

# Treatment strategies in the left main coronary artery disease associated with acute coronary syndromes



Ahmet Karabulut<sup>a,\*</sup>, Mahmut Cakmak<sup>b</sup>

<sup>a</sup>Department of Cardiology, Acibadem University, School of Medicine, Acibadem Atakent Hospital, Istanbul

<sup>b</sup>Department of Cardiology, International Medicine Hospital, Phristina

<sup>a</sup>Turkey

<sup>b</sup>Kosovo

Significant left main coronary artery (LMCA) stenosis is not rare and reported 3 to 10% of patients undergoing coronary angiography. Unprotected LMCA intervention is a still clinical challenge and surgery is still going to be a traditional management method in many cardiac centers. With a presentation of drug eluting stent (DES), extensive use of IVUS and skilled operators, number of such interventions increased rapidly which lead to change in recommendation in the guidelines regarding LMCA procedures in the stable angina (Class 2a recommendation for ostial and shaft lesion and class 2b recommendation for distal bifurcation lesion). However, there was not clear consensus about the management of unprotected LMCA lesion associated with acute myocardial infarction (MI) with a LMCA culprit lesion itself or distinct culprit lesion of other major coronary arteries. Surgery could be preferred as an obligatory management strategy even in the high risk patients. With this review, we aimed to demonstrate treatment strategies of LMCA disease associated with acute coronary syndrome, particularly acute myocardial infarction (MI). In addition, we presented a short case series with LMCA lesion and ST elevated acute MI in which culprit lesion placed either in the left anterior descending artery or circumflex artery. We reviewed the current medical literature and propose simple algorithm for management.

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**Keywords:** Left main coronary artery, Acute coronary syndrome, Surgery, Percutaneous intervention

## Contents

Introduction . . . . .	273
Current management of left main coronary artery stenosis in stable angina . . . . .	273
Left main coronary artery stenosis as a culprit lesion in the acute coronary syndromes . . . . .	274

**Disclosure:** Authors have nothing to disclose with regard to commercial support.

Received 27 January 2015; revised 25 February 2015; accepted 3 March 2015.

Available online 21 March 2015

\* Corresponding author at: Acibadem University Atakent Hospital, Department of Cardiology, Halkalı Merkez Mah. Turgut Özal Bulvarı, No: 16, 34303, Kucukcekmece, Istanbul, Turkey. Tel.: +90 5053577477; fax: +90 2124044445.

E-mail address: [drkarabulut@yahoo.com](mailto:drkarabulut@yahoo.com) (A. Karabulut).



P.O. Box 2925 Riyadh – 11461KSA  
Tel: +966 1 2520088 ext 40151  
Fax: +966 1 2520718  
Email: [sha@sha.org.sa](mailto:sha@sha.org.sa)  
URL: [www.sha.org.sa](http://www.sha.org.sa)



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Peer review under responsibility of King Saud University.

URL: [www.ksu.edu.sa](http://www.ksu.edu.sa)

<http://dx.doi.org/10.1016/j.jsha.2015.03.002>



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Left main coronary artery stenosis as a non-culprit lesion in acute coronary syndromes . . . . . 274  
 Short case series . . . . . 274  
 Conclusion . . . . . 275  
 Acknowledgements . . . . . 275  
 References . . . . . 275

## Introduction

Significant left main coronary artery (LMCA) stenosis is not rare, occurring among a reported 3% to 10% of patients undergoing coronary angiography [1]. Unprotected LMCA intervention remains a clinical challenge. With the advent of drug-eluting stent (DES), extensive use of IVUS and skilled operators, the number of such interventions have increased rapidly, leading to changes in guideline recommendations for LMCA procedures in stable angina (Class 2a recommendation for ostial and shaft lesions and class 2b recommendation for distal bifurcation lesions) [2]. Moreover, isolated LMCA disease with low SYNTAX score ( $\leq 22$ ) was recommended as class 1 indication with the level of evidence of B in the recent revascularization guidelines of European Society of Cardiology. However, there was no clear consensus on unprotected LMCA lesions associated with acute myocardial infarction with culprit lesion of LMCA itself or distinct culprit lesion of other major coronary arteries [3-6].

This review sought to demonstrate the treatment strategies of LMCA disease associated with acute coronary syndromes, particularly acute myocardial infarction (MI). In addition, we present a short case series with an LMCA lesion and ST-elevated acute MI in which the culprit lesion was placed either in the left anterior descending artery (LAD) or circumflex artery (CX). We review the current medical literature

### Abbreviations

CABG	coronary artery bypass graft
CX	circumflex artery
DES	drug-eluting stent
IVUS	intravascular ultrasonography
LAD	left anterior descending artery
LMCA	left main coronary artery MI myocardial infarction
PCI	percutaneous coronary interventions
RCA	right coronary artery
SYNTAX	synergy between percutaneous coronary intervention with TAXUS and cardiac surgery
TIMI	thrombolysis in myocardial infarction

and conclude with an algorithm for LMCA lesions associated with acute coronary syndromes.

