Original Article

Can Patients with Left Main Stenosis Safely Wait for Elective Coronary Artery Bypass Grafting?

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Abstract

Background: The purpose of this study was to evaluate the clinical outcomes of patients with left main coronary artery stenosis (LMCA Stenosis) who were placed on a waiting list in a government hospital for coronary artery bypass grafting (CABG). **Material and Methods:** Between 2013 and 2014, information on 50 patients undergoing isolated coronary artery bypass grafting was gathered both proactively and retrospectively. Fifty patients had either no left main disease or less than 50% left main stenosis (non-LMS group), whereas fifty patients had critical left main stenosis (LMS), which is defined as ≥50% stenosis. **Results:** Patients with LMS had shorter average times between angiography and surgery. In the LMS group, two patients died during perioperative period. Following non-Q-wave myocardial infarctions, four individuals underwent surgery without experiencing any difficulties. The presence of LMS did not significantly influence operative mortality, incidence of low cardiac output syndrome, or perioperative myocardial infarction. In order to assess how waiting time affected results, LMS patients were separated into: * Early revascularization group: Surgery within 10 days of angiography. * Late revascularization group: Surgery more than 10 days after angiography. The incidence of myocardial infarction, low cardiac output syndrome, and operative mortality were comparable in the two groups. Individuals who underwent early surgery were more likely to: * New York Heart Association (NYHA) Class IV symptoms. * Unstable angina. *Recent preoperative myocardial infarction. **Conclusion:** Patients with substantial left main stenosis who are carefully chosen can wait for elective coronary artery bypass grafting without a significant increase in perioperative morbidity or mortality. Early surgical intervention should be prioritized for patients with severe symptoms, unstable angina, or a recent preoperative myocardial infarction.

Keywords: Left main Coronary Artery Disease; Coronary artery Bypass Grafting; Waiting Time; Surgical Outcomes; Coronary Revascularisation.

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Introduction

Objective

This study set out to investigate the impact of left main stenosis on surgical morbidity and death. More precisely, we looked at the connection between postoperative clinical outcomes and waiting time (the period between a diagnostic cardiac catheterization and an operation). Furthermore, we looked for the factors that distinguished between early and late surgical intervention.

Materials and Methods

Patient Population: One hundred patients undergoing isolated primary coronary artery bypass grafting (CABG) at SJIC&R in Bangalore between January 2013 and December 2014 had preoperative, perioperative, and postoperative data collected retrospectively.

Among these patients:

*50 patients had significant left main coronary artery disease, defined as ≥50% stenosis (LMS group).

*50 patients, including those with triple-vessel disease, double-vessel disease, or single-vessel disease (non-LMS group), either had no left main disease or left main stenosis of less than fifty percent.

The analysis did not include patients who had any related cardiac treatment, such as ascending aortic repair or valve replacement.

Data Collection: For every patient, comprehensive clinical, angiographic, surgical, and demographic data were gathered. These factors comprised:

* Age and sex
* Cardiovascular risk factors
* Clinical presentation
* Angiographic findings

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* Time interval between coronary angiography and surgery
* Operative details
* Postoperative outcomes and complications

The collected data were analyzed to determine the effect of significant left main coronary artery disease and surgical waiting time on perioperative morbidity and mortality outcomes.
including age, sex, peripheral vascular disease, diabetes, hypertension, stroke, creatinine, CK-MB, left ventricular ejection fraction, pre-operative IABP, and post-operative IABP. The time interval between cardiac catheterisation and CABG, as well as the incidence of cardiovascular events during that period, were given special attention.
New ischaemic alterations on a surface 12-lead ECG accompanied by a serial increase in cardiac enzymes were considered preoperative myocardial infarction. A fresh Q wave on the postoperative ECG was considered a postoperative myocardial infarction. Additionally, if the postoperative ECG showed a new left bundle branch block, loss of R wave progression, or new ST and T wave changes along with an increase in creatine kinase-MB level greater than 50 U/L and a ratio of creatine kinase-MB to creatine kinase greater than 5%, a myocardial infarction was diagnosed.
After all electrolyte and blood gas abnormalities were corrected and the preload was adjusted to the ideal level, low output syndrome was diagnosed if the patient needed inotropic medication to maintain a systolic blood pressure greater than 90 mm Hg in the critical care unit.
All causes of death that occur within 30 days following surgery or during the same hospital stay are referred to as operative mortality.
Statistical Analysis: SAS (SAS Institute, Cary, NC) software, specifically the SPSS version 15.0 (IBM Corp, Armonk, NY,USA) was used for statistical analysis.
The Chi-square (χ^2) test or Fisher's exact test were used to analyse the categorical data, which were then reported as percentages and absolute frequencies for each variable.
Two-tailed t tests were used to analyse continuous data, which were then reported as mean ± standard deviation.
Logistic regression analysis was also used.

