



MINIMALLY INVASIVE CORONARY ARTERY BYPASS GRAFTING – A NOVEL TECHNIQUE AND STUDY AT OUR CENTRE

Surgery

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ABSTRACT

Background—Minimally invasive coronary artery bypass grafting (MICS CABG) is a procedure that does not require any additional infrastructure and can be done at all cardiac centers. It helps to decrease the invasiveness of surgery and with better postoperative results. This study aims to assess feasibility and advantages of MICS CABG.

Methods and Results—All myocardial territories are accessed via a 4- to 6-cm left fifth intercostal thoracotomy. An apical positioner and epicardial stabilizer are introduced into the chest through the subxyphoid and left seventh intercostal spaces, respectively. The left internal thoracic artery is used to graft the left anterior descending artery and saphenous vein segments are used to graft the lateral and inferior myocardial territories. Proximal anastomoses are performed directly onto the aorta. In the 50 MICS CABG procedures at our centers, mean SD age was 54 +/-9 years and 18 patients were female (36%). The average number of grafts was 1.2 +/- 0.4, with complete revascularization in 95% of patients. There were no conversions to sternotomy, and no reinterventions for bleeding. Only one patient had superficial wound infection.

Conclusions—MICS CABG is feasible any cardiac center. It is beneficial to patient and with excellent result as observed by the study done at our center.

KEYWORDS

Bypass, Coronary Disease, Surgery

INTRODUCTION

MICS CABG is a novel coronary operation that aims at decreasing the invasiveness of conventional CABG while preserving the applicability and durability of surgical revascularization. Conventional CABG is associated with major morbidity in ~ 15 % of patients, which includes septicaemia, stroke, reoperation, haemorrhage, low cardiac output, new onset hemodialysis and adult respiratory distress syndrome^{1,2}. Furthermore, atrial fibrillation is seen in upto 50% of patients after CABG^{3,4}. Chronically, post-sternotomy patients not uncommonly experience decreased physical functioning^{5,7}, and upto 30 % of CABG patients still report pain even 1 year after the operation^{8,9}.

The thoracic invasiveness of CABG has not decreased since the operation was introduced > 40 years ago¹⁰. MICS CABG is a surgical procedure based on anatomic relations between the LIMA, the coronary arteries and their branches, the apex of the heart and the ascending aorta¹¹. The goal of this technique is to allow the surgeon to perform within a patient's closed anterior thorax a revascularization configuration equivalent to that of a regular CABG while keeping the procedure minimally invasive, without a sternotomy and in many cases without the use of CPB. We hereby report our experience of this procedure at our center.

METHODS

Patient population - Between 2013 and 2017, 50 patients with CAD referred for CABG underwent MICS CABG at the PK Sen Department of Cardiovascular and Thoracic Surgery, KEM hospital Parel, Mumbai. The preoperative characteristics of the patients are as shown in Table. Symptomatic single vessel CAD was the most common indication for operation.

Preoperative evaluation –

Absolute contraindications – Emergency surgery with haemodynamic compromise, Severe pectus excavatum, Severe pulmonary disease.

Relative contraindications- Haemodynamically significant left SCA stenosis, severe left ventricular dysfunction, need for RCA graft with no posterior descending or left ventricular branch target, absence of femoral pulses bilaterally.

Pulmonary disease if suspected is investigated because tolerance of single lung ventilation greatly facilitates the conduct of this operation

Operative Procedure –

Intubation is performed either with a double lumen ET tube or with a regular ET tube and a bronchial blocker. Transoesophageal echocardiography is routinely used to monitor cardiac function.

Patients are positioned in a 15 degree to 30 degree right lateral decubitus position, with the right arm extended to allow harvest of radial artery if applicable. The patient is draped to allow access to the left groin and right thigh/leg for femoral cannulation and saphenous vein harvest respectively.

A 4-6 cm incision is made in the left 5th intercostal space, starting at the mid clavicular line and extended laterally. A rib spreader is inserted, and an incision is made in the pericardium ~ 1-2 cm anterior to the left phrenic nerve, extended cephalad to the level of left atrial appendage and antero-caudally towards the diaphragmatic reflection. Pericardial retraction stitches are taken and coronaries assessed. LIMA is harvested from a lateral approach from the first rib down to the bifurcation using electrocautery and long instruments. Care is taken at identifying and avoiding the phrenic nerve. Heparin is given @ 100U/Kg before LIMA division.

A 6mm incision is made in the left 7th intercostal space to allow for the introduction of an Octopus epicardial tissue stabilizer, positioned over the pulmonary artery or right ventricular outflow tract to gently depress it in a left posteroinferior direction. A starfish apical positioner is inserted below the xiphoid process through a 6mm incision, and suction is applied to the apex of the heart. An Octopus epicardial tissue stabilizer is positioned around the coronary artery to be grafted. Coronary anastomoses are performed in continuous manner using 7-0 polypropylene and visualization is obtained using an intracoronary shunt and a blower mister.

At the end of the procedure, a pleural chest tube is inserted through the orifice created for the Octopus and a pericardial drain is left in the hole created for the Starfish. The lung is reinflated, and the grafts checked under direct vision to rule out any kinking or tension. Wound is closed in layers.

Post Operative Management and Evaluation

All patients are treated with medical therapy as with conventional CABG via sternotomy including aspirin, beta blockers and anticholesterol agents. All patients were followed up for a minimum of 30 days after discharge from the hospital. Death was defined as mortality occurring within 30 days of the operation or at any time during hospitalization. Stroke was defined as a permanent, new, focal neurological deficit occurring either intraoperatively or post-operatively. Respiratory insufficiency was defined as a cumulative requirement for intubation and ventilation of 72 hrs or more at any time during the post-operative stay. New onset renal failure was defined as the need for temporary or permanent renal dialysis of any

type. Transfusion rates were determined by the proportion of patients who received atleast 1 transfusion of any blood product .