### Current management of left main coronary artery stenosis in stable angina

Surgery is accepted as a traditional and standard treatment of unprotected LMCA disease. Recent data comparing the safety and efficacy of LMCA interventions with DES and coronary artery bypass graft (CABG) surgery showed comparable results in terms of safety and mortality [2]. Long-term mortality rates were also similar. However, percutaneous coronary interventions (PCI) were associated with higher rates of repeat revascularization, whereas CABG was associated with higher stroke rate compared to PCI [7-10]. Patient selection for both strategies is fundamental

Table 1. Indication for coronary bypass graft surgery vs. percutaneous coronary intervention in the stable angina patients with lesions suitable for both procedures.

LMCA LESION	Favours CABG	Favours PCI
<sup>a</sup> Left main with SYNTAX score $\leq 22$	1 (Level of evidence – B)	1 Level of evidence – B)
<sup>a</sup> Left main with SYNTAX score 23-32	1 (Level of evidence – B)	2a (Level of evidence – B)
<sup>a</sup> Left main with SYNTAX score $>32$	1 (Level of evidence – B)	3 (Level of evidence – B)
<sup>a</sup> Left main (isolated or 1 VD, ostium/shaft)	1 (Level of evidence – A)	2a (Level of evidence – B)
<sup>a</sup> Left main (isolated or 1 VD, distal bifurcation)	1 (Level of evidence – A)	2b (Level of evidence – B)
<sup>a</sup> Left main + 2 VD or 3 VD, SYNTAX score $\leq 32$	1 (Level of evidence – A)	2b (Level of evidence – B)
<sup>a</sup> Left main + 2 VD or 3 VD, SYNTAX score $\geq 33$	1 (Level of evidence – A)	3 (Level of evidence – B)

LMCA, Left main coronary artery; CABG, Coronary artery bypass graft; PCI, Percutaneous coronary; VD, Vessel disease; SYNTAX, Synergy between percutaneous coronary intervention with taxus and cardiac surgery.

<sup>a</sup> According to 2014 European Society of Cardiology Guidelines in Myocardial Revascularisation.

<sup>a</sup> According to 2010 European Society of Cardiology Guidelines in Myocardial Revascularisation.

and may directly impact clinical outcome. For this reason, LMCA disease management should be discussed extensively by the heart team prior to treatment. LMCA lesion >50% with documented ischemia or fractional flow reserve <0.80 for angiographic diameter stenosis between 50% and 70% and more than 70% stenosis of LMCA lesion should be revascularized for prognosis and improved survival. The current guidelines of the European Society of Cardiology on LMCA disease management in stable angina are summarized in Table 1 [11].

### Left main coronary artery stenosis as a culprit lesion in the acute coronary syndromes

In patients with LMCA culprit lesions, the optimal revascularization strategy is not obvious [3-6]. Most patients usually present with hemodynamic instability and cardiogenic shock. Even after successful revascularization, the mortality rate is higher when compared to stable patients [12,13]. Treatment allocation is primarily determined by presentation with thrombolysis in myocardial infarction (TIMI) 0/1 flow. As percutaneous intervention offers an earlier restoration of TIMI flow, PCI could be the obligatory treatment strategy [14-16]. In the case of hemodynamic stability, treatment approach could either be PCI or surgery in parallel with guidelines for stable patients [4].

Multi-vessel disease with higher SYNTAX score ( $\geq 33$ ) could be a major candidate for bypass surgery [17,18], whereas higher operative risk assessed by euroSCORE and higher possibility of complete revascularization may require PCI [19]. The following clinical variables were shown as prognostic factors in a LMCA culprit lesion:

- Cardiogenic shock: a strong indicator of mortality [20], and associated with nearly fourfold increment in 30-day mortality (55% vs 15% in non-cardiogenic shock patients) [20]
- ST-elevation MI is associated with higher periprocedural complications and higher six-month mortality compared to non-ST-elevation MI and unstable angina patients [1]
- Initial TIMI 1/0 flow
- Reduced left ventricular ejection fraction
- Older age
- Multi-vessel disease and high SYNTAX score
- Diabetes mellitus.

Cardiogenic shock with isolated LMCA culprit lesion shows relatively better prognosis after successful primary PCI compared to multi-vessel disease. Such patients usually recover earlier from cardiogenic shock; and long-term prognosis is

similar to non-cardiogenic shock patients in selected patient groups [21]. PCI should be preferred in the presence of the following clinical features:

- Cardiogenic shock
- Initial TIMI 1/0 flow
- Isolated LMCA culprit lesion
- Poor surgical candidate (high euroSCORE, distal coronary disease unfavorable to CABG or co-morbidity, including chronic obstructive lung disease and renal failure)
- Favorable anatomy providing complete revascularization (low or intermediate SYNTAX score)
- Patients with rudimentary circumflex artery
- Advanced age (octogenarians).

In the following clinical settings with hemodynamic stability and low perioperative risk, CABG is a preferred option:

- Concomitant valvular disease or mechanical complication
- Heavy calcified LMCA disease
- Multi-vessel disease with high SYNTAX score
- Reduced left ventricular function
- Diabetic patients.

### Left main coronary artery stenosis as a non-culprit lesion in acute coronary syndromes

Concurrent LMCA and non-LMCA PCI has worse outcomes than isolated LMCA PