Surgical Left Main Ostioplasty; An Alternative Option in Selected Cases of Left Main Coronary Artery Stenosis

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Objective : **Left main coronary artery stenosis associated with diffuse coronary artery disease is not uncommon. However, isolated ostial left main stenosis is a rarity constituting less than 1% of total patient population referred to surgery.**

Methods : **Although surgical revascularization with LIMA to LAD remains the gold standard, in some cases its use may not be possible or prudent as in cases of post chest wall irradiation, morbidly obese patients with borderline pulmonary function and others.**

Result : **Here we share our experience with 5 patients who underwent surgical ostial left main ostioplasty in the period between June 1998 and June 2003. Access to the left main was approached through complete transection of the aorta for optimum visualization rather than the traditional posterior or anterior approach.**

Conclusion : **All patients had uneventful procedure and recovery. Three of the five patients underwent early catheterization to confirm left main patency. Early and mid term follow up was free of ischemic events and patients were back to there full functional capacity.**

The incidence of left main coronary artery (LMCA) stenosis associated with multivessel coronary artery disease is not uncommon, accounting for about 10-15% of cases referred in the daily practice of most cardiac centers. On the other hand, isolated ostial or proximal LMCA stenosis with free distal coronary tree is a rarity accounting for only 0.5-1% of cases [1].

Stenosis of the left main coronary artery (LMCA) is an anatomic lesion with a malignant nature and with a highly lethal course when untreated. The preferred treatment of this disorder has traditionally been conventional coronary artery bypass surgery, and the best long term option would be the utilization of the ITA to the LAD [2]. In some cases, harvesting the ITA is not possible or prudent (discussed later).

Several efforts have been made directly against the pathological lesion in the LMCA by means of endarterectomy and onlay patch angioplasty. The initial experience of these attempts was depressing with a high mortality rate and frequent restenosis at the site of reconstruction [3, 4, and 5].

Better techniques for cardioprotection and cardiopulmonary bypass inspired Hitchcock and coworkers in 1983 [5] to revive and modify the angioplasty procedure of LMCA stenosis resulting in excellent outcome. This was followed by others reporting similar results. Dion and colleagues [6, 7] with the largest single experience of the procedure- have further delineated the indications and contraindications and also refined the technique. Principally, a venous or pericardial patch has been used for the angioplasty with acceptable early to midterm results.

Accepted for publication May1,2005.

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Codex :04/03/cord/0506.

Classically, there have been two surgical approaches to reach the LMCA, the anterior and the posterior approach each with its own advantage and disadvantage. Here, we share our experience with a newly described surgical approach, which is in our view provides optimum exposure to conduct such a procedure optimally and safely [8, 9].

Patients and Methods

In the period from June 1998 to June 2003, we operated on five consecutive patients who suffered from isolated significant (> 75%) ostial or proximal LMC stenosis with no distal coronary artery disease or associated cardiac disease.

Two of the patients were males 45 and 52 years of age respectively. Both were hyperlipidaemic with positive family history of ischemic heart disease (IHD). The etiology of there stenosis was atherosclerotic in nature. Three patients were females, two with a history of previous radical mastectomy followed by chest wall irradiation 7 and 10 years ago. The last patient was of undetermined etiology, however she was complaining of progressive lower back pain and stiffness. She was followed up by our rheumatology colleagues to rule out ankylozing spondylitis or other rheumatoid disease. All patients suffered from rapidly progressive course (less than 6 months) suffering from angina class III or IV on presentation [10, 11].

All patients underwent full routine preoperative evaluation including cardiac catheterization and echocardiography. All had preserved LV function except for the last patient who had an EF of 40%.

The operation is performed using the standard anesthetic and monitoring techniques. After median sternotomy, a piece of pericardium 2x3 cm is harvested and kept aside in wet gauze. The ascending aorta is totally freed from its relationship to the main and right pulmonary artery. The dissection commenced before cardio-pulmonary bypass (CPB) and completed thereafter. Perfusion is started utilizing an aortic cannula in the distal ascending aorta and bicaval cannulation with tapping lowering the patients' systemic temperature to 32C. Left atrial vent is inserted.