Results

Patient Population
[Table 1] displays the preoperative features of the 100 patients.
Patients in the LMS group had a slightly greater incidence of stroke (8% in LMS versus 6% in no LMS) and a higher likelihood of peripheral vascular disease (22% in LMS versus 18% in no LMS; P = 0.617).
The LMS group experienced a shorter waiting period (14 ± 8 days compared to 40 ± 19 days in the no LMS group) between diagnostic cardiac catheterisation and operation.
The LMS group saw a median waiting time of 14 days (range: 0–42 days), while the no LMS group experienced a median waiting time of 40 days (range: 0–108 days).
There were no significant differences between the groups with respect to other clinical characteristics.
LMS = Left Main Stenosis
No LMS = No significant Left Main Stenosis
PVD = Peripheral Vascular Disease

Table 1: Preoperative Characteristics of Patients With and Without Left Main Stenosis

Characteristic	No LMS (n = 50)	LMS (n = 50)	p Value
Mean age (years)	54 ± 8	54 ± 9	0.991
Female sex	16%	14%	0.779
Diabetes	40%	32%	0.405
Hypertension	48%	46%	0.841
Peripheral Vascular Disease (PVD)	18%	22%	0.617
Stroke	8%	6%	0.695
Recent Myocardial Infarction (MI)	8%	8%	0.643
Mean wait time (days)	40 ± 19	14 ± 8	0.0001*

[Table 2] illustrates the preoperative differences between patients with LMS (early) versus patients without LMS (late).
The early group's mean waiting time was 14.18 ± 8.431 days, while the later group's mean waiting time was 40.10 ± 19.726 days (p < 0.0001).
The New York Heart Association (NYHA) Functional Class IV was more common among patients in the early group (32% versus 18%; p = 0.326).
Additionally, a left main stenosis of 75% or more was more common in patients in the early group (p < 0.0001).
Abbreviations
* LMS = Left Main Stenosis
* MI = Myocardial Infarction
* PVD = Peripheral Vascular Disease
*NYHA = New York Heart Association Functional Classification

Table 2: NYHA Functional Class Distribution

Characteristic	No LMS (n = 50)	LMS (n = 50)	p Value
NYHA Class			0.326
Class I	6%	4%	
Class II	40%	28%	
Class III	36%	36%	
Class IV	18%	32%	

Postoperative Outcomes

Left Main Stenosis's Impact

[Table 3] shows the preoperative information and postoperative results for the LMS and no-LMS groups.
Compared to patients in the no-LMS group, those in the LMS group had a higher likelihood of receiving numerous (three or more) bypass grafts (80% versus 78%; p = 0.488).

Table 3: Number of Coronary Artery Bypass Grafts Performed:

Characteristic	No LMS (n = 50)	LMS (n = 50)	p Value
Number of Bypass Grafts			0.488
2 grafts	20%	20%	
3 grafts	62%	54%	
4 grafts	16%	26%	
5 grafts	2%	0%	

Although patients with substantial left main stenosis were more likely to exhibit advanced symptoms, the distribution of NYHA functional classes was similar across the groups. Compared to 18% of patients without LMS, 32% of patients with LMS had NYHA Class IV symptoms (p = 0.326).
Regarding surgical revascularization, patients with LMS tended to receive a greater number of bypass grafts. Three or more grafts were performed in 80% of patients in the LMS group compared with 78% in the non-LMS group (p = 0.488). Three grafts were the most commonly performed procedure in both groups (54% in LMS and 62% in non-LMS patients). Four grafts were required more frequently in the LMS group (26% versus 16%), while five grafts were performed only in 2% of patients without LMS.

