Case report - Coronary

Acute transection of the left internal mammary artery remote from the anastomosis following coronary artery bypass surgery

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Abstract

We report a case of spontaneous transection of the left internal mammary artery 4 h after a patient underwent coronary artery bypass surgery. This complication has been reported in two patients following minimal access coronary artery bypass grafting, but to our knowledge, this is the first case of transection of the left internal mammary artery, following conventional myocardial revascularization via median sternotomy. Possible mechanisms leading to this rare, but potentially life-threatening complication are also discussed.

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Keywords: Complications of surgery; Coronary artery bypass surgery; Coronary artery bypass conduits

1. Introduction

The left internal mammary artery (LIMA) is an established conduit in myocardial revascularization, with proven long-term patency and prognostic benefit [1]. Recognized complications associated with its use, however, include phrenic nerve injury, coronary steal syndrome and postoperative vasospasm, the clinical consequences of which are largely dependent on the severity of the original complication [2]. We describe the case of a patient who suffered a potentially life-threatening condition of transection of the LIMA proximal to its anastomosis to the left anterior descending artery (LAD).

2. Case report

A 65-year-old male underwent routine quadruple coronary artery bypass grafting (CABG) for left main stem stenosis. Significant premorbid pathology included marked emphysematous lung disease.

The LIMA was harvested on its pedicle in the standard fashion with fasciotomy and application of ligation clips (Horizon™, Weck Closure Systems, NC, USA) to the side branches. It was of satisfactory caliber (1.5 mm) with good flow and there were no concerns about its quality. The terminal 2 cm of the LIMA was skeletonized and anastomosed to the middle third of the LAD using 8/0 Prolene (Ethicon Ltd, Edinburgh, UK) suture. The left pleura was opened widely and the LIMA was passed beneath the medial border of the left lung and through a pericardial slit to ensure it lay in a tension-free manner. The patient came off cardiopulmonary bypass easily and the chest was closed in the usual fashion over left pleural and mediastinal drains.

The patient was stable for the first 3 h following surgery. Initiation of weaning from the ventilator was commenced and the patient was self-ventilating. At this point a sudden increase in the mediastinal blood loss was noted (500 ml in 30 min) and concomitant hemodynamic instability. Emergency resternotomy was performed. The principal finding was complete transection of the LIMA 2 cm proximal to the anastomosis at the origin of a side branch which had been ligaclipped. The cut edge of the graft was jagged. The anastomosis was completely intact and the proximal segment of the LIMA had retracted into the left...
pleural space (Fig. 1). There was, in addition, approximately 3 l of free blood in the mediastinum and the left hemithorax. The patient developed ventricular fibrillation and internal cardiac massage was commenced prior to institution of crush cardiopulmonary bypass.

The LIMA was deemed unusable and a fresh segment of long saphenous vein was harvested and anastomosed to the LAD at the site of the previous arteriotomy. Cardiopulmonary bypass was discontinued with the assistance of an intra-aortic balloon pump and inotropic support. Apart from transient left upper limb weakness which recovered completely, the patient’s postoperative course was uneventful and he was discharged from hospital on the 14th post-operative day. Outpatient review at 6 weeks showed the patient to be making a satisfactory symptomatic, clinical and functional recovery.

3. Discussion

At operation it appeared the transection had occurred at a point of weakness in the graft at the junction of the pedicled and skeletonised sections centered on a side branch. The history suggested the transection occurred during weaning from the ventilator. At this time sudden forceful lung expansion (e.g. while coughing) can occur, resulting in the lung edge coming into contact with the graft with considerable force. Alternatively, over expansion of the patients emphysematous lungs could have stretched the graft causing an avulsion.

Rupture of the internal mammary artery has been described in the non-cardiac setting following cases of blunt and penetrating trauma [3]. There has also been one case of this condition in a patient with Ehlers–Danlos syndrome with no history of trauma [4]. The current case, to our knowledge, is the first report of complete transection of the IMA following conventional myocardial revascularization via median sternotomy.