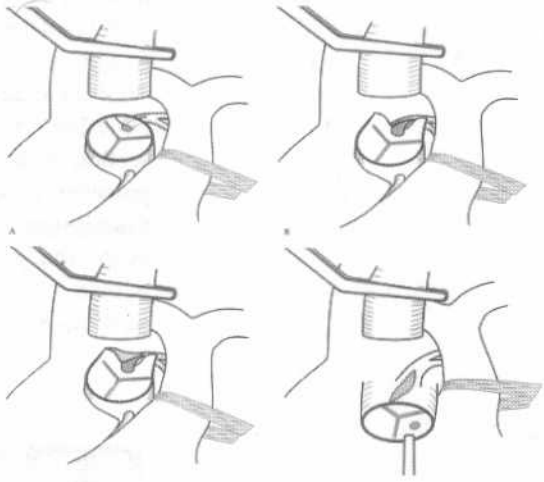
Myocardial protection is achieved by initial antegrade blood enriched cardioplegia followed by subsequent doses every 20 minutes retrogradely directly into the right atrium utilizing Fabian's technique after snaring down onto the caval cannulae and tugging on the main PA with a tape around it.

The aorta is completely transected 1.5 cm distal to the origin of the RCA. With downward and anterior retraction on the aortic root together with retraction of the main pulmonary artery upward and to the left provides excellent exposure and access to the LMC artery.

An incision is started into the left coronary sinus 5 mm to the left of commissure between the left and non-coronary cusp and extending it into the LMCA 5 – 10 mm distal to the stenosis or just proximal to the bifurcation of the LMCA.

The pericardial patch is tailored to the appropriate size and sutured into place as an onlay patch with a 6/0 prolene suture up to the level of the transverse aortotomy. The aortotomy is closed with a running 5/0 prolene suture.

This technique was also described by Liska and colleagues in 1999 [12] (Fig. 1).



(fig 1)

Mean aortic cross clamp was 65 min (53 -76) and mean perfusion time was 90 min (80-109).

(Figure 1; Diagramatic representation of the surgical technique, (a) complete transection of the aorta with retraction of the main pulmonary artery to the left (b) incision in the left coronary sinus extending into the left main coronary artery (c) placement of the an onlay patch on the incision (d) completion of the onlay patch to be followed by re-approximation of the aortic ends, Liska et al, 1999.)

Results

All patients had uneventful postoperative course with stable hemodynamics and without ischemic EKG changes. There were no significant elevations of the enzymatic markers to indicate perioperative MI. The patients were extubated with a mean ventilation time of 8.6 hrs. (6-15). Mean blood loss was 560 mls (400-850) with no reentry for bleeding. All patients were

discharged from ICU within the first 48 hrs. There were no neurological, renal or respiratory complications. One patient developed superficial wound infection which was cleared within 10 days with appropriate antibiotics.

All patients received thrombo-prophylatic regimen, in the form of concomitant use of coumadin and clexane (40 u bid subcutaneously) till INR catches up and maintained between: 1.8-2.2 thereafter and for the next 3 months. Aspirin at a dose 150mg/day is commenced since day one and continued thereafter for life.

The first three patients underwent coronary angiography before hospital discharge (Fig. 2). In the three cases the left main ostia were widely patent. On the other hand, the last two patients also underwent TEE before hospital discharge and both were very satisfactory. All patients underwent exercise EKG after 3 months of the operation and again after one year. All were negative for ischemia. Also, patients were followed by regular clinic visits. None had ischemic complaints or was readmitted for ischemic events. All had a NYHA class of I or II.

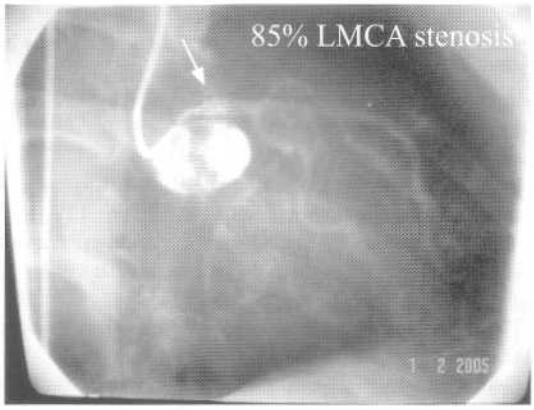


Fig 2 (a)

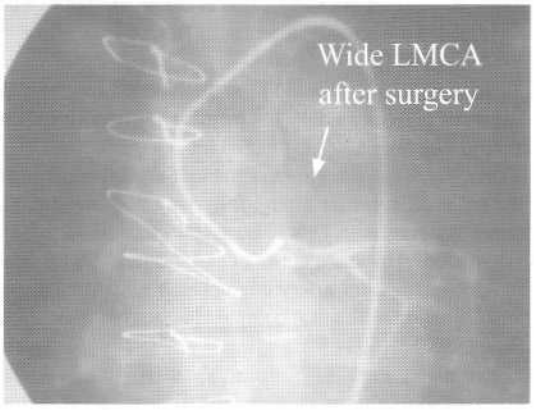


Fig 2 (b)