Table 4: Perioperative Data and Postoperative Outcomes

Characteristic	No LMS (n = 50)	LMS (n = 50)	p Value
ICU Stay (days)	2.8 ± 1.0	3.3 ± 1.7	0.113
IABP Use			0.727
Preoperative	4%	6%	
Postoperative	10%	8%	
Low Output Syndrome	28%	24%	0.648
Operative Mortality	4%	4%	1.000

The preoperative information and postoperative results for the early and late groups are displayed in [Table 4]. A preoperative intra-aortic balloon pump was more frequently administered to patients in the early group (6.0% versus 4%). Furthermore, the ICU stay was greater for patients in the LMS group (3.32 ± 1.766 days versus 2.86 ± 1.010 days; p = 0.113).
The LMS and no-LMS groups had comparable rates of myocardial infarction, operational death, and postoperative low output syndrome.

Table 5: Biochemical Analysis of Patients with and Without Left Main Stenosis

Characteristic	No LMS (n = 50)	LMS (n = 50)	p Value
Creatinine (mg/dL)	1.022	1.004	0.707
CPK (U/L)	113.5 ± 89.7	219.0 ± 327.0	0.032*
CK-MB (U/L)	20.56 ± 8.6	28.94 ± 34.5	0.102

The biochemical analysis of the two groups with respect to creatinine and cardiac enzymes has been illustrated in Table 5 above.
Patients in the LMS group had demographic characteristics with those in the no-LMS group. The LMS group had a significantly greater incidence of preoperative neurological problems due to a little higher percentage of patients with peripheral vascular disease. The existence of cerebrovascular disease and the more aggressive or advanced stage of atherosclerosis disease are likely the reasons for this finding. Prior research has shown that individuals with left main stenosis are more likely to suffer carotid artery disease.[16]
It's interesting to note that neither the incidence of preoperative myocardial infarction nor the patients' symptomatic status prior to surgery were significantly different in the LMS group. However, compared to patients in the no-LMS group, individuals with left main disease had much shorter waiting times (14 ± 8 days versus 40 ± 19 days; p < 0.0001).

Table 6: Perioperative Myocardial Infarction (MI)

Variable	LMS (n = 50)	No LMS (n = 50)	p Value
Perioperative MI	4 (8%)	5 (10%)	0.809
Total Patients	50	50	—

Definition of Groups: Early Group: Surgery performed on or before the 10th day after coronary angiography (CAG) Late Group: Surgery performed after the 10th day following coronary angiography (CAG)

Table 7: Comparison of Early and Late Surgery Groups

Variable	Early (N = 22)	Late (N = 28)	p Value
Age (years)	55.54 ± 9.06	53.89 ± 9.15	0.53

ICU Stay (days)	3.23 ± 1.54	3.39 ± 1.95	0.75
Creatinine	1.04 ± 0.19	0.98 ± 0.20	0.24
CPK (U/L)	251.00 ± 371.40	193.86 ± 292.80	0.55
CK-MB (U/L)	32.86 ± 50.56	25.86 ± 12.71	0.53
EF (Preoperative) (%)	51.09 ± 8.25	50.36 ± 7.82	0.75
EF (Postoperative) (%)	52.36 ± 7.43	51.89 ± 7.28	0.82

There was no statistically significant difference between the early and late surgery groups with respect to age, ICU stay, renal function (creatinine), cardiac enzyme levels (CPK and CK-MB), or left ventricular ejection fraction (both preoperative and postoperative).

Similarly, the incidence of perioperative myocardial infarction was comparable between patients with LMS and those without LMS (4 vs. 5 patients; p = 0.809).

