

Sequential Anastomosing Technique in Coronary Artery Bypass Grafting Surgery CABG, Efficacy and Short Term Outcome

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Abstract

Background: (CABG) is performed in patients with ischemic heart disease to improve long-term clinical outcomes, Several modifications have been made, including anastomosing technique, to improve long term patency.

Aim of Study: To evaluate the efficacy and outcome of sequential grafting technique for multiple coronary arteries bypass.

Patients and Methods: It is an interventional non randomized prospective study. Conducted from January 2019 till January 2020 at National Heart Institute, Cairo, Egypt. It included 50 patients who were prepared for on pump CABG for multi-vessel coronary artery disease.

Results: Our study showed less operative time, least aortic manipulations, Troponin 6 hours post operatively 0.95 ± 0.8 (ng/ml), no ECG ischemic changes were noticed.

Conclusion: Sequential technique in coronary artery bypass grafting seems clinically accepted as safe and efficient procedure that can be used routinely in CABG.

Key Words: CABG – Sequential anastomosis – Outcome.

Introduction

CORONARY artery bypass grafting (CABG) is performed in patients with ischemic heart disease to improve long-term clinical outcomes, including prevention of symptom recurrence, frequent admission to hospital, repeat coronary intervention and death [1]. Since its evolution, several modifications to bypass strategies have been suggested to improve long term conduit patency including the choice of conduit, distal target selection and a sequential anastomotic technique [2]. The use of sequential technique in grafting coronary arteries has started in the 80th of the last century to overcome the problem of shortage of venous grafts as well as a way to overcome frequent manipulations

of diseased ascending aorta and to provide a way to increase usage of arterial conduits. Since then, the usage of sequential technique in grafting the internal mammary artery is widely used [3].

By using the sequential technique in grafting coronary arteries one can do two or more distal anastomosis by the same conduit, thus providing only one proximal anastomosis for two or more distal anastomoses which is thought to improve the total flow in the graft by augmentation the distal run off and improving graft patency [4]. Furthermore, sequential technique provide more preservation of conduits and decrease in manipulations of the ascending aorta, as well as a way to provide more anastomoses to small diameter coronary arteries thus improving survival and outcomes [5].

Many surgeons did not adopt the principle of sequential grafting of the coronary arteries easily. They used to highlight the main disadvantage of this technique which is focused on the concept that a large area of myocardium might be subjected to high risk in case of proximal occlusion. Others propose that this technique has the disadvantage of increasing manipulation of the conduit used, concerns about the conduit lay down and the technical difficulty of performing this anastomosis [6]. Many centers adopt this technique for redo cases referred for bypass where there is no available conduits and for patients with atherosclerotic diffusely diseased coronaries, advising more usage of this technique. Updated data regarding the results and outcome of this grafting technique is conflicting [7].

Aim of the work:

The objective of this study is to evaluate the efficacy and outcome of sequential grafting technique for multiple coronary arteries branches by

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assessment of hospital mortality, early clinical outcomes and postoperative complication.

Patients and Methods

It is an interventional non randomized prospective study. Conducted from January 2019 till January 2020 at National Heart Institute, Cairo, Egypt. It included 50 patients who were prepared for on pump CABG for multi-vessel coronary artery disease, planned for left internal thoracic artery and saphenous vein grafting procedure. It included on-pump, isolated multi-vessels coronary artery disease who met the indication for CABG surgery. With exclusion of: Redo surgery, Off-pump patients, Patients with concomitant valve lesion, Low EF >40% and acute evolving myocardial infarction.

Study procedures (Operative techniques):

Internal mammary artery was harvested as skeletonized graft. LIMAs were used as pedicle grafts with harvesting the great saphenous vein. Intermittent blood warm cardioplegia was used in all cases. Left internal mammary artery distal anastomosis in the form of sequential grafting: Side to side anastomosis to proximal artery which may be Perpendicular sequential side-to-side anastomosis or parallel sequential side-to-side anastomosis depending on the surgeon preference and anatomy of the artery to be grafted. End to side anastomosis to distal artery. Statistical Analysis and package: Using PASS program, settles alpha editor at 5% and power at 80. p -value >0.05 is considered non-significant.

