

CORONARY BYPASS THROUGH VERY LIMITED STERNOTOMY

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SUMMARY

Purpose : Coronary artery bypass grafting (CABG) is the most widely performed operation and its techniques are being continuously improved. We performed CABG on a beating heart through a very limited sternotomy incision. **Methods:** Between 1 Feb and 30 Oct, 2000 36 patients underwent CABG through a partial sternotomy in the distal third of the sternum. Patients with stenosis of the obtuse marginal, posterior descending and left main coronary arteries were excluded. Emergency operation was considered as a contraindication for the use of this technique. **Results:** In 4 patients the operation was reverted to other classic methods (11.1 %). The patients received an average of 1.4 grafts. One patient developed enzymatic and electrocardiographic criteria of myocardial infarction in the perioperative period. Endarterectomy was carried out in 5 patients. No patient was reoperated due to bleeding or other reason. Control angiography in 11 patients (30.5 %) with 17 grafts showed two occluded grafts (11.7 %). **Conclusion:** CABG to the anterior vessels of the heart can be carried out through very limited sternotomy with satisfying results.

Key Words: Coronary Bypass, Beating Heart, MIDCAB.

INTRODUCTION

Although coronary bypass can be truly considered as the most widely studied and practiced surgical procedure, its application and methods are continuously being evolved. Myocardial preservation during the operation is the mainstay of studies in this field. In the last few years it has been claimed that the best myocardial preservation during the operation is to avoid cardiopulmonary bypass and cardiac arrest and to carry out the operation on a beating heart. Recently the concept of minimal access surgery has gained popularity and most surgeons have been focusing on doing these operations on

the beating heart and through limited incisions. Different types of small and less invasive incisions have been introduced to the practice of coronary surgery. Partial lower sternotomy excluding the disruption of the manubrium is one of them. We performed coronary bypass on a beating heart via a very limited sternotomy (VLS). The incision is limited to the distal 6-8 cm of the sternum and xyphoid process. Exposure is quite satisfactory in this method and all the coronary arteries except the obtuse marginal branches and posterior descending artery can be revascularized.

MATERIALS AND METHODS

From 1 February, 2000 to 30 October, 2000 a total of 214 patients underwent coronary bypass graftings in our clinic. From this total, 36 were carried out via VLS. Thirty-three patients were in New York Heart Association (NYHA) class II or III. Three patients were admitted with the complaint of pain at rest and were classified in NYHA class IV. The decision to do the operation via VLS was taken preoperatively. Presence of stenosis in the obtuse marginal or posterior descending arteries, emergency operation or left main coronary lesion precluded the use of this technique. Obesity was not a contraindication for the use of VLS. All the patients were hospitalized the night before the operation and informed about the type of operation. Diazepam 10 mg IM and cefazoline 1 gr IV were injected while transferring the patient to the operating room. Anaesthesia was induced by intravenous injection of fentanyl 3-5 µg/kg, pancronium 0.1 mg/kg and pentothal 6-8 mg/kg. Maintenance of anaesthesia was accomplished by inhalation of sevoflurane 1-2% MAC. A 10 cm skin incision in the lower portion of sternum was made. A transverse incision at the junction of the middle and distal third of the sternum was made by a gigly saw. VLS was done using an electrically powered sternum saw. The distal third of left internal mammary artery (LIMA) and, if necessary, right internal mammary artery (RIMA) were prepared using scissors and electrocautery. Heparin 1.5 mg/kg was administered intravenously. A single blade sternal retractor was used for the exposure (Fig. 1). The pericardium was opened in its distal half. The decision to continue cardiopulmonary bypass would lead to conversion to full sternotomy. If the coronaries were suitable for beating technique, then several sponges were placed behind the heart as necessary. Hemodynamic instability not responding to volume loading and pharmacologic intervention would lead to the conversion to the other classic techniques. LIMA was always used for left anterior descending artery (LAD) revascularization. RIMA was either used for the right coronary artery (RCA) and/or the diagonals as a composite graft. Failure to mobilize the full length of RIMA was the reason for using composite grafts for the revascularization of the diagonals. One circular proximal and one semicircular distal prolene



Fig. 1 : Intraoperative view of the pericardial space using VLS. Note the end to side anastomosis between the saphenous graft to RCA and LIMA (Arrow). LIMA to LAD anastomosis can be seen in the bottom right field of the picture (Arrow head). VLS: very limited sternotomy, RCA :right coronary artery, LIMA: left internal mammary artery

suture were the only means to control bleeding and exposure of the coronary artery through the limited sight of exposure during the anastomosis. Following completion of the distal anastomosis, the graft was flushed with a diluted solution of heparin (100 IU/ ml). After completion of all of the anastomoses, heparin was neutralized with protamine in a ratio of 2:1. The sternum was closed by two transverse and two longitudinal steel wires.

RESULTS

Postoperative follow-up was complete and ranged from 1 to 6 months. Thirty-six patients were operated using the VLS technique. In two patients the operation was changed to the classic method using cardiopulmonary bypass because of hemodynamic instability. Both of these patients had very low ejection fractions (25 and 23 %). In another patient, while canjup out the proximal anastomosis of saphenous vein graft of the diagonal artery to LIMA, dissection appeared in the internal mammary artery and the operation was changed to full length sternotomy without cardiopulmonary bypass. A fourth patient was scheduled to undergo a double coronary revascularization using VLS technique. Failure to attain a satisfactory RIMA- RCA anastomosis