Table 8: Comparison of Early and Late Surgery Groups

Characteristic	Early (N = 22)	Late (N = 28)	p Value
Gender			0.38
Male	20 (91.0%)	23 (82.1%)	
Female	2 (9.0%)	5 (17.9%)	
NYHA Class			0.998
Class I	1 (4.5%)	1 (3.6%)	
Class II	6 (27.3%)	8 (28.6%)	
Class III	8 (36.4%)	10 (35.7%)	
Class IV	7 (31.8%)	9 (32.1%)	
Hypertension (HTN)	9 (40.9%)	14 (50.0%)	0.918
Peripheral Vascular Disease (PVD)	5 (22.7%)	6 (21.4%)	0.639
Stroke	1 (4.5%)	2 (7.1%)	0.386
Number of Grafts			0.282
2 Grafts	3 (13.6%)	7 (25.0%)	
3 Grafts	11 (50.0%)	16 (57.1%)	
4 Grafts	8 (36.4%)	5 (17.9%)	
Myocardial Infarction (MI)	2 (9.1%)	2 (7.1%)	0.308
Low Cardiac Output Syndrome (LCOS)	6 (27.3%)	6 (21.4%)	0.548
Preoperative IABP	1 (4.5%)	2 (7.1%)	0.386
Postoperative IABP	1 (4.5%)	3 (10.7%)	0.616
Mortality	1 (4.5%)	1 (3.6%)	0.862

There was no statistically significant difference between the early and late surgery groups with respect to demographic characteristics, NYHA functional class, hypertension, peripheral vascular disease, stroke, number of bypass grafts performed, myocardial infarction, low cardiac output syndrome, requirement for intra-aortic balloon pump support, or mortality.

Overall, the outcomes of patients undergoing early surgery (on or before 10 days after coronary angiography) were comparable to those undergoing surgery after 10 days, with no significant difference in perioperative morbidity or mortality.

Left Main Stenosis's effects: In terms of their demographic features, patients in the LMS group were comparable to those in the no-LMS group. Peripheral vascular disease patients made up a much larger percentage of the LMS group.

It's interesting to note that neither the incidence of preoperative myocardial infarction nor the patients' symptomatic status before to surgery differed significantly in the LMS group.

However, waiting times for patients with left main disease were considerably shorter (14 ± 9 days versus 40 ± 8 days; p < 0.0001) than those of patients in the no-LMS group.

Aortic cross-clamp and cardiopulmonary bypass times increased when left main disease was present because more bypass grafts were created.

The variation in hospital stays did not reach statistical significance. There was no higher incidence of postoperative low cardiac output syndrome, perioperative myocardial infarction, or surgical mortality in patients with left main stenosis.

These findings support earlier findings suggesting that left main stenosis is no longer a significant predictor of surgical death.

Impact of Early vs. Late Operations

In the LMS group, about one-third of the patients had surgery after fewer than ten days of waiting. The greater percentage of patients in the early group who presented with New York Heart Association (NYHA) Functional Class IV symptoms or a recent preoperative myocardial infarction indicates that symptoms were the primary reason for surgery.

Patients with 75% or more left main stem stenosis were more likely to have surgery in the early group, indicating that the severity of left main disease also had an impact on waiting time.

There was no higher incidence of surgical morbidity or mortality among patients in the late group.

Triage to the late group did not result in longer hospital stays or hospitalisations in the intensive care unit.

Two patients in the late group needed extended hospital stays for rehabilitation due to perioperative strokes.

Discussion

Left main coronary artery (LMCA) stenosis has traditionally been regarded as one of the most serious manifestations of coronary artery disease because a significant proportion of the myocardium is dependent on blood flow through the left main

coronary artery. Historically, patients with LMCA disease were considered to be at increased risk of sudden cardiac death, myocardial infarction, and adverse perioperative outcomes. Consequently, early surgical revascularization has often been advocated for these patients.

