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Original Article

Early Outcome of Minimally Invasive Direct Coronary Artery Bypass Surgery- A hospital based study

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Abstract

Background: *coronary artery bypass surgery (CABG) is expensive, uses disposable appliances and patients require more perioperative intensive care, long stay in hospital and often have a lengthy recovery time. These complications, together with the growing trend towards less invasive techniques in other areas of surgery, have encouraged cardiac surgeons to see if minimally invasive cardiac surgery can become a reality with improved outcomes and costs.*

Methods: *This is a prospective nonrandomized comparative clinical study done at the Department of Cardiac Surgery in National Institute of Cardiovascular Diseases (NICVD) Sher-E- Bangla Nagar, Dhaka from July 2006 to June 2008 among routine CABG patients. Purposive sampling was done with 26 patients in group A selected for MIDCAB and 24 patients in Group B selected for conventional CABG surgery. Patients were followed up for three months. Postoperative outcomes were assessed to evaluate the safety and efficacy of MIDCAB in relation to conventional CABG.*

Results: *Mean age were 54.19 vs 53.87 in group A and Group B. 92.3% vs 87.5% were male respectively. Mean duration of operation, per operative blood loss transfusion and arrythmia were lower in MIDCAB group ($p<0.05$) number of grafts were also statistically significant ($p< 0.001$). Regarding post-operative outcome ventilation time in hours ICU stay post-operative hospital stay in days, postoperative MI and stroke rate were lower in favor of group A MIDCAB patients ($p<0.001$). Three months postoperatively six-meter walking distance is also statistically significant in favor of Group A MIDCAB ($p<0.01$) patients. However, pain score in early post-operative period was higher in group A significantly but it decreased significantly in late post-operative period which is also highly statistically different ($p<0.001$). However, mortality and quality of life at three months were similar in both groups.*

Conclusion*: No difference in mortality rates detected between MIDCAB and CCABG group. But there was evidence that MIDCAB is associated with less perioperative and early postoperative morbidity and improved quality of life. The MIDCAB surgery is an effective procedure of complete revascularization in ischemic heart diseases like CCABG. The procedure is associated with shorter operating time, shorter ICU stay time, shorter hospital stays and better quality of life than for CCABG.*

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Introduction:

Incidence of IHD is increasing in developing countries, including Bangladesh. In 1975 the incidence of IHD in Bangladesh was reported to be 3.3 per thousand and that in 1985 was 14 per thousand.[1] The prevalence of CAD in urban India was reported to be 9.67 percent and that in rural Indians was 0.48 percent.[2] The first coronary

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artery bypass grafting (CABG) procedures were done on the beating heart where left internal mammary artery anastomoses to the left anterior descending artery by Kolessov in Leningrad in 1964 and then 3 years later in 1967 by Favalore at the Cleveland Clinic, USA.[3,4] CABG then progressed to the use of temporary cardiopulmonary bypass (CPB) with a heart- lung machine or pump oxygenator.[5] CABG then spread rapidly throughout the world. Nevertheless, it remains a major operation with significant complications, and surgeons have sought new ways of reducing the insult to the patient. A variety of minimally invasive techniques. offer some promise. Innovations over the 40 years since coronary artery bypass graft were first developed have included greater use of arterial conduits, better method of cardioprotection, and improvements in oxygenator technology. The cardiopulmonary bypass circuit has got safer and better, but important pathophysiological consequences still remain for the patient.[3]

CABG under CPB is a maximally invasive procedure. Invasiveness is likely due to use of CPB which is nonphysiologic, prolonged general anesthesia with endotracheal intubations and full median sternotomy which interfere with sternal stability and thus disrupt the normal pulmonary mechanics. So, to minimize the undesired effects of the CPB an alternative procedure has been developed called off pump bypass surgery (OPCAB). Which uses mechanical devices dampen cardiac motion either by holding myocardium by means of small suction cups (Octopus) or by downwards pressure on each side of coronary segment. A bloodless field is attained with a CO_2 moist blower, an intra coronary occluder, a coronary shunt or a bulldog clamp.[6]