Preoperative patient characteristics

Age	54+/- 9 yrs (38 – 76)
Sex	18 f / 32 m
Height (cm)	160.3 +/- 8 (140 – 178)
Weight(kg)	56 +/- 9.2 (42 – 82)
Ejection fraction	50 +/- 2 (40 – 55)
Single vessel disease	38
Double vessel disease	12
Diabetes mellitus	18
Hypertension	24
Peripheral vascular disease	7
Chronic renal disease	5
Cerebrovascular disease	3
Chronic pulmonary disease	2
Prior myocardial infarction	3
Prior PCI	-
Prior CABG	-

Result

All 50 patients that were included in this study underwent MICS CABG without conversion to sternotomy . There was no peri operative mortality and no case required a need for return to the operating room. Table 2 shows operative characteristic and postoperative results. Rates of perioperative transfusion, stroke, and atrial fibrillation were low along with excellent wound healing results . Only one patient had superficial chest wound infection . Pleural complication were observed almost exclusive in left thorax.

Postoperative result

No of grafts	42
1 graft	8
2 graft	
Use of CPB	0
Conversion to sternotomy	0
Return to operating room	0
Perioperative transfusion	16
No of units	1 – 1.5
New onset of Q wave	0
Stroke	0
Respiratory insufficiency	3
New onset renal failure	0
New onset atrial fibrillation	2
Pneumothorax	1
Wound infection	1
Death	0
Length of stays	4 +/-1.2 (3 – 7)
Pleural effusion	3

Discussion

MICS CABG is a safe and predictable surgical option for patients with single vessel coronary disease (LAD) who are not suitable for PCI. The avoidance of sternotomy and extracorporeal circulation decreases the potential risks and adverse effects of conventional CABG. We have observed low incidence of perioperative mortality and morbidity in our experience with this procedure. The procedure has wide applicability and excellent procedural outcomes. Furthermore in our experience the procedure can be implemented and developed without the occurrence of significant learning curve with respect to morbidity and mortality. These findings are significant in that > 40 yrs since the introduction of CABG, no diffusible change has occurred to decrease the invasiveness of the operation. Our results show that this approach compares favourably with the results of conventional “gold standard” CABG especially in patients with diffuse single vessel CAD and in those with diffuse double vessel disease in a related geographic area. An additional advantage is that it does not involve any significant infrastructure acquisition or additional operational costs, thereby facilitating its implementation without any significant increase in costs.

Conclusion

Our experience with the procedure of MICS CABG shows that a novel minimally invasive surgical alternative to CABG exists, is widely applicable, and is associated with atleast as good procedural outcomes. However, randomized , controlled trials will be necessary to compare MICS CABG with CABG with respect to survival, long term patency , and physical functioning.

References

1. Brown PP, Kugelmass AD, Cohen DJ, Reynolds MR, Culler SD, Dee AD, Simon AW. The frequency and cost of complications associated with coronary artery bypass grafting surgery: results from the United States Medicare program. *Ann Thorac Surg.* 2008;85:1980–1986.
2. SchimmerC, ReentsW, BernederS, Eigelp, SezerO, ScheldH, Sahraoui K, Gansera B, Deppert O, Rubio A, Feyrer R, Sauer C, Elert O, Leyh R. Prevention of sternal dehiscence and infection in high-risk patients: a prospective randomized multicenter trial. *Ann Thorac Surg.* 2008;86: 1897–1904.
3. Prasongsukarn K, Abel JG, Jamieson WR, Cheung A, Russell JA, Walley KR, Lichtenstein SV. The effects of steroids on the occurrence of postoperative atrial fibrillation after coronary artery bypass grafting surgery: a prospective randomized trial. *J Thorac Cardiovasc Surg.* 2005;130: 93–98.
4. Halonen J, Halonen P, Jarvinen O, Taskinen P, Auvinen T, Tarkka M, Hippelainen M, Juvonen T, Hartikainen J, Hakala T. Corticosteroids for the prevention of atrial fibrillation after cardiac surgery: a randomized controlled trial. *JAMA.* 2007;297:1562–1567.
5. Jideus L, Liss A, Stahle E. Patients with sternal wound infection after cardiac surgery do not improve their quality of life. *Scand Cardiovasc J.* 2009;43:194–200.
6. Jarvinen O, Saarinen T, Julkunen J, Huhtala H, Tarkka MR. Changes in health-related quality of life and functional capacity following coronary artery bypass graft surgery. *Eur J Cardiothorac Surg.* 2003;24:750–756.
7. Speziale G, Bilotta F, Ruvofo G, Fattouch K, Marino B. Return to work and quality of life measurement in coronary artery bypass grafting. *Eur J Cardiothorac Surg.* 1996;10:852–858.
8. Lahtinen P, Kokki H, Hynynen M. Pain after cardiac surgery: a prospective cohort study of 1-year incidence and intensity. *Anesthesiology.* 2006;105:794–800.
9. Meyerson J, Thelin S, Gordh T, Karlsten R. The incidence of chronic post-sternotomy pain after cardiac surgery: a prospective study. *Acta Anaesthesiol Scand.* 2001; 45: 940–944.
10. Ruel M, Sellke FW. Coronary artery bypass grafting. In: Sellke FW, Del Nido PJ, Swanson SJ, eds. *Sabiston and Spencer’s Surgery of the Chest*, 7th ed. Philadelphia: Elsevier Science; 2005:1459–1490.
11. Lapiere H, Chan V, Ruel M. Off-pump coronary surgery through miniincisions: is it reasonable? *Curr Opin Cardiol.* 2006;21:578–583.