In the present study, patients with LMCA stenosis did not differ significantly from those without LMCA disease with regard to demographic characteristics, preoperative symptomatic status, or incidence of previous myocardial infarction. However, the LMCA group had a noticeably higher prevalence of peripheral vascular disease, which is indicative of the patient's diffuse and systemic atherosclerotic disease. Similar findings have been reported in previous studies, where LMCA stenosis has frequently been associated with more extensive vascular involvement.

A notable observation in our study was the significantly shorter waiting time for surgery among patients with LMCA stenosis compared with those without LMCA disease. This finding reflects the clinical practice of prioritizing patients perceived to be at higher risk because of the potentially catastrophic consequences of untreated left main disease. Patients with severe LMCA stenosis, recent myocardial infarction, or advanced symptoms were more likely to undergo earlier surgery, indicating that the triage system appropriately identified higher-risk individuals.

When LMCA disease was present, more bypass grafts were carried out, and aortic cross-clamp and cardiopulmonary bypass periods increased in tandem. In patients with left main involvement, coronary artery disease is probably more severe and complex. There was no discernible rise in postoperative morbidity or death despite the increased complexity of the procedure. The LMCA and non-LMCA groups had similar rates of surgical mortality, low cardiac output syndrome, perioperative myocardial infarction, and length of hospital stay.

These findings are consistent with contemporary reports demonstrating that advances in myocardial protection, cardiopulmonary bypass techniques, perioperative care, and surgical expertise have significantly improved outcomes in patients undergoing CABG for LMCA disease. Earlier studies identified LMCA stenosis as an independent predictor of operative mortality; however, more recent series suggest that the adverse impact of left main disease has diminished considerably in the modern surgical era.

An important objective of this study was to evaluate the effect of surgical waiting time on postoperative outcomes in patients with LMCA stenosis. Patients who underwent delayed surgery did not experience increased operative mortality, prolonged intensive care unit stay, or longer hospitalization compared with those undergoing earlier intervention. Although two patients in the delayed surgery group experienced perioperative stroke, the overall incidence of major adverse events remained low. These results imply that individuals with stable LMCA illness who are properly chosen may safely wait for surgery without experiencing a notable increase in perioperative risk.

The results should, however, be interpreted with caution. Patients selected for delayed surgery were likely clinically stable and may therefore represent a lower-risk subgroup. The absence of increased mortality in this group should not be interpreted as evidence that all patients with LMCA disease can safely tolerate prolonged delays. Patients with unstable angina, recent myocardial infarction, severe symptoms, or critical (>75%) LMCA stenosis remain at higher risk and may benefit from expedited surgical intervention.

There are various limitations to the current investigation. Because it is a retrospective observational study, selection bias may exist. The sample size may not have been sufficient to detect small differences in uncommon adverse outcomes. In addition, long-term follow-up data were not available, limiting assessment of the impact of waiting time on long-term survival and freedom from major adverse cardiac events.

Despite these limitations, the study provides valuable evidence regarding the contemporary management of LMCA disease. The findings suggest that LMCA stenosis alone is no longer an independent predictor of poor operative outcome following CABG. Furthermore, a triage strategy based on symptom severity and clinical stability appears to be safe and effective, allowing prioritization of higher-risk patients while permitting carefully selected stable patients to undergo surgery after a reasonable waiting period.

Conclusion

The study examines the impact of waiting time on postoperative outcomes and presents the outcomes of isolated coronary artery bypass grafting in patients with left main stenosis.

Our triage method prioritises the patient's symptomatic state, and patients in the late group frequently had to wait for non-medical reasons such socioeconomic problems, consent-related concerns, and other practical considerations.

As a result of this preference, the mean waiting time for nearly two-thirds of patients with left main stenosis remained more than three weeks.

This study shows that triaging individuals for coronary artery bypass grafting is safe.

Specifically, if patients with left main stenosis are carefully chosen, they can be safely triaged to a later procedure.

Patients who have had a recent preoperative myocardial infarction or who have unstable angina that is not responding to medication should be given priority for early surgical surgery.

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Conflicts of interest

There are no conflicts of interest.

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