Since the heart continues to beating and no use of cross clamp, circulation is maintained without the use of cardiopulmonary bypass machine.[7] But it still required full median sternotomy which interfere with sternal stability and thus disrupt the normal pulmonary mechanics.[8] The new intervention, Minimally invasive direct coronary artery bypass (MIDCAB), refers to coronary artery bypass surgery performed on a beating heart without the aid of cardiopulmonary bypass using incision smaller than a full median sternotomy. MIDCAB was initially limited to single vessel revascularization, usually of the left anterior descending artery (LAD). MIDCAB procedure also be done in patients with multivessel disease, either as repair of all the lesions (complete revascularization) or restricted to repair of the "culprit" lesion(s) (complete or target revascularization).[5]

The prime objective of CABG is to obtain complete revascularization by bypassing all severe stenoses (at least 50% diameter reduction) in all coronary arterial trunks and branches having a diameter of 1 mm or more.[9]

The two main features of MIDCAB purportedly offer the following advantages over conventional CABG (CCABG): reduction of operating time and perioperative complications such as blood loss and harmful neurocognitive effects; and reduction of postoperative recovery time, hospital stay and cost.[10]

In National Institute of Cardiovascular Diseases, Bangladesh (NICVD) CCABG are being done since 1981 and off pump coronary artery bypass surgery (OPCAB) since 1997.[11] MIDCAB surgery started from the early of 2005. In our NICVD context, the early outcome of MIDCAB seems to be excellent & encouraging. The degree of patient satisfaction was gratifying and cost effective. In our country no study has yet been performed on comparative outcome of MIDCAB surgery with CCABG. Evaluation of outcome of MIDCAB surgery as better and safer procedure and success of this new technique over CCABG is important for future direction.

Study methods:

This is prospective, non-randomized, comparative, clinical study was carried out in the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh from July 2006 to June 2008. Patients admitted in the Department of Cardiac Surgery, National Institute of Cardiovascular Disease, Dhaka, Bangladesh for MIDCAB surgery and CCABG surgery were taken as study population. Purposive sampling method. Were followed accordingly in this study 26 and 24 patients were taken MIDCAB and CCABG group respectively with inclusion criteria: All patients had symptoms refractory to medical treatment

those were not candidates for further catheter-based interventions and selected for elective CABG. Exclusion criteria were patients who refused to be included in the study, myocardial infarction within the last 3 months, combined CABG & valve or other congenital heart diseases, ejection fraction <30%, emergency or redo CABG, diffusely diseased with calcified artery, patient with impaired hepatic, pulmonary and renal function, patients who underwent beating heart revascularization by a median sternotomy approach and previous thoracotomy.

The aim of this study was to measure the safety and benefit of MIDCAB surgery for surgical revascularization in Ischemic Heart Diseases. Specific objectives were to define efficacy for complete revascularization by MIDCAB surgery and to compare the early outcome of MIDCAB surgery with conventional CABG. Preoperative variables include demographic variables Age (years), sex, height (meter) and weight (kg) were recorded to assess the similarity between two groups. Preoperative characteristics of study patients: were recorded from history and preoperative investigations to find out whether the risk factors uniformly distributed between two groups or not. All coronary angiographic finding were assessed- number of vessels involvement, number of planned grafts, site of distal anastomoses and type of conduit recorded and that were compared per operative assessment and performance to evaluate the efficacy of MIDCAB for complete revascularization of ischemic myocardium. Perioperative variables -operating time, Graft per patient and type of conduit [artery/ vein] were noted. Postoperative variables - Ventilation time in hours, ICU stay, Hospital stay were noted. Patients were followed up to 3 months: Re-intervention, quality of life assessed by pre and postoperative measured by 6 Minutes Walking Test (6MWT), postoperative daily pain score was assessed by visual analogue scale (VAS). Prior to the commencement of this study, the research protocol was approved by the thesis committee of NICVD.