led us to do a full sternotomy and continue the operation as a cardiopulmonary bypass. In total, this method failed in four patients (10 %). There were 14 females and 22 males. Average age was 56 ± 4.7 . Fifty five stenoses were bypassed with an average of 1.5 graft per patients (Table 1). Five patients underwent endarterectomy of the coronary arteries (3 RCA, 1 LAD, 1 diagonal). In the first 20 patients the average time for of anastomosis was 16 ± 2.6 minutes but in the last 16 patients this decreased to 9 ± 1.6 minutes. Postoperative drainage was 230 ± 50 cc. Postoperatively one patient had 1050 cc of drainage. No patient was reoperated because of bleeding or any other reason. Postoperatively one patient developed electrocardiographic evidence of myocardial infarction and a rise in the serum levels of CPK-MB. This was a patient with a previous PTCA and stent of the lateral circumflex artery. Preoperative angiography showed the stented vessel widely open. Acute myocardial infarction occurred in the circumflex artery domain but the hemodynamic status was stable. He is doing well 3 months after the operation. Control angiography showed an open LIMA to LAD anastomosis and occlusion of the stented lateral circumflex artery with akinetic lateral wall of the left ventricle. Postoperatively there was only one case of low cardiac output and this was a patient with a preoperative ejection fraction of 30%. Intra-aortic balloon counterpulsation and dopamine infusion was started. His condition improved gradually and he was transferred to a normal ward in the 3rd postoperative day. The rest of the patients were transferred to a normal ward the day after the operation and all except one were discharged from hospital on the fourth postoperative day. In one patient with severe chronic obstructive pulmonary disease, laceration of the right lung occurred during transverse sternotomy with a gigly saw. This was due to the adhesion of the right lung to the sternum. This patient developed a prolonged air leak which eventually disappeared without surgical intervention. He was discharged at the fifteenth postoperative day. He was the only patient with postoperative use of narcotic analgesics. All patients returned to their preoperative life style two weeks after the operation. Control angiography was carried out in 11 (30.5%) patients one month after the operation. Eight LAD-LIMA, 3 LIMA to

Table 1 : Localization and number of the revascularized stenotic coronary arteries.

Coronary Artery	Number
LAD	27
LAD + RCA	2
LAD + D1	6
LAD + RCA + D1	2
LAD + D1 + D2	2
Toplam	55

diagonals using saphenous vein and 2 RCA - saphenous and RIMA composite graft anastomoses were open. One saphenous to LIMA for diagonal artery and one RIMA to endarterectomized RCA were completely occluded (11 %). Postoperatively all patients experienced an improvement in their NYHA classification score and were either in class I or II. Only the patient with prolonged air leakage had a functional capacity of NYHA class III.

DISCUSSION

Although coronary bypass operation is the most widely used operation, its techniques are still being improved and refined in many ways. Now that myocardial protection has reached its optimal precision, attention has been focused on the less invasive methods of revascularization of the stenotic vessels. Minimally invasive methods can be used to treat most of the stenotic lesions on the anterior aspect of the heart. Lesions on the posterior aspect of the heart can either be addressed by PTCA (hybrid operation) or using different stabilizing devices with less satisfying results. Doing coronary bypass by using extracorporeal circulation involves the necessity of aortic and venous cannulation and aortosaphenous anastomoses which dictates the exposure and manipulation of the above mentioned structures through a full sternotomy. Using RIMA and LIMA as arterial inflow and doing the coronary bypass operation on a beating heart precludes the need for a full sternotomy. Lichtenberg (1) and Moreno (2) reported the use of partial midline and distal T sternotomy for CABG. Choi (3) used the same T incision for the treatment of both acquired and congenital lesions. Walterbusch(4) did a reverse V incision in the distal half of the sternum and separated this part from the rest of the bony structure. Some authors such as Cooley (5) and Doty (6) emphasize the possibility of performing some cardiac operations

through a distal third sternotomy. The method described by them is quite similar to the one used by us. Although Ali et al (7) used a small midline incision and a full sternotomy and cardiopulmonary bypass in the treatment of various congenital and acquired diseases of the heart, the reproducibility of their technique has been debated by many others. They argue that although the skin incision is a smaller one because of the use of full sternotomy and cardiopulmonary bypass, it cannot be considered as a type of minimally invasive surgery. In parallel with small sternotomy incisions, some centers have reported sternum sparing parasternal incisions with good results. Right parasternal incision can be an access for some cardiac lesions specially atrial septal defects and mitral and tricuspid diseases (8, 9). Cooley and colleagues in the Texas Heart Institute have reported total excision of the distal half of the sternum and the attached cartilages followed by reimplantation of the excised part (10). In our opinion excision and reimplantation of a portion of sternum may cause irreversible damage to the structure and in turn is against the main spirit of minimally invasive surgery. Left mini thoracotomy incision (MIDCAB) has been exclusively used for the revascularization of LAD (11). Wide left anterolateral thoracotomy can visualize the posterior coronary arteries and any lesion in these arteries can be treated via this incision (12).

In parallel with other cardiac centers, we have used a new partial sternotomy incision. Exposure of the anterior vessels of the heart is quite satisfactory and any combination of the vascular grafts can be used with LIMA and RIMA as the only means of arterial inflow (Fig. 1). Although we only used a saphenous graft in the composite grafts, any combination of the arterial grafts with internal mammary artery can be used for revascularization. Due to the smaller nature of the incision, postoperative pain is much less severe in intensity and duration. Only one patient in our series needed narcotic analgesic in the immediate postoperative period. Obviously total sternal dehiscence is not a matter of concern in this method and the smaller nature of the VLS gives a much better cosmetic result (Fig. 2). Although long term patency of the grafts could not be evaluated, short and mid term results are comparable to those of the classic techniques.



Fig. 2 : Postoperative view of the skin incision.

In conclusion, coronary bypass to the anterior vessels of the heart can be carried out through a limited distal sternotomy with accepted morbidity and mortality.

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