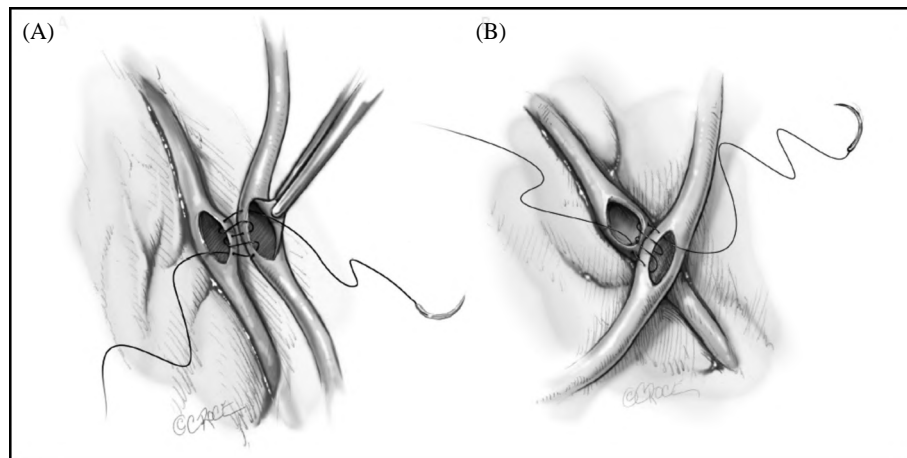


Fig. (1): Sequential grafting. (A) Longitudinal in-parallel side-to-side anastomosis. (B) Oblique and diamond-shaped anastomoses for sequential grafting available [20].

Results

The age distribution ranged from 45 to 63 years, the mean age being 53.9 ± 8.5 years with only two females (4%) of patients.

The mean body mass index was 28.9 ± 0.8 .

25 patients were smoking (50%). 24 patients were diabetics (48%) with glycosylated hemoglobin 6.09 ± 0.7 . 30 patients were suffering from angina class II (60%), while 17 patients in class III (34%) and 3 patients were in class IV (6%). 41 patients were Hypertensive (82%), 34 patients were dyslipidemia (68%). Pre-operative creatinine 0.88 ± 0.2 mg/dl with only 3 patients had had renal impairment (6%).

The mean left ventricular ejection fraction (LVEF) was 59.2%, LVEDD was 5.3 ± 0.6 , LVESD was 3.6 ± 0.6 , LA was 3.8 ± 0.4 , Pre-operative seg-

mental wall motion abnormality (SWMA) was found in 11 patient (22%). Left main lesions were found in 26 patients (52%), LAD lesion in 50 patients (100%), Diagonal lesion in 38 patients (76%), Ramus in 8 patients (16%), CX lesion in 45 patients (90%) OM lesion in 25 patients (50%), RCA lesion in 28 patients (56%), PDA in 13 patients (26%) and PL in 3 patients (6%) with total number of lesions 4.6 ± 1.14 . Total number of lesions were (4.6 ± 1.14) . Operative data showed operative time was 5.1 ± 0.8 hours, bypass time 130.6 ± 21.5 min, cross clamp time 81.6 ± 16.2 , inotropes were needed in 41 patients (82%), number of coronary anastomosis was 2 in 6 patients (12%) where LIMA was anastomosed to both diagonal and LAD arteries. While 3 anastomoses were done in 30 patients (60%) where LIMA to LAD plus venous graft was done, 4 in 14 patients (28%) including LIMA to LAD and Diagonal plus saphenous vein to the other two grafts. As regard leg incision, single leg