MIDCAB Procedure: Patients were positioned with the left side elevated to more than 60 degrees. The left hand is elevated above the head and fixed on a padded hand rest. A skin incision of approximately 8 to 10 cm is made 2.5cm below and 2.5cm medial to the left nipple and extended laterally to the mid to posterior axillary line. The medial edge of the incision is therefore 3 to 4 cm lateral to the LIMA. Once the pleural cavity has been opened, the left lung is deflated and wrapped with wet mob and the LIMA is identified by palpation. Saphenous vein graft was harvested from the right lower extremity. A specially adopted wound spreader (LIMA retractor) is secured in place and gently opened to avoid rib fracture. No costal cartilage was resected. Once the pleural cavity has been opened, the left lung is deflated and wrapped with wet mob and the LIMA is identified by palpation. The LITA was then harvested as a pedicle from the first rib down to seventh intercostal space (up to the bifurcation), starting at the level of skin incision. Pericardiotomy was done parallel and anterior to the phrenic nerve and extends from the apex of heart to the ascending aorta. Left lung was retracted downward and anteriorly to expose the descending thoracic aorta for proximal anastomosis of saphenous vein. Heparin is given (100 lU/kg) and mammary artery pedicle is divided. The cardiac tissue stabilizer (octopus) is placed on anastomosing site. LAD is opened longitudinally, coronary shunt introduced and the mammary to coronary artery anastomosis is performed with a running 7-0 polypropylene suture. $C0_2$ blower is used to keep anastomosis site bloodless. Deep pericardial sling and mechanical device Urchin were used to position the heart for optimal visualization of the lateral, posterior, inferior and the distal right coronary arteries. To maintain hemodynamic stability, sometime patients were placed in Trendelenburg position for grafting PDA, and OMs. The proximal anastomoses (RSVG) were done on the descending thoracic aorta or subclavian artery and distal anastomoses is made same way as LAD. After completion of anastomoses protamine was administered for heparin reversal. After placing temporary pacing wire in the right ventricular epicardium, the pericardium and mediastinal fat was loosely approximated to cover the grafts and to prevent cardiac herniation. Chest wound was closed keeping two drain tubes in situ.

Data collection and analysis all relevant data were collected from each participant using pre-designed questionnaire and data collection form. Statistical

analysis of data: were done with the use of Statistical Packages for Social Sciences (SPSS-13) (SPSS Inc, Chicago, IL, USA) and Minitab 14. 95% confidence limits were taken. Probability value <0.05 were considered as level of significance.

Results:

Mean age of the patients of MIDCAB group was 54.19 and CCABG group was 53.87 years (p>0.05). Male were dominant in both groups. In occupation group service holders were maximum. Twenty-eight patients fourteen from each group were service holder. Maximum patients of both groups were educated either higher secondary level or graduate and above. 73.1% respondents of MIDCAB group and 79.2% of CCABG group were from middle class economic family.

Out of all patients of MIDCAB group 12 (46.2%) were current smoker followed by 9 (34.6%) nonsmoker and 5 (19.2%) ex-snooker. In CCABG group 9 (37.5%) current smoker, similar number ex-smoker and 6 (25.0%) nonsmokers (p>0.05). Preoperative clinical characteristics of MIDCAB group and CCABG group were more or less same and no significant statistical difference between two groups (p>0.05).

Pre-operative coronary angiogram revealed that 6 (23.1%) patients of MIDCAB group and 6 (25.0%) of CCABG group had left main vessel involvement. All patients of both groups had LAD involvement, 16 (61.5%) patients of group A and 18 (75.0%) of CCABG group B had LCX artery, 16 (61.5%) patients of MIDCAB group and 19 (79.2%) patients of CCABG group had RCA involvement. In MIDCAB group maximum patients had DVDs. In CCABG group 45.8% patients had DVDs, 50.0% patients had TVDs, and 4.5% patients had SVD. In MIDCAB group 23.1% patients and in CCABG group 25.0% patients also had LM artery disease. Mean duration of operation of MIDCAB Group was 245.77 ± 23.0 minutes and in CCABG surgery was 344.79 ± 29.1. Preoperative blood loss in MIDCAB surgery was 68.27±15.68 mL and in CCABG was 123.88 ± 19.99 mL Mean per operative transfusion was given in group A 195.0 ± 36.79mL and in group B 339.17 ± 53.72 mL. Mean total blood loss of MIDCAB group was 370.96 ± 211.33 mL and CCABG group was 804.29 ± 291.52 mL Mean need of transfusion for MIDCAB group as 651.92 ± 228.96 mL and for CCABG group was 1160.0 ± 358.71 (p<0.05). Total 4 (15.4%) patients of group A and 10 patients of group B had developed arrhythmias (p <O.05). In MIDCAB group mean number of planned grafts was 2.38 ± 0.70 and performed graft was 2.27 ± 0.67. In CCABG group mean number of planned grafts was 3.0 ± 0.59 and performed graft was 2.92 ± 0.58 (p>0.05).