(Figure 2. (a) Pre-operative angiogram of the second patient (b) Post operative angiogram of the same patient)

Discussion

The LMCA can, from an anatomical standpoint, be divided into three parts, the ostial region, the midsegment, and the distal segment. The most common etiology to LMCA stenosis is arteriosclerosis, and accounts for the vast majority of LMCA stenosis engaging particularly the midpart and distal bifurcation, often associated with two or three-vessel coronary disease. LMCA stenosis is found in approximately 10-15% of the patients subjected to coronary artery bypass surgery [10, 11].

On the other hand, isolated stenosis of the ostial region or the first third of the LMCA is substantially less common with an observed prevalence of approximately 0.5-1%. This entity of LMCA stenosis also has a more diversified etiology and is often related to inflammatory processes of the aortic wall, e.g., syphilitic aortitis, Takayasu aortitis, rheumatoid arthritis, and post-irradiation treatment [13]. Such a rare entity is most frequently seen in middle-aged women. It is characterized by rapid development of unstable angina refractory to medical treatment and a high incidence of sudden death due to the complete absence of collateral coronary circulation. The morphologic basis is the progressive fibrous thickening of the ostial intima with otherwise normal coronary arteries and without the presence of aortic wall lesions. Three of our patients fell in this category.

Coronary artery bypass grafting is an excellent and safe treatment for LMCA stenosis, however with some potential limitation, such as complete graft dependant perfusion because of the progressive occlusion of the coronary ostium, and the risk of arteriosclerosis to the venous grafts if the ITA or other arterial conduits are not used [2]. It also has a theoretical negative effect by perfusing large areas of the myocardium retrogradely. Direct surgical angioplasty of LMCA offers a good alternative by restoring native antegrade flow and also by maintaining access to the distal coronary vessels allowing for future percutaneous transluminal coronary angioplasty of peripheral lesions if need arise. It can also be useful in patients with intramyocardial coronary arteries.

Also, in some patients the use of ITA is not possible or prudent. For example we had two patients who had previous chest wall irradiation and it was not possible to utilize their ITA. Also, there is an increased risk of wound infection or respiratory embarrassment in morbidly obese poorly controlled diabetic or COPD patients with borderline pulmonary functions respectively. In such subset of patients, surgical LMCA ostioplasty could be a good alternative option.

Also, it has the potential advantage of sparing conduits if CABG is needed in the future. Again, it reduces the potential injury of ITA to LAD or distal conduit emboliza-

tion if future redo surgery is required [14, 15, and 16].

The main limitation for the application of such a technique is the presence of extensive calcification either the aortic wall or the LMCA.

Technically there have been two principal methods described on how to access the LMCA, the posterior, and the anterior approach. The posterior incision has the advantage of avoiding an acute angle of the patch at the junction between the LMCA and the aortic wall, which could possibly cause a stenosis. On the other hand, the posterior approach has the disadvantage of a less good exposure of LMCA and vice versa for the anterior approach [16, 17].

In our study, the ascending aorta was instead transected, which resulted in an excellent visualization of LMCA and also the proximal part of LAD and the circumflex artery. An oblique incision was made in the aortic wall extending into the roof of the LMCA thus avoiding an acute angle of the patch at the ostial junction. We advocate this approach, because it combines the beneficial properties of both the posterior and anterior techniques. A similar approach was described by Eishi et al [17] and Liska et al [12].

Several investigators have advocated various methods or studies to assess the mid and late term results of LMCA ostioplasty surgery. Some attempted the use magnetic resonance imaging [18] or spiral computed tomography [19] as noninvasive tools for follow-up assessment of reconstruction patency. Both were found to have limited accuracy and high cost. Others reported [20] the use of TEE is an accurate semi-invasive tool for such an assessment. The LMCA anatomy and patency can be optimally delineated. In our study, we performed early postoperative TEE instead of angiography in the last two patients and indeed the results were accurate and satisfactory.

Conclusion

In conclusion, our experience suggests that surgical reconstruction of the LMCA is safe and effective surgical method for the treatment of isolated left main stenosis. It offers several advantages over conventional revascularization. Although the previously described anterior or posterior approaches provided good results, the newly introduced technique of transection of the ascending aorta allowed optimum visualization and access of the LMCA. Early catheterization demonstrated excellent results. Clinical follow-up showed no residual symptoms of ischemic heart disease. Long-term patency is still to be evaluated.

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