

# Coronary Artery Bypass Graft for Left Main Coronary Artery Disease

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## Abstract

Because left main coronary artery disease carries a high risk of morbidity and mortality, this retrospective study will review the data and results of surgical management of left main coronary artery disease, in King Abdulaziz University Hospital. 448 patients underwent coronary bypass graft into two groups, left main group (50) patients and non-left main group (398) patients. Preoperative data, risk factors and cardiac catheterization findings were compared in between the two groups in addition to perioperative morbidity and mortality. Patients in the left main group were younger in age with significantly lower ejection fraction and more risk factors (hypertension, dyslipidemia, and smoking). In our study the left main group patients had higher mortality than non-left main patients [4 patients = 8%, 6 patients = 1.8%]; the most common cause of perioperative mortality in the left main group was low cardiac output state, and the most common complications were perioperative myocardial infarction and prolonged ventilation. The higher mortality and morbidity associated with surgery for left main coronary artery disease can be explained by the higher risk profile, the need of urgent surgery and critical preoperative status.

## Keywords

Left main coronary artery disease; Coronary artery bypass grafts

## Introduction

Significant left main coronary artery (LMCA) disease, defined as greater than 50% narrowing, occurs in 5–7% of patients undergoing coronary angiography<sup>[1]</sup>. Patients treated medically for LMCA disease have a 3-year survival rate of less than 50%<sup>[2]</sup>. Several studies have shown a significant benefit following the treatment of left main (LM) stenosis with coronary bypass grafting (CABG) compared with medical treatment<sup>[3]</sup>. Coronary bypass grafting has been the gold standard therapy for LM disease for many years. However, advances in percutaneous intervention techniques and stent technology have allowed evaluation of the role of

percutaneous coronary intervention (PCI) for protected LM disease. Surgery is preferred in patients with heavily calcified LM disease, reduced left ventricular function LV function, diabetic patients particularly with insulin-dependent diabetes, multi-vessel disease MVD suitable for CABG, and distal LM bifurcation lesion with reduced LV function or with occluded right coronary artery RCA or with additional complex lesions on the other coronary vessels<sup>[4]</sup>.

## Patients and Methods

448 patients underwent coronary artery bypass grafting at King Abdulaziz University Hospital, Jeddah,

Saudi Arabia, between January 2009 and July 2014. Patients were divided into two groups: left main group included 50 patients; non-left main group included 398 patients. All patients were informed about the procedure, the possible complications, and signed the informed consent. Preoperative data, operative, and postoperative data were collected. Follow up after operation by clinical and echocardiography evaluation was done at outpatient bases. All data retrospectively reviewed through patient's files and phoenix information system, chi-square ( $\chi^2$ ) test and *t*-test used to calculate p value, p value considered significant if below 0.05.

### Results

The total number of patients was 448: 50 patients had LMCAD (Group 1), 398 patients had no LMCAD (Group 2). The demographic data and preoperative risk factors of all patients in group 1 and group 2 were analyzed and compared between the two groups: mean age (56.4 years  $\pm$  8.8 and 57.8 years  $\pm$  9.8,  $P = 0.34$ ); gender distribution (42 males = 84% and 322 males = 80.9%,  $P = 0.59$ ); percentage of patients with *diabetes mellitus* (37 patients = 74% and 254 patients = 63.8%,  $P = 0.15$ ); percentage of patients with hypertension (35 patients = 70% and 183 patients = 45.9%,  $P = 0.001$ ); percentage of patients with dyslipidemia (25 patients = 50% and 103 patients = 25.8%,  $P < 0.001$ ); percentage of patients with renal impairment (4 patients = 8% and 40 patients = 10.1%,  $P = 0.64$ ); percentage of smoking among the patients (23 patients = 46% and 103 patients = 25.8%,  $P = 0.002$ ); percentage of obesity (BMI > 30) among the patients (6 = 12% and 55 = 13.8%,  $P = 0.72$ ); percentage of patients with history of cerebrovascular accidents (CVA) (4 patients = 8% and 16 patients = 4%,  $P = 0.19$ ) (Table 1).