0.0% in MIDCAB group and 8.3% in CCABG group had MI attack after surgery. Similar feature was observed in term of stroke in both groups. Three patients of MIDCAB group and 10 patients of CCABG group had developed AF, 3.8% patients of group A and 12.5% of group B had renal failure, 7.7% of MIDCAB group and 20.8% of CCABG group had developed respiratory dysfunction. Two patients of CCABG group and one of MIDCAB group had needed reoperation for bleeding (p>0.05).

Mean ventilation time, ICU stay and postoperative hospital study of both groups were 5.62 ± 0.57 and 11.09 ± 0.93 hours, 2.4 ± 0.20 and 4.0 ± 0.24 day and 7.96 ± 0.40 and 12.26 ± 0.85 day respectively. One patient from each group had expired postoperatively due to complication. Statistically significant differences were observed in term ventilation time, ICU stay and postoperative hospital stay in both groups (p<0.001). No statistically significant differences other than AF were observed in term of post-operative complications of both groups (p>0.5).

Preoperatively 38.5% patients of group A and 45.8% patients of group B were able to walk adequately. At post-operative month three 96.0% patients of group A and 87.0% patients of group B were able to walk adequately. There was significantly improved quality of life after the procedure in both groups (p<0.05).

Table-I

Risk factors for IHD among the study population (N=50).

	Group A (MIDCAB) n=26	Group B (CCABG) n=24	
Current smoker	12 (46.2)	9 (37.5)	0.351^{ns}
Ex-smoker	5 (19.2)	9 (37.5)	
Non-smoker	9 (34.6)	6 (25.0)	
Hypertension	17 (65.4)	13 (54.2)	0.41 9 ^{ns}
Diabetes	12(46.2)	8 (33.3)	0.355 ^{ns}
History of angina	23 (88.5)	17 (70.8)	0.229 ^{ns}
History of MI	9 (34.6)	12 (50.0)	0.27 l^{ns}
History of CVA	2 (7.7)	O(.O)	0.506 ^{ns}

Table-II

Baseline characteristics of the study population (N=50).

	Group A n=26	Group B n=24	p value
Pulse/min	67.15±5.1	66.75±4.64	0.771"[5]
Systolic BP mm of Hg	128.1±8.6	127.1±7.1	0.659 [ns]
Diastolic BP mm of Hg	76.4±5.9	77.9±5.1	0.322 [ns]
Hb level (gm/dL)	12.6±0.86	12.3±0.9	0.226 [ns]
Serum urea (mg/dL)	35.5±5.0	36.5±4.9	0.46 l[ns]
Serum creatinine (mg/dL)	1.0±0.14	1.02±0.2	0.717 [ns]
FBS (mmol/L)	5.7±0.4	5.6±0.4	0.738 [ns]

ns= non significant

Table-III

Echocardiographic findings of the study population (N=50).

	Group A n=26	Group B n=24	p value
PWT (mm)	9.08±0.69	8.83±0.7	0.222 [ns]
LVIDd (mm)	49.15±3.59	50.08±3.43	0.356 [ns]
LVIDs (mm)	31.38±4.96	32.17±3.43	0.523 [ns]
LVEF (%)	53.92±3.40	54.41±7.47	0.762 [ns]
LV dysfunction			
Absent	14 (53.8)	14 (58.3)	0.914 [ns]
Mild	9 (34.6)	8 (33.3)	
Moderate	3(11.5)	2 (8.3)	
Regional wall motion abnormality	8 (30.8)	10(41.7)	0.423 [ns]

Table-IV

Angiographic findings of the study population (N=50).