There have been two other reports of this complication in English literature, and both occurred after minimal invasive CABG. In the first, the condition was noted 5 days after surgery in a 58-year-old man who was attempting to lift a heavy garbage can [5]. Postulated causes included inadequate length of the LIMA, interaction of the artery with the edge of the pericardium and adhesion of the conduit either to the chest wall, mediastinum or lung rendering it susceptible to excessive traction. In the second, the complication occurred in a 49-year-old man 13 days after surgery soon after the patient had undergone vigorous stretching exercises [6]. A further point of note is that the transection occurred at the junction of the pedicle and skeletonized segment of the LIMA where coincidentally there was a side branch with an attached ligation clip. This may well have been a point of weakness and studies have shown that localized intimal dissections often arise at the site of origin of these small side branches [2]. Such dissections are often trivial and go unnoticed, but occasionally can extend with profound hemodynamic consequences as described in the case of a patient who died following redo CABG. The post-mortem in the latter revealed the presence of intimal dissection of the LIMA originating at the point of a hematoma in the arterial wall [7]. It is also conceivable that such a point of weakness, centered on a side branch and ligation clip, is more vulnerable to any shear forces resulting in the subsequent transection.

These cases emphasize the importance of meticulous surgical technique in creating the IMA pedicle with particular reference to the clipping of side branches. Also important is the correct alignment and positioning of the IMA in relation to other anatomical structures to prevent undue tension and traction of the artery [8]. In patients with emphysematous lungs, LIMA length should be determined, with some additional length obtained by making a fasciotomy to the LIMA or by extending the length of skeletonization. Alternatively, graft tension can be reduced in these patients by creating a fissure in the lung to allow passage of the graft [9]. The reality is that the precise etiology of this complication remains unknown, but is likely to be multifactorial. However, the present case serves to highlight a potentially life-threatening condition that requires early recognition and prompt surgical intervention.

References


Appendix A. ICVTS on-line discussion

Author: Dr. Eadwine Chen, Chi-Mei Hospital, Department of Cardiovascular surgery No. 2-2, 4F, 2nd section of Bei-Men Rd., Lane 577, Tainan, Taiwan
Date: 29-Aug-2004

Message: In discussion, a case report was mentioned about the unnoticed dissection of left internal mammary artery (LIMA) which resulted in transection. Did this happen in your case? Did you make a fixation suture between the adventitia of the LIMA and the epicardium? We routinely perform this technique after anastomosis to reduce the tension of LIMA. In this case, a fixation placed between the adventitia of LIMA just proximal to the "branch"and the epicardium probably can avoid the complication.

Response

Author: Mr. Pankaj Kaul, Leeds General Infirmary, Department of Cardiothoracic Surgery, Jubilee Wing, Great George Street, Leeds, UK
Date: 27-Sep-2004

Message: Examination of the distal and proximal stumps of the LIMA did not reveal any obvious dissection. We routinely tack the LIMA down to the epicardium to buffer the tension on the anastomosis to guard against the effects of sudden lung expansion, not unusual just before or after extubation. The transection of the LIMA seems to have occurred despite this and despite the fact that LIMA was generously long with sufficient “give”.

Author: Dr. Hitoshi Hirose, The Cleveland Clinic Foundation, Department of Thoracic and Cardiovascular Surgery, Metro Health Drive, Cleveland, OH 44106, USA
Date: 14-Oct-2004

Message: I agree with the authors that the junction of the pedicle and skeletonized segment of the internal mammary artery (IMA) is the weakest point of the graft. The area of the junction may be overstretched and may cause local dissection which further causes occlusion of the IMA graft. Maximum shear stress may be applied into the area while the over-inflation of the lung. To avoid the stress to the junction area of the IMA, the IMA should be harvested long enough, especially the patients with chronic lung disease with emphysematous lung.