The main preoperative clinical presentation of patients in group 1 and group 2 was as follows: unstable angina (9 patients = 18% and 17 patients = 34%); non ST elevation myocardial infarction (15 patients = 30% and 28 patients = 56%); ST elevated myocardial infarction (26 patients = 52% and 6 patients = 12%),  $P < 0.001$  for all (Table 2).

The preoperative cardiac catheterization and ejection fraction results in the two groups were: single vessel disease (0 patients = 0% and 23 patients = 5.8%); double vessel disease (9 patients = 18% and 41 patients = 10.3%); 3 vessel disease (41 patients = 82% and 334 patients = 83.9%),  $P = 0.07$  for all cardiac catheterization data; ejection fraction (49.9  $\pm$  8.4 SD and 57.1  $\pm$  9.7 SD,  $P < 0.001$ ), (Table 3).

Comparing the main operative data between the 2 groups: the number of grafts performed (3.27  $\pm$  0.76 SD and 3.46  $\pm$  0.95 SD  $P = 0.96$ ); cardiopulmonary bypass (CPB) time (124.3  $\pm$  49.73 min. and 95  $\pm$  31.3 min.,  $P = 0.001$ ); aortic cross clamp (AXC) time (67.7  $\pm$  26.4 min. and 54.1  $\pm$  17.1 min.,  $P < 0.001$ ), (Table 4).

In the postoperative period group 1 patients required a higher use of inotrops and a need for intra-aortic balloon pump (IABP) counter pulsation (7 patients = 14% vs. 2 patients = 0.5%,  $P < 0.001$ ), group 1 required prolonged mechanical ventilation time (12.3 h  $\pm$  8.36 vs. 7.2 h  $\pm$  3.89,  $P = 0.001$ ), longer intensive care unit stay (95.7 h  $\pm$  30.3 vs. 45.6 h  $\pm$  17.1,  $P = 0.01$ ), higher chest tube drainage (1214 ml  $\pm$  307 vs. 962 ml  $\pm$  230,  $P = 0.01$ ), and longer hospital stay (11.3 days  $\pm$  4.3 vs. 8.6 days  $\pm$  3.2,  $P = 0.01$ ), (Table 5).

Group 1 had higher perioperative mortality rates (4 patients = 8% vs. 7 patients = 1.8%,  $P = 0.003$ ), and higher complication rate: myocardial infarction (8 patients = 16% vs. 17 patients = 4.2%,  $P = 0.001$ );

**Table 1.** Patient characteristics and demographic data for both groups.

	Left Main n= 50	Non Left Main n= 398	P value
Age mean $\pm$ SD	56.4 $\pm$ 8.8	57.8 $\pm$ 9.8	0.34
Gender:			
Male (%)	42 (84.00%)	322 (80.90%)	0.59
Female (%)	8 (16.00%)	76 (19.10%)	
<i>Diabetes mellitus</i> (%)	37 (74.00%)	254 (63.80%)	0.15
Hypertension (%)	35 (70.00%)	183 (45.90%)	0.001
Dyslipidemia (%)	25 (50.00%)	103 (25.80%)	< 0.001
Obesity (%)	6 (12.00%)	55 (13.80%)	0.72
Smoking (%)	23 (46.00%)	103 (25.80%)	0.002
Renal impairment (%)	4 (8.00%)	40 (10.10%)	0.64
CVA (%)	4 (8.00%)	16 (4.00%)	0.19

$\pm$  SD = Standard deviation; CVA = Cerebrovascular accident

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**Table 2.** Pre-operative clinical presentation for both groups.

