circumstances and can be safely performed without cardiopulmonary bypass.

A male aged 79 years was referred for elective coronary revascularization. He had complete ostial occlusion (Fig. 1) of the left anterior descending artery (LAD) that was filling through collaterals from the right coronary artery (RCA). In addition, there was a significant proximal occlusion of a nondominant left circumflex artery with good-sized obtuse marginal (OM) branch. The dominant RCA showed 30% diameter stenosis and 50% area stenosis in the proximal segment with ectasia up to the mid-portion. There was a discrete stenosis in the mid-portion of the posterior descending artery (PDA) and the distal PDA was nongraftable (Fig. 1). An operative plan of grafts to the LAD and the OM along with an endarterectomy—vein patch angioplasty of the PDA without cardiopulmonary bypass (CPB) was formulated.

## METHODS

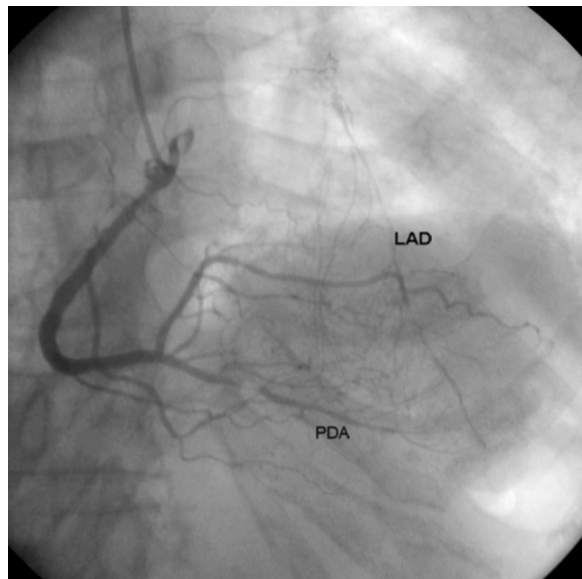
All grafts were constructed without CPB. A pedicled left internal mammary artery graft was anastomosed to

the LAD and flow reestablished and reversed saphenous vein anastomosed to the OM using Octopus® Evolution Tissue stabilizer (Medtronic Inc. Minneapolis, MN, USA). Exposure of the posterior descending artery was achieved by lifting the heart vertically upward with a slight tilt into the left pleural cavity. Placement of a laparotomy sponge in the pericardial cavity to support the heart enabled a stable position without the need for pericardial traction sutures or an apical suction device. The diseased segment of the PDA was identified by careful palpation and exposed by blunt dissection of the epicardial fat in the posterior interventricular groove after stabilization (Fig. 2A). An arteriotomy was made, closed endarterectomy performed, and the plaque removed. Temporary Codman Dietrich bulldog clamps were essential on the endarterectomized artery to control torrential antegrade flow from the right coronary artery and retrograde flow through the septal arteries. Distal flow was reestablished by the placement of an intracoronary shunt. Autologous saphenous vein was used as an onlay patch to repair the arteriotomy site (Fig. 2B). The patient was given dextran infusion and heparin in the immediate postoperative period. Low-dose nicoumalone (acitrom) and oral antiplatelet drugs were continued in the early postoperative period.

## COMMENT

Treatment of significant distal disease in the presence of normal or mildly diseased upstream coronary artery is a challenge. The lesion may not be amenable to percutaneous intervention and bypass graft beyond

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**Figure 1.** Right coronary injection showing mild proximal disease, an ectatic mid-segment, and the lesion in the posterior descending artery (PDA) with refilling left anterior descending artery (LAD).

the area of stenosis may not always be possible in a distal vessel of small caliber.

Patch angioplasty,<sup>1</sup> a time-honored surgical procedure, is an excellent therapeutic option in this clinical situation. Initially described for the management of ostial stenosis of the major coronary arteries, this technique has been employed in the era of off-pump coronary revascularization, for the management of discrete coronary artery perforation.<sup>2</sup>

Removal of segmental disease from the right coronary artery with patch-graft reconstruction improves collateral circulation to the left side of the heart.<sup>3</sup> Off-pump endarterectomy combined with bypass grafting is now a widely performed procedure with good long-

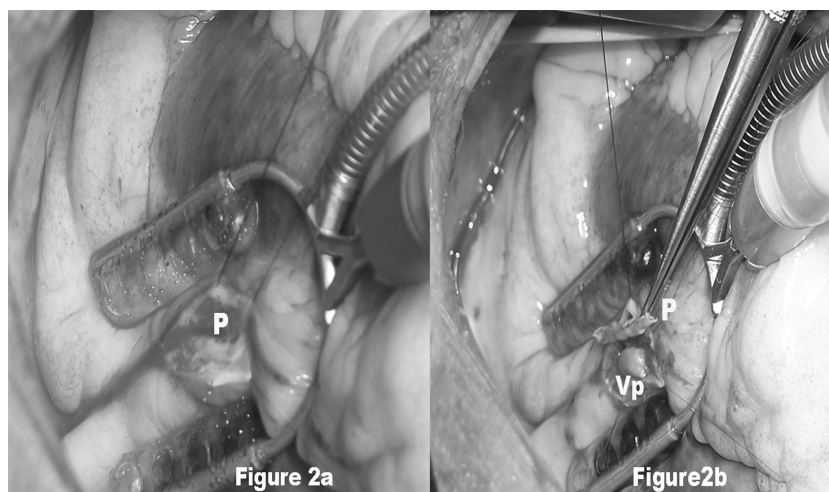
term outcomes.<sup>4</sup> However, a word of caution is essential as extensive endarterectomy in small caliber distal vessels is fraught with the hazard of removal of an entire cast of the coronary artery and the dreaded complication of coronary artery dissection.<sup>3</sup> A safer alternative in difficult cases may be endarterotomy with proximal and distal dilation followed by patch angioplasty.

This procedure can be safely combined with multivessel coronary grafting during off-pump coronary artery bypass grafting (CABG). Careful positioning, stabilization of the heart, and accurate localization of the target area are of utmost importance. Maintenance of filling pressures by adequate volume loading and a stable rhythm merit special attention as a meticulous repair is often time-consuming.

Placement of a temporary occluding spike or a silastic loop around the coronary artery is necessary to control torrential bleeding following endarterectomy. The presence of retrograde flow through collaterals adds to the blood loss resulting in hemodynamic instability. In this situation of ostial occlusion of the LAD, the RCA was the collateralizing vessel. The collateralized LAD was revascularized initially followed by endarterectomy of the PDA. Temporary bulldog clamps were required on the distal RCA and the PDA as well as to control retrograde flow from the revascularized septal arteries. Expedite placement of an intracoronary shunt to reestablish flow prevents rhythm disturbance especially during intervention on the right coronary artery.

Vein patch is thin-walled, tends to curl on itself, and has poor handling characteristics that might prolong the time required for completion of the anastomosis. This is specially so during beating heart angioplasty. An epithelial surface, lack of valves, easier handling characteristics, and abundant supply make the pericardium an excellent substitute for vein patch.<sup>3</sup>

In conclusion, off-pump endarterectomy/endarterotomy of the diseased segment with onlay patch angioplasty is an excellent treatment option for discrete distal coronary lesions with mild proximal disease.



**Figure 2.** (A) Intraoperative image showing plaque (P) in the posterior descending artery. (B) Completed vein patch (Vp) angioplasty with extracted endarterectomy specimen (P).

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