	Group A n=26	Group B n=24	p value
LM	6(23.1)	6 (25.0)	0.874[ns]
LAD	26 (100.0)	24 (100.0)	Can not be Computed
LCX	16(61.5)	18 (75.0)	0.308 [ns]
RCA	16(61.5)	19 (79.2)	0.174[ns]
LIMA	1 (3.8)	3 (12.5)	0.545 [ns]
Diagnosis			
LM	6(23.1)	6 (25.0)	0.874 [ns]
SVD	4 (15.4)	1 (4.2)	0.236 [ns]
DVDs	14 (53.8)	11(45.8)	
TVDs	8 (30.8)	12 (50.0)	

Table-V

Distribution of per operative findings among the study population (N=50).

	Group A n=26	Group B n=24	p value
Duration of operation (min)	245.77 ± 23.0	344.79 ± 29.1	0.001[s]
Blood loss (mL)	68.27 ± 15.68	123.88 ± 19.99	0.001[s]
Transfusion needed (mL)	195.0±36.79	339.17±53.72	0.001[s]
Arrhythmia developed	4 (15.4)	10(41.7)	0.039[s]

Table-VI

Distribution of postoperative in hospital outcomes among the study population (N=50).

Post-operative outcome	Group A (MIDCAB)	Group B (CCABG)	p value
Ventilation time (hour)	5.62±0.57 (n=26)	11.09±0.93 (n=23)	0.001[s]
ICU stay (day)	2.4±0.20 (n=25)	4.0±0.24 (n= 23)	0.001[s]
Postoperative hospital stays (day)	7.96±0.40 (n-25)	12.26±0.85 (n-23)	0.001[s]
Death	1 (3.8)	1 (4.2)	0.823[ns]

Table-VII

Distribution of postoperative 6MDW test among the study population.

6MWD	Group A		p value (df)
	Preoperative n=26	Post-operative n=25	
Inadequate	16(61.5)	1 (4.0)	0.001[s]
Adequate	10 (38.5)	24 (96.0)	
Total	26 (100.0)	25 (100.0)	
6MWD	Group B		p value (df)
	Preoperative n=24	Post-operative n=23	
Inadequate	13 (54.2)	3 (13.0)	0.003[s]
Adequate	11(45.8)	20 (87.0)	
Total	24 (100.0)	23 (100.0)	

s= significant.

Table-VIII

Distribution of patient by pain measurement with VAS.

	Group-A n=25	Group B n=23	p value
Day 1	7.72±0.458	6.57±0.51	0.001[s]
Day 2	6.36±0.70	5.35±0.71	0.001[s]
Day 3	5.96±0.73	5.09±0.67	0.001[s]
Day 5	3.68±0.74	4.13±0.69	0.041[s]
Day 7	1.40±0.50	2.26±0.81	0.001[s]

Discussion:

This study was carried out in the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh from July 2006 to June 2008. Because NICVD has been performing the central role in the field of cardiac surgery countrywide and it is the best referral hospital for MIDCAB and CCABG surgery. Aim of this prospective, non-randomized, comparative clinical study to define safety and effectiveness of MIDCAB surgery and compare the early outcome of MIDCAB surgery with conventional CABG. Total 50 patients were studied in two groups. Mean age of the patients of MIDCAB group was 54.19 ± 6.94 and CCABG group was 53.87±6.78 years (p>0.05). Mean age was 61.0 ± 10.7 years for MIDCAB and 60.0 ± 8.5 years for CCABG in Gu et al. series that is nearly comparable with our findings.[12]

In our study male were dominant in both groups. In MIDCAB group 92.3% patients were male and in CCABG group 87.5%. These findings suggest that atherosclerotic coronary artery disease is more prevalent in male. Gu et al. reported the same result of 70.9% male in MIDCAB and 61.3% in CCABG .[12]

In Rahman series nearly 50.0% patients of CHD were smoker and in Khan series 55%.[13,14] In our study out of all patients of MIDCAB group 12 (46.2%) were current smoker followed by 9 (34.6%) nonsmoker and 5 (19.2%) ex-smokers. In CCABG group 9 (37.5%) current smoker, similar number ex-smoker and 6 (25.0%) nonsmokers.