	Left Main N (%)	Non Left Main N (%)		P value
Unstable Angina	9 (18.00%)	17 (34.00%)	135 (33.90%)	< 0.001
Non ST Myocardial Infarction	15 (30.00%)	28 (56.00%)	217 (54.50%)	
ST Myocardial Infarction	26 (52.00%)	6 (12.00%)	46 (11.60%)	

**Table 3.** Angiographic and echocardiographic criteria.

	Left Main N = 50	Non Left Main N = 398		P value
SVD n (%)	0 (0.00%)	23 (5.80%)		0.07
DVD n (%)	9 (18.00%)	41 (10.30%)		
TVD n (%)	41 (82.00%)	334 (83.90%)		
EF % (mean ± SD)	49.9 ± 8.4	57.1 ± 9.7		< 0.001

SVD = Single vessel disease; DVD = Double vessel disease; TVD = Triple vessels disease; EF = ejection fraction

**Table 4.** Operative data.

	Left Main Mean ± SD	Non Left Main Mean ± SD		P value
Numbers of Graft	3.27 ± 0.76	3.46 ± 0.95		P = 0.96
CPB time/min	124.3 ± 49.73	95 ± 31.3		P = 0.001
AXC time/min	67.7 ± 26.4	54.1 ± 17.1		P < 0.001

CPB = Cardiopulmonary bypass; AXC = Aortic cross-clamp

**Table 5.** Post-operative data.

	Left Main N = 50	Non Left Main N = 398		P value
On IABP (%)	7 (14.00%)	2 (0.50%)		< 0.001
Ventil. time h (mean ± SD)	12.3 ± 8.36	7.2 ± 3.89		0.001
ICU stays h (mean ± SD)	95.7 ± 30.3	45.6 ± 17.1		0.01
Drainage ml (mean ± SD)	1214 ± 307	962 ± 230		0.01
Hospital stay days (mean ± SD)	11.3 ± 4.3	8.6 ± 3.2		0.01

IABP = Intra-aortic balloon pump; ICU = Intensive care unit

**Table 6.** Post-operative complications.

	Left Main = 50 N (%)	Non Left Main = 398 N (%)		P value
Mortality	4 (8.00%)	7 (1.80%)		0.003
Myocardial infarction	8 (16.00%)	17 (4.20%)		< 0.001
Prolonged ventilation	7 (16.00%)	16 (4.00%)		0.002
Exploration for bleeding	3 (6.00%)	8 (2.00%)		0.08
DSWI	6 (12.00%)	9 (2.20%)		< 0.001
CVA	3 (6.00%)	7 (1.70%)		0.06
Renal impairment	7 (14.00%)	40 (10.10%)		0.39

DSWI = Deep sternal wound infection; SWI = Superficial wound infection; CVA = Cerebrovascular accident

prolonged ventilation (7 patients = 16% vs. 16 patients = 4%, P = 0.002); re-exploration for bleeding (3 patients = 6% vs. 8 patients = 2%, P = 0.08); sternal wound infection (6 patients = 12% vs. 9 patients = 2.2%, P < 0.001); postoperative cerebrovascular accident (3

patients = 6% vs. 7 patients = 1.7%, P = 0.06); transient postoperative renal impairment (7 patients = 14% vs. 40 patients = 10.1%, P = 0.39); no permanent renal failure requiring hemodialysis among all patients, (Table 6).

## Discussion

In our study, we found that patients in left main group were younger and had significantly more patients with hypertension, dyslipidemia, and smoking. We also observed large numbers of left main patients presented by ST elevated myocardial infarction. Similar results were reported by Anders *et al.*<sup>[5]</sup>: younger age, higher diabetes, hypertension, and renal impairment in the left main group.

Most of the patients in left main group had triple vessel disease, with impairment of left ventricular function, other studies have demonstrated similar results<sup>[5,6]</sup>. We observed significantly longer CPB time and AXC time in the left main group. The increase in postoperative need to use IABP was significant, with significantly longer ventilation time, ICU stays, and hospital stay.

