Case Report

Concomitant Aorto-axillary Bypass and Beating Heart Total Arterial Coronary Artery Bypass Grafting by RIMA-LIMA "Y" graft

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Abstract

In common practice, left internal mammary artery (LIMA) along with great saphanous vein is used in coronary artery bypass grafting (CABG). Day by day total arterial CABG specially use of bilateral mammary arteries are becoming demanding. Coexisting occlusive disease may rarely affect coronary arteries along with left subclavian artery. We have reported a successful concomitant aorto-axillary bypass and CABG of a 52-year-aged man with the diagnosis of triple-vessel-disease (TVD) angiographically along with proximal stenosis in left subclavian artery. Aorto-axillary (left) bypass was done with 6-mm ring re-inforced polytetrafluoroethane (PTFE) graft and CABG was done by total arterial RIMA-LIMA "Y" graft on beating heart. The post-operative course was uneventful with reappearance of peripheral pulses in left upper extremity. The patient was discharged on the 9th post-operative day.

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Introduction:

Co-existing occlusive disease in the coronary and peripheral arteries occur frequently, and the treatment of choice is concomitant revascularization.[1] Subclavian artery occlusive disease has become clinically significant since the internal mammary artery (IMA) has been used for coronary artery bypass grafting, because collateral inflow from the other subclavian branches is predictable.[2,3] The stenosis or occlusion of the proximal to the origin of internal mammary artery may result reduction of its flow. Hence, conventional left internal mammary artery to left anterior descending (LAD) artery graft becomes entirely unrewarding.[4] We have reported a case of both symptomatic occlusive disease of the left subclavian artery and triple vessel coronary artery disease in whom left- sided aorto-axillary bypass along with total arterial revascularization with RIMA-LIMA "Y" graft was done successfully on a beating heart.

Case Report

A 52-year-aged man was admitted with exertional chest pain and left arm cramping. The patient reported that chest pain radiating to the left shoulder and the left arm could easily be provoked by abduction.

The physical examination on admission revealed no pulse on left upper extremity (i.e. radial, ulnar, brachial or axillary). Bilateral carotid pulses could be palpated. An electrocardiogram showed ischaemia in leads V1-V4 and II, III and aVF. Laboratory tests were within normal limit. Echocardiography showed antero-lateral and apical hypokineasia with ejection fraction (EF) 54%.

The coronary angiogram showed 90% stenosis in the LAD, the circumflex artery was diffusely diseased and the RCA was totally occluded proximally (figure-1). The LIMA-graphy showed totally occluded left subclavian artery (figure-2). Duplex scan of upper extremity revealed occlusion in the proximal left subclavian artery with good distal collateral filling. Both carotid arteries were atherosclerosed but not stenosed.

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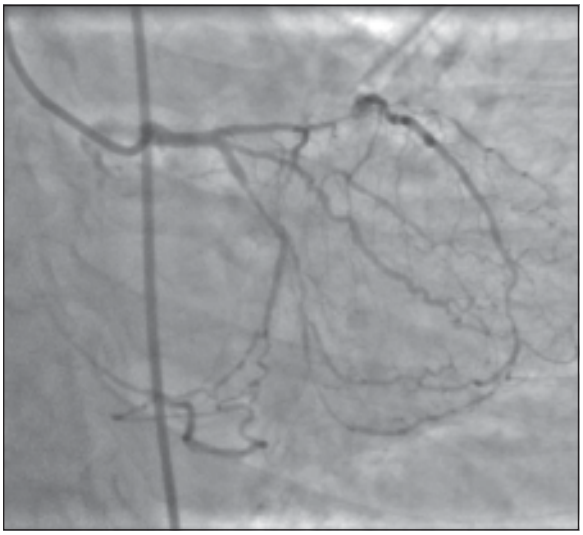

Fig.-1: CAG shows severe TVD.