Out of all patients of MIDCAB group 23 (88.5%) and in CCABG group 17 (70.8%) had history of angina. Among the patients with angina of MIDCAB group 33.3% had CCS class II and 66.7% had class III. On the other side in /CCABG group 31.6% had class II and 68.4% class III. In MIDCAB group 42.3% patients had history of MI, 65.4% had history of HTN, 7.7% had CVA and 46.2% had history of DM. In CCABG group 50.0% patients had history of MI, 54.2% had history of HTN, and 33.3% had history of DM (p>0.05). Hitoshi et al. reported in a study DM, HTN, MI were 23% & 32%, 66% & 67%, and 34% & 38% in MIDCAB and CCABG group respectively.[15] Zaman reported in comparative off-pump versus on-pump CABG that common risk factor almost uniformly distributed between the two groups.[16]

In echocardiographic findings mean LVIDd, LVIDs, and LVEF of MIDCAB group was 49.15±3.59 mm, 31.38±4.96 mm and 53.92±3.40% and in CCABG group 50.08±3.43mm, 32.17±3.43mm and 54.41±7.47 % respectively. In MIDCAB group 53.8% of patients had no LV dysfunction, 34.6% had mild and 11.5% had moderated dysfunction. In CCABG group 58.3% had no LV dysfunction, 33.3% had mild and 8.3% had moderate dysfunction. 30.8% patients of MIDCAB group and 41.7% patients of CCABG group had regional wall motion abnormality (p>0.05). Khan in his comparative study off-pump versus on-pump CABG shows similar type of finding between two groups.[14]

Pre-operative coronary angiogram revealed that 6 (23.1%) patients of MIDCAB group and 6 (25.0%) of CCABG group had left main vessel involvement. All patients of both groups had LAD involvement, 16 (61.5%) patients of MIDCAB group and 18 (75.0%) of CCABG group had LCX artery, 16 (61.5%) patients of MIDCAB group and 19 (79.2%) patients of CCABG group had RCA involvement. In MIDCAB group maximum patients had DVDs. 53.8% patients had DVDs, 30.8% had TVDs and 15.4% had SVD. In CCABG group 45.8% patients had DVDs, 50.0% patients had TVDs, and 4.5% patients had SVD. In MIDCAB group 23.1% patients and in group B 25.0% patients also had LM artery disease. Maruf in his comparative off-pump versus on-pump study shows in on-pump group 6.7% SVD, 26.7% DVD, 56.7% TVD and 10% were LM disease. Maruf et al. showed in his MIDCAB series 36% SVD, 28% DVD, 22% TVD and 14% LM disease.[17]

Mean duration of operation of MIDCAB surgery of Group was 245.77 ± 23.0 minutes and in CCABG surgery of group was 344.79 ± 29.1. In POEM mean duration of operation for MIDCAB was 168±108 and for CCABG 240 ± 90.0 minute. Our duration of operation time calculated from incision to closure. Due to lack of information we cannot find out the appropriate definition of their total duration of operation.[18]

Per operative blood loss in MIDCAB surgery was 68.27 ± 15.68 mL and in CCABG was 123.88 ± 19.99 mL. Mean per operative transfusion was given in MIDCAB group 195.0 ± 36.79mL and in CCABG group 339.17 ± 53.72 mL. Total 4 (15.4%) patients

of MIDCAB group and 10 patients of CCABG group had developed arrhythmia. Statistical significance differences were observed in between groups in term of duration of operation, amount of per operative blood loss, transfusion needed and arrhythmias ($p<0.05$).

No Conversion needed form MIDCAB to CCABG in our study. Conversion rate was 4.7% in a study reported by Diegelier.[19] One MIDCAB need to conversion in case series of MIDCAB by Maruf.[17]

In MIDCAB group 22 (84.6%) patients had given both artery and venous type of graft, 3 (11.5%) had given only arterial graft and 1 (3.8%) had given venous graft. Maruf et al. in his case series of MIDCAB showed 44.95% grafts were arterial and 55.05% grafts were venous. In CCABG group 21 (87.5%) patients had given both arterial and venous graft and 3 (12.5%) had given only venous graft. Out of all patients of MIDCAB group 50.0% had two, 38.5% had three and 11.5% had one performed graft. Maruf in a case series of MIDCAB showed 42% had two grafts, 34% had three grafts and 22% had only one graft on the other side CCABG group 66.7% had three, 20.8% had 2 and 12.5% had four performed graft. Mean graft per-patient in MIDCAB group was 2.27 ± 0.67 and in CCABG group 2.92 ± 0.48.[17] Bigilio et al.[20] in a retrospective review showed that mean number of grafts was 1.29 ± 0.7 for the MIDCAB group and 2.9 ± 1.1 for the CCABG group, ($p<0.0001$). In our study mean number of grafts per patient in MIDCAB group was higher than that of Connolly's findings.[21]

