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# Long Segment Left Anterior Descending Endarterectomy [10 cm] and its Reconstruction Using Left Internal Thoracic Artery

**Abstract**

Although coronary endarterectomy is an option for surgical reconstruction of a diffusely diseased vessel, it has not been widely used. In coronary artery bypass grafting, a diffusely diseased left anterior descending coronary artery (LAD) is an obstacle to achieving complete revascularization, consequently leading to the possibility of a poor prognosis. Here, we report a successful case of long segmental reconstruction of a diffusely diseased LAD using a left internal thoracic artery onlay patch after endarterectomy and its early clinical and angiographic assessment.

**Introduction**

Recently, the use of percutaneous coronary intervention (PCI) for treatment of coronary artery disease has progressively increased. A large number of simple stenoses in one or two coronary vessels can be treated by PCI. Therefore, the number of high-risk and severely diseased patients referred for coronary artery bypass grafting (CABG) has been relatively increasing. Coronary endarterectomy has been used to treat severely or diffusely diseased coronary arteries since the 1950s [1]. More recently, the benefits of endarterectomy for the left anterior descending artery (LAD) have gradually become recognized because surgical techniques and technologies have evolved. The greatest advantage of endarterectomy is that the myocardium supplied by the side branches (diagonal branches and septal perforators) of a diffusely diseased LAD can be relieved of ischemia. This advantage cannot be obtained using a conventional graft to the distal LAD alone because this is beyond the diffusely diseased segments.

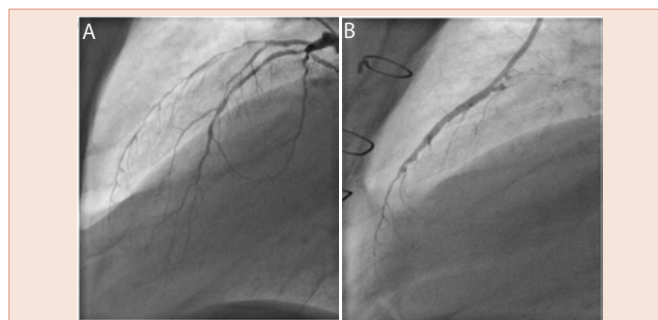
In coronary artery bypass grafting (CABG), the left anterior descending artery (LAD) and the left internal thoracic artery (LITA) are the best combination with respect to both long-term patency and clinical outcomes. Use of left internal thoracic artery to bypass left anterior descending artery is associated with long term patency and event free survival. Herein, we report a case of long segment revascularisation of a diffusely diseased LAD using the LITA after endarterectomy.

**Case Report**

A 54-year-old male with hypertension and non-insulin-dependent diabetes was admitted to our hospital for exertional chest discomfort. He had a history of acute myocardial infarction six weeks previously. A preoperative angiogram showed that he had double vessel disease with a diffusely diseased LAD showing severe proximal stenosis (Figure 1A). Echocardiography revealed regional wall motion abnormalities in the LAD and the left circumflex artery territories

and mild left ventricular systolic dysfunction (left ventricular ejection fraction=45%).

He underwent coronary artery bypass grafting via median sternotomy. The left internal thoracic artery (LITA) and long saphenous vein graft were harvested. Cardiopulmonary bypass was instituted using ascending aorta and right atrial appendage cannulations. After cardioplegic arrest, a coronary arteriotomy was made in the middle portion of the LAD. The atheromatous core was carefully dissected from the adventitia with a fine spatula and forceps (Figure 2A). The proximal atheromatous core was sharply divided, in order to avoid removing the most proximal stenotic lesion. The distal end of the atheromatous core was also divided sharply when it reached the intact intima (Figure 2B). The divided intima of the distal LAD was tacked with 8-0 polypropylene sutures. The raw surface of the LAD was flushed with saline and the flaps were removed, taking care not to cause distal embolism with fragments of the incised plaque

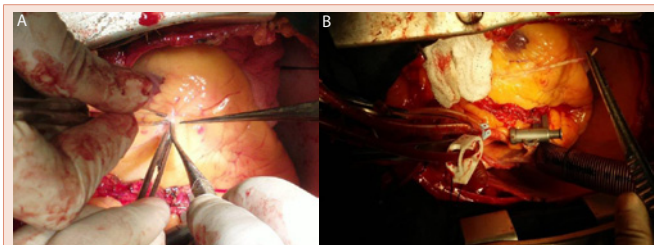


**Figure 1:** Coronary artery angiography. (A) A preoperative angiogram shows a diffusely diseased LAD coronary artery with multiple segmental lesions, although the diameter of the non-diseased region was >1 mm. (B) A postoperative angiogram via the LITA shows that the diameter of the reconstructed LAD had increased and the side branches (diagonal branches and septal perforators) were also visible.