Mortality rate of CABG in patients with left main disease varies according to different reports from 2.8%-6% which is significantly higher than mortality in patients with no left main stenosis 1.7%-2%<sup>[7]</sup>. The great difference in mortality rate depends on many factors. In our study we observed 8% mortality in left main group versus 1.8% mortality in non-left main group; this higher mortality rate is explained by the fact that most of our patients had a higher risk profile and that most of their surgeries were done on an urgent and emergency basis. Low cardiac output state was the most common cause of deaths, the most common complications after urgent CABG in our study are perioperative myocardial infarction, prolonged ventilation, and superficial and/or deep wound infection.

## Conclusion

Coronary artery bypass graft in left main coronary artery disease is associated with significantly higher mortality and morbidity than non-left main patients. This is mainly because of the higher risk profile and critical preoperative clinical status. Urgent or emergency surgery, long CPB time, and low preoperative ejection fraction add to the risk of morbidity and mortality. Despite the higher surgical mortality rate (8%) after surgery for left main, a favorable early clinical outcome is observed, and an acceptable mid and long term outcome can be expected if the patients survive. High-quality clinical evidence is still needed to evaluate the result of left main coronary artery disease, and to define the optimal perioperative and operative management of these patients; clarified risk profiles are also needed.

## Conflict of Interest

The author have no conflict of interest.

## Disclosure

The author did not received any type of commercial support either in forms of compensation or financial for this study. The author have no financial interest in any of the products or devices, or drugs mentioned in this article.

## Ethical Approval

Obtained.

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## عمليات توصيل الشرايين التاجية للقلب في حالات تضيق الجذع الشرياني الأيسر

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**المستخلص.** إن تضيق الجذع الأيسر للشرايين التاجية مصحوب بخطورة عالية وإرتفاع في نسبة الوفيات والإعتلال، تراجع هذه الدراسة بيانات المرضى و نتائج التدخل الجراحي لهؤلاء المرضى في جامعة الملك عبد العزيز بجدة. تشمل هذه الدراسة ٤٤٨ مريض من الذين تم لهم اجراء جراحة توصيل الشرايين التاجية في الفترة بين يناير ٢٠٠٩ و يوليو ٢٠١٤، تم تقسيم المرضى المجموعتين، شملت المجموعة الاولى ٥٠ مريضا يعانون من تضيق جزع الشريان الايسر وشملت مجموعة الثانية ٣٩٨ مريضا من الذين لا يعانون من تضيق جزع الشريان الايسر. المرضى في المجموعة الأولى كانوا هم الأصغر سنا، والأكثر ارتفاعا في ضغط الدم، وفي زيادة نسبة الدهون بالدم، وكان اغلبهم من المدخنين. كما لوحظ في المجموعة الأولى زيادة الإصابة بتضيق في الشرايين التاجية الرئيسية الثلاثة، مع انخفاض كبير في وظائف القلب. لاحظنا ارتفاع نسبة الوفيات بعد لاحظنا ارتفاع نسبة الوفيات بعد الجراحة (٨٪) في المجموعة الاولى بالمقارنة مع المجموعة الثانية (١, ٨٪)، وكان ضعف نسبة ضخ الدم القلبي و السبب الأكثر شيوعا للوفاة. و أن المضاعفات الأكثر شيوعا بعد الجراحة في المجموعة الأولى هي احتشاء عضلة القلب والحاجة للتنفس الصناعي لفترات طويلة. التدخل الجراحي لعلاج المرضى المصابين بتضيق الجذع الأيسر للشرايين التاجية مصحوب بخطورة عالية وإرتفاع في نسبة الوفيات والإعتلال وذلك بسبب ارتفاع نسبة عوامل الخطورة لديهم و الحاجة للتدخل الجراحي العاجل إضافة إلى حالتهم الصحية الحرجة قبل العملية.