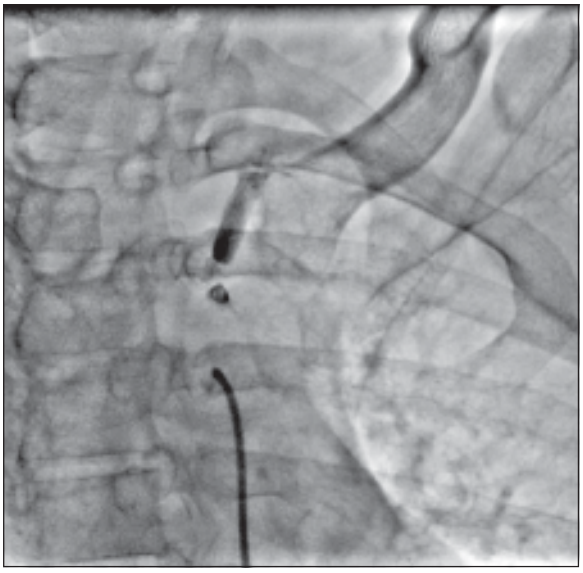

Fig.-2: *CAG shows total occlusion in left subclavian artery.*

Technique

After median sternotomy, the LIMA and RIMA were harvested first. Injection heparin was not taken.

Then the left axillary artery was approached by combined deltopectoral-subclavicular approach. The skin incision, 5 to 6 cm long, parallel to the inferior border of the clavicle, corresponding to its middle portion was made. Then the incision was extended down to the distal edge of the pectoralis major along the delto-pectoral groove. In the upper part of the groove, the cephalic vein was dissected out and preserved. The pectoralis major was retracted medially, which allowed exposure of the pectoralis minor. At this point, the tendon of the pectoralis minor was transected and retracted medially. The neurovascular bundle appeared in view where the axillary artery was the central structure. The vein, somewhat larger, was medial to the artery.

Proximal and distal controls of axillary artery were taken and injection heparin was given. After applying clamps proximally and distally axillary artery was opened longitudinally at its middle part. A 6-mm ring-reinforced polytetra-fluoroethylene (PTFE) graft was anastomosed to the proximal part of the axillary artery (fig.-3). Then the prosthetic graft was led to the ascending aorta with the help of a Kelly forceps through the 2nd intercostal space via the pleural cavity (fig.-4). The aorta was partially clamped and the proximal end of the PTFE graft was anastomosed with the side of the ascending aorta (fig.-5).

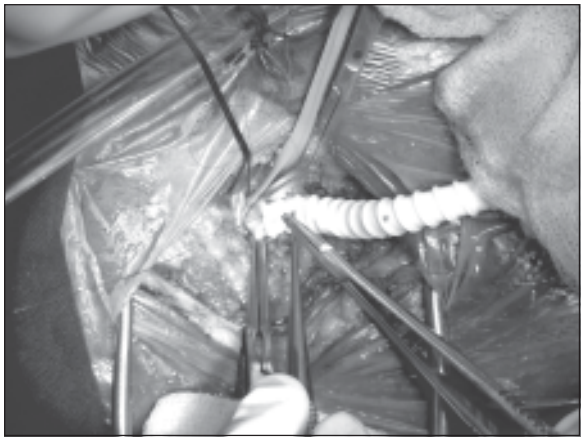

Fig. -3: *Distal anastomosis between PTFE graft and proximal left axillary artery.*

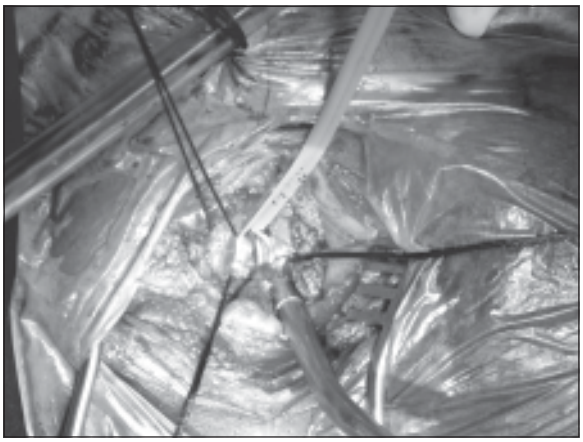

Fig.-4: *Distal anastomosis as seen after tunneling the PTFE graft through the anterior chest wall.*

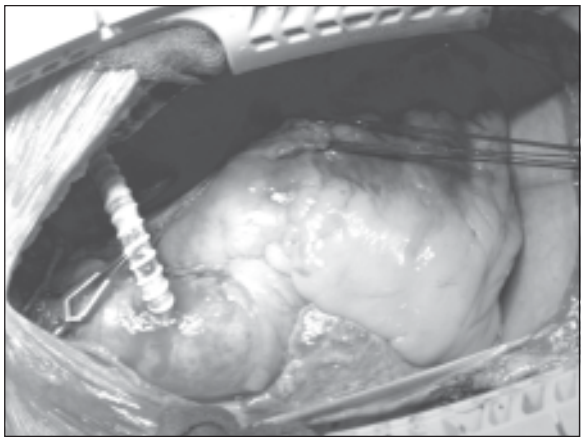

Fig.-5: *Proximal anastomosis between PTFE graft and ascending aorta.*

After completion of aorto-axillary bypass flow of both the mammary arteries were measured. The LIMA flow was found poor. Hence, LIMA was excited and RIMA-LIMA "Y'-graft was made between in situ RIMA and dissected-out LIMA. RIMA to LAD graft was done first. The sequential grafts of LIMA to OM (obtuse marginal) and PDA (posterior descending artery) were done (fig.-6). All the grafts were done on beating heart.

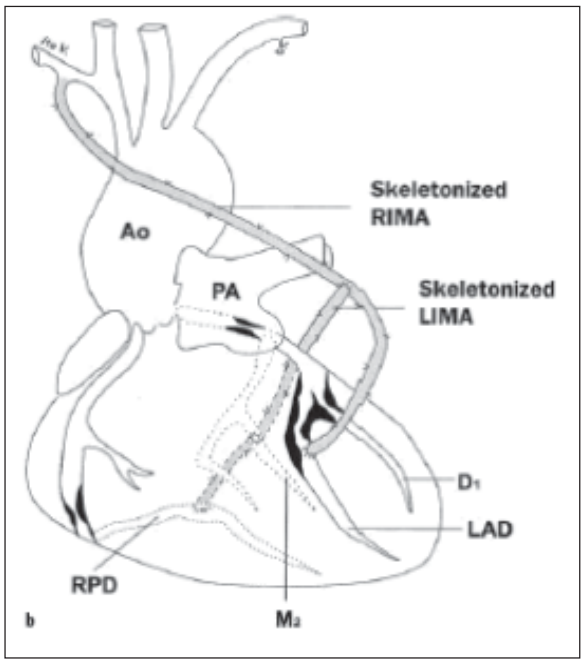

Fig.-6: *Configuration showing RIMA-LIMA 'Y' graft.*

Discussion:

The presence of concomitant symptomatic or asymptomatic subclavian artery occlusive disease in patients who present with coronary artery disease requires the surgeon to decide whether to use the IMA as a bypass conduit. Although the use of alternative conduits (such as an IMA free graft, a vein, or the radial artery) will avoid the potential risk for development of coronary-subclavian steal and myocardial ischemia, it is not clear whether other conduits can achieve the documented long-term patency of the standard IMA conduit.[5,6]