incision was 20 cases (40%), both leg incision was zero and 6 cases weren't utilized leg incision. Post operatively duration of ventilation was 11.5 ± 5.3 hours, long post operative ventilation $<24h$ occurred in 3 cases (6%), duration of inotropes 17.2 ± 10.1 hours, need for IABP in 3 cases (6%), long inotropic support <48 hrs. in 7 cases (14%), Troponin 6 hours post operatively 0.95 ± 0.8 (ng/ml), no ECG ischemic changes were noticed, duration of ICU stay 2.3 ± 0.8 days, Long ICU stay $<48h$ was detected in 11 patient (22%), ward stay duration was 5.4 ± 1.4 days, long hospital stay <10 days occurred in 4 patients (8%), High drainage and reopening in 2 patients (4%). 3 patients developed post operative AF (6%), 3 patients developed Atelectasis (6%), 2 patients superficial wound infection (4%), renal impairment (0.7 rise in creatinine level more than pre op status, or post-op creatinine more than 2mg/dl) occurred in 6 patients (12%), no deep wound infection occurred with no in-hospital mortality. Post operative echocardiography showed LVEDV of 5.3 ± 0.6 , LVESD of 3.6 ± 0.5 , LVEF (%) of 59.9 ± 6.8 .

Table (1): Showing demographic data of patients.

Age (years)	Mean \pm SD	53.9 \pm 8.5	
Sex	Male	84	96%
	Female	2	4%
BMI (kg/m ²)	Mean \pm SD	28.9 \pm 0.8	

Table (2): Showing co-morbidities.

Smoker	Num/%	25	50%
DM	Num/%	24	48%
HbA1C (%)	Mean \pm SD	6.09 \pm 0.7	
Angina pain (CANADIAN CLASS)	II	30	60%
	III	17	34%
	IV	3	6%
HTN	Num/%	41	82%
Dyslipidemia	Num/%	34	68%
Pre-op Creat (mg/dl)	Mean \pm SD	0.88 \pm 0.2	
Pre-op renal impairment	Num/%	3	6%

Table (3): Showing operative data.

Op. Time (hours)	Mean \pm SD	5.1 \pm 0.8	
Bypass Time (min)	Mean \pm SD	130.6 \pm 21.5	
Cross Clamp Time (min)	Mean \pm SD	81.6 \pm 16.2	
Need of Inotropes	Yes	41	82%
No. of coronary anastomosis	2	6	12%
	3	30	60%
	4	14	28%
	3	42	84%
	4	7	14%
	Yes	20	40%
Leg incision	1	20	40%
	2	0	0

Discussion

In our study, we observed that coronary arteries revascularization by using sequential technique has good results regarding in-hospital and early clinical outcomes and Sequential LIMA grafting was not found to be an independent predictor for post-operative MI. However, some cardiac surgeons did not adopt this technique as a routine use in coronary artery bypass grafting. They have some concerns regarding the relative technical difficulty, prolonged duration of time which may have worse results regarding outcome [8]. Therefore, we performed this study to determine the early outcomes observed following sequential grafting to assess the outcome and efficacy of CABG sequential grafting as a routine procedure. The main observation of this study was that the higher mammary utilization, smaller leg incision with no leg incision at all in some patients, less bypass time, more coronary arteries to be revascularized and less manipulations of the ascending aorta. Because of maximum mammary utilization in sequential technique, increasing the number of coronary targets to be revascularized using internal thoracic arteries so total and left system arterial revascularization is more achieved, therefore better long-term outcomes.

Cardiac surgeons refusing or opposing this technique were focusing on the main disadvantage of having more maneuvers and handlings needed to lay down the conduit, more technically demanding anastomosis technique, dependence of many grafts on one single inflow which may subject a large area of the myocardium to a fatal risk in case of occlusion. They also addressed the problem of using the internal thoracic artery for more than one anastomosis which forces the usage of the distal part of internal thoracic artery which have a relatively small diameter and is more muscular than its proximal part which in turn threatens the graft patency [7]. On the other hand another study involving 240 patients who underwent coronary artery bypass grafting comparing one group where left internal thoracic artery was anastomosed to Diagonal artery then sequentially anastomosed to left anterior descending artery, to another group of patients where left internal thoracic artery was anastomosed separately to left anterior descending artery. They found that clinical outcome and graft patency were the same with no statistically significant difference and sequentially grafting the left internal thoracic artery was not accompanied by worse results. They obtained a follow up period for almost 3 years with patency rate 99% for diag-

onals and 98.2 % for left anterior descending artery [9].