Out of all patients of MIDCAB group none and in CCABG group 8.3% had MI attack after surgery. Similar feature was observed in term of stroke in both groups. 3 (11.5%) patients of MIDCAB group and 10 (41.7%) patients of CCABG group had developed AF, 3.8% patients of MIDCAB group and 12.5% of CCABG group had renal failure, 7.7% of MIDCAB group and 20.8% of CCABG group had developed respiratory dysfunction. In D'Amato series AF rate was 4.0% for MIDCAB and 28.0% for convention group during early postoperative.[22] In our series two patients of group and one of MIDCAB group had needed reoperation for bleeding. Mean ventilation time, ICU stay and postoperative hospital study of both groups were 5.62 ± 0.57 and 11.09 ± 0.93 hours, 2.4 ± 0.20 and 4.0 ± 0.24 day and 7.96 ± 0.40 and 12.26 ± 0.85 day respectively. Statistically significant differences were observed in term ventilation time, ICU stay and postoperative hospital stay in both groups ($p<O.OO1$).

One patient from each group had expired (3.8 % and 4.2%) in in-hospital postoperative period due to complication. Ott in his study in 1999 showed the mortality rate was 3.4% and 1.9% respectively MIDCAB and CCABG group.[23] In a study Lichtenberg et.al., the death rate was 1.2% and 9.2% respectively MIDCAB and CCABG group. Death rate was more or less similar in our study. No death was observed within first follow-up at month three.[24]

No statistically significant differences other than AF were observed in term of post-operative complications of both groups. 8.0% patients of MIDCAB group and 21.7% of CCABG group had anginal pain and they were in CCS class II. Only one patient of CCABG group had developed AF. After three months only one patient of CCABG group had LV dysfunction. Regional wall motion abnormality (RWMA) was observed in 2 patients of MIDCAB group and in 4 patients of CCABG group.

Preoperatively 38.5% patients of group A and 45.8% patients of group B were able to walk adequately. At post-operative month three 96.0% patients of group A and 87.0% patients of group B were able to walk adequately. Statistically highly significant differences were observed in between preoperative and postoperative 6MWT.

Significant differences were observed in term of pain score measured by VAS at different follows up. At day 1 mean pain score of MIDCAB group and CCABG group was 7.72 ± 0.458 and 6.57 ± 0.51. Significantly high pain score was observed in MIDCAB group than CCABG group. On subsequent follows up pain intensity was decreased more in MIDCAB group than CCABG group.

At final follow up mean pain was less in MIDCAB group than CCABG group. Diegeler et al. stated mean pain score at POD1 was 6.3 vs. 5.0 and at POD7 3.9 vs. 5.2 in both MIDCAB and CCABG group respectively and comparable with us.[19]

There were no deaths in the MIDCABG group and 1 death in the conventional CA. In Antonio et al. series mortality rate for MIDCAB group was 4.3%

and for CCABG group 16.7%.[5] The average ICU stay and average hospital stay were also similar. In POEM series mean ICU stay was 1.2±1.7 for MIDCAB group and 2.1±3.3 day for CCABG group. Mean hospital stay in Gu et al. series was 4.4 ±1.7 hour for MIDCAB and 7.7±2.6 for conventional group. There was greater blood loss ($p<0.001$) for CCABG compared to MIDCAB, more CCABG patients than MIDCAB patients required transfusion in their study.[12]

Conclusions:

No difference in mortality rates detected between MIDCAB and CCABG group. But there was evidence that MIDCAB is associated with less perioperative and early postoperative morbidity and improved quality of life. The MIDCAB surgery is an effective procedure of complete revascularization in ischemic heart diseases like CCABG. The procedure is associated with shorter operating time, shorter ICU stay time, shorter hospital stays and better quality of life than for CCABG.

Conflict of Interest - None.

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