The subclavian occlusive lesion has a special meaning in coronary artery bypass surgery. The development of a focal occlusion within the proximal segment of the subclavian artery before or after myocardial revascularization can result in so-called coronary–subclavian steal syndrome, ie, a devastating steal from the coronary artery with flow reversal in the ITA into the subclavian artery causing myocardial ischemia. Prevention of the steal syndrome is best accomplished by a careful examination of the patients and appropriate arteriography before operation.[7] Coronary–subclavian steal is uncommon but sufficiently important to think of before coronary artery bypass grafting.[8]

As a simultaneous procedure in the open heart operation, aorto-axillary bypass may have some advantages. In aortoaxillary bypass, the site of anastomosis is very accessible. It does not require manipulation of the carotid artery. Further, the area around the subclavian artery is a "busy place." The phrenic nerve, the recurrent laryngeal nerve, the vagus nerve, the brachial plexus, the cervical sympathetic chain, and the thoracic duct on the left side are always encountered in the vicinity of the subclavian artery. In contrast, only the nerves of the brachial plexus lie deep to the proximal part of the axillary artery. Accordingly exposure of the subclavian artery in the supraclavicular region has the possibility of several kinds of postoperative complications, although most of them are transient in nature.[9-11] In the aortoaxillary bypass procedure, the graft is easily led to the axillary artery without any fear of kinking through the intercostal space, and the

distal anastomosis can be performed on the axillary artery without difficulty.[12] This can be performed even in emergency situations as in our cases.

Several surgical techniques can be employed for subclavian artery reconstruction. Extrathoracic approaches, such as carotid-subclavian bypass and subclavian-carotid transposition, offer long-term graft patency and the advantage of avoiding a thoracotomy in fragile elderly patients. Patients with subclavian artery occlusive disease frequently have several risk factors associated with atherosclerosis, including hypertension, diabetes, hyperlipidemia, and cigarette smoking. The transthoracic approach is employed in those with atherosclerotic involvement of multiple vessels or with concomitant open heart procedures. Although the transthoracic approach was associated with relatively high morbidity and mortality rates, these have dropped significantly in recent reports.[13] When a symptomatic subclavian occlusive lesion co-exists with severe coronary artery disease, carotid-subclavian bypass or aortoaxillary bypass may be preferable as a concomitant procedure with CABG. Aortoaxillary bypass carries some advantages in the context of open heart procedures. When the carotid artery has atherosclerotic involvement and is not acceptable as a donor artery for subclavian artery revascularization, aortoaxillary bypass is a convenient choice of anastomosis. Furthermore, dissection of the area around the proximal subclavian artery, including the phrenic nerve, the brachial plexus, and cervical sympathetic chain, is not required. The aortoaxillary bypass graft is easily led to the axillary artery without kinking, and the site of distal anastomosis is technically attractive.[14]

The technique of CABG on the beating heart, without CPB, is now accepted, particularly for patients with renal failure, respiratory problems, advanced age, or cerebrovascular abnormalities.[15,16] As those with subclavian artery occlusive disease frequently have atherosclerotic involvement of multiple arch vessels, CABG without CPB may decrease cerebral complications attributed to plaque emboli, low perfusion pressure, or microemboli. In this situation, in situ IMA is the key graft for achieving CABG on the beating heart without CPB. Therefore, when a patient with subclavian artery occlusive disease has to undergo CABG without CPB due to several risk factors, the affected IMA may be considered for use after subclavian artery reconstruction, if feasible. To assess the availability of the affected IMA after subclavian artery reconstruction, a longer follow-up period would be necessary to establish the long-term patency and efficacy of aortoaxillary bypass grafts.[12]

Undoubtedly, internal mammary artery has proved to be the gold standard of the conduits used and the use of bilateral internal mammary artery has proved additional long term benefit as reported in literature.[17]

Conclusion:

Subclavian artery occlusive lesion, although rare, is sufficiently important to consider before coronary artery bypass grafting. While performing simultaneous subclavian artery reconstruction along with coronary artery bypass grafting, the aorto-axillary bypass procedure may be the method of choice in such a special condition.

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