Failure of sequential anastomoses of the internal mammary artery may be due to discrepancy in diameter, poor targets, improper lay out or competitive flow. Others found that this competitive graft failure is reversible and may improve with worsening the degree of stenosis in the native vessels [10]. Kieser and associates reported sequential grafting for both right and left mammary arteries in 231 patients with patency rate was 95% at 6 months [11]. Palatino and colleagues, confirmed the efficacy of this technique. Over 145 patients, the operative mortality was 2.8% and an extremely low percentage of perioperative myocardial infarction was observed (0.7%) [3]. A follow-up report by Dion and associates, showed that these very good results were found at 10 years follow-up. They found excellent patency rate of sequential anastomoses directed to the left anterior descending, the circumflex, and the right coronary artery of 96%, 92%, and 82 % respectively, with need for redo intervention of only 3.1% [12]. Sequential internal thoracic artery anastomoses showed excellent patency rates to all coronary arteries except the very distal circumflex artery and the distal branches of right coronary artery. Therefore, for this area, it is recommended nowadays to use either gastro-epiploic artery or the right internal thoracic artery in a 'T' connection with the pedicled LIMA [13]. Previous studies such as Raja, Jones and their colleagues declared that single source blood supply in Composite arterial grafting may be complicated with hypoperfusion syndrome in the form of steal phenomenon, competitive flow, and Vasospasm of arterial grafts which may lead to catastrophic consequences with high mortality due to hypoperfusion of the entire left coronary arteries leading to perioperative ischemia, infarction, low cardiac output states [14-17]. In another study including 304 patients comparing usage of bilateral internal mammary arteries in situ to another group of using the internal mammary artery as a Y graft, they found no difference patency rate with a greater number of arteries grafted using the Y grafting technique with low incidence of adverse cerebral and cardiac events. (MACCE) [18]. In our study, we performed sequential graft however we did not observe perioperative infarction or hypoperfusion syndrome as Post op troponin level was within normal level (0.95) and there is no ECG ischemic change (new pathological Q or ST segment elevation) was remarked, however low cardiac output states had been recorded in the study as prolonged inotropic support occurred in 7 cases (14%). The composite anastomosis have multiple advantages

as it decreases manipulations of aorta, decreases incidence of stroke, provides the long length of right internal thoracic artery for anastomosing more vessels, and decreasing the need for another conduit other than the two internal thoracic arteries [19-21].

Conclusion:

Sequential technique in coronary artery bypass grafting seems clinically accepted as safe and efficient procedure that can be used routinely in CABG especially for young non or controlled diabetic patients as regard short-term outcomes and hospital mortality. Sequential technique has good outcome as regard hospital mortality, short-term outcomes and post-operative complications (wound infection, pulmonary problems, atrial fibrillation, myocardial infarction, bleeding and low cardiac output). With the evolution and increase use of minimally invasive direct coronary artery bypass grafting (MIDCAB), sequential grafting technique will have more space of usage due to decrease manipulations of the aorta.

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الطريقة التسلسلية فى عمليات ترقيع الشرايين التاجية للقلب. فاعليتها ونتائجها الأولية

مع ازدياد حالات قصور الشرايين التاجية للقلب ظهرت الحاجة إلى طرق مختلفة لترقيع الشرايين التاجية. دراستنا هذه تهدف إلى دراسة النتائج الأولية وفاعلية طريقة ترقيع الشرايين التاجية للقلب بواسطة الطريقة التسلسلية. أجريت هذه الدراسة على خمسون مريضاً أُجريت لهم عملية ترقيع الشرايين التاجية للقلب فى معهد القلب القومى. أظهرت الدراسة أن هذه الطريقة آمنة للمرضى حيث لم يحدث لآى منهم جلطات قلبية مصاحبة للعملية ولم يحدث وفيات بالعمليات ولم ترتفع انزيمات القلب.