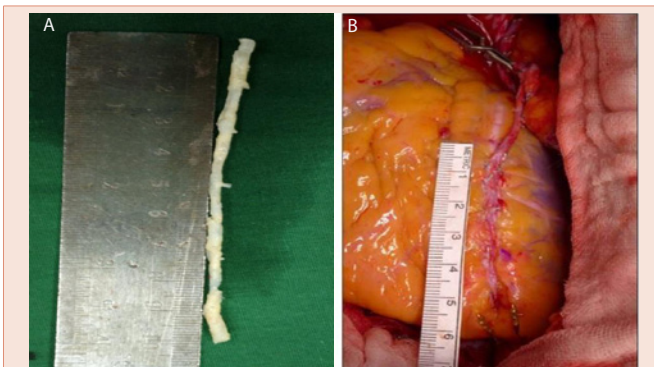
(Figure 3A). The matched length of the LITA was anastomosed to the incised LAD (approximately 10 cm) (Figure 3B). Several 7-0 and 8-0 polypropylene sutures were used to perform the anastomosis using an over-and-over suture technique. The first diagonal and ramus intermedius were bypassed sequentially with a saphenous vein graft which was anastomosed proximally to the ascending aorta. The aortic cross-clamping and cardiopulmonary bypass times were 70 and 90 minutes, respectively. Continuous intravenous unfractionated heparin infusion was initiated on the day of the operation, after confirming the absence of excessive bleeding. Anti-platelet agents (aspirin and clopidogrel) and warfarin (with a target international normalized ratio of 2.0) were started on the first postoperative day. Intravenous heparin was discontinued after the warfarin target international normalized ratio was achieved and the patient was discharged on the fourteenth postoperative day. At clinical follow-up performed two years later, postoperative angiography revealed complete patency of the LITA and the LAD (Figure 1B) and the patient was in good condition without angina.

## Discussion

In CABG surgery, complete revascularization is one of the most important factors that influence long-term mortality and morbidity. However, in cases involving a diffusely diseased LAD, complete revascularization is not always possible because conventional bypass techniques involving only the distal LAD cannot provide sufficient blood supply to the side branches, including the diagonal branches and septal perforators.



**Figure 2:** [A] Slow dissection and separation of plaque from LAD with spatula; [B] LAD arteriotomy extended and complete plaque 10 cm separated from LAD.



**Figure 3:** (A) A specimen of the endarterectomized core 10 cm. (B) The left anterior descending artery LAD was reconstructed with a long segmental patch anastomosis using the left internal thoracic artery.

In this situation, the implantation of multiple drug-eluting stents in the diffusely diseased coronary artery has been performed in several institutions. However, stent implantation involves a risk of compromising the flow to the side branches and in-stent restenosis. In order to overcome these obstacles, some surgeons have performed the technique of long-patch reconstruction of the LAD with or without endarterectomy, reported clinical and angiographic results [2-6]. However, the diffusely diseased LAD remains a challenge for both PCI and CABG.

The optimal endarterectomy technique remains controversial. Two surgical methods have been developed, known as the closed method (traction technique) and the open method. The closed method is performed by traction of the endarterectomized intima through a small arteriotomy. It does not require much time and the anastomosis is technically easy. In contrast, the open method involves long arteriotomy and total removal of the atheromas under direct visualization. Fukui et al. [2], criticized the closed method because the diagonal branches and septal perforators may be torn off despite gentle traction, and the distal end of the lumen may become occluded with a thrombus or dissection due to insufficient endarterectomy. In this report, we used the open method of performing endarterectomy, as the openings of the septal and diagonal branches and the distal end of the LAD can be directly observed and endarterectomized with confidence. Furthermore, complete extraction of the atherosclerotic plaque is an essential prerequisite for this procedure. In general, the worst outcomes are associated with incomplete endarterectomy. Any residual intimal flaps should be removed carefully to prevent obstruction of the tributary vessels.

With respect to the selection of an onlay patch, in general, two options exist: the LITA or a saphenous vein onlay patch. Although Myers et al. [6], have reported that the reconstruction method did not have a significant impact on long-term survival, Japanese investigators recommend using the LITA for reconstruction rather than a saphenous vein graft because of the superior patency rate of the LITA [2-4]. Additionally, the use of retrograde cardioplegia is recommended not only for optimal myocardial protection, but also for mechanical flushing and clearance of any debris that may have embolized distally.

The major causes of suboptimal results after coronary endarterectomy are related to triggering of the coagulation cascade by the lack of endothelium in the early stages and myofibrointimal proliferation in the late stages [2,3]. Therefore, strict management with DAPT (dual antiplatelet therapy) and anticoagulation therapy should be implemented after endarterectomy.

A search of the literature published in Korea about LSR (long segment reconstruction) with endarterectomy only revealed one report [6]. In that report, the coronary arteries were reconstructed using a saphenous vein graft instead of an internal thoracic artery graft. Therefore, to the best of our knowledge, this is the first reported case in India of a diffusely diseased LAD that was reconstructed with long patch angioplasty using the LITA after extensive endarterectomy. Although the reconstruction was performed successfully, further studies are warranted to substantiate and validate the long-term viability of this method.



## Conclusion

Coronary endarterectomy of the LAD with a patch plasty using the LITA is an acceptable method of revascularization of diffused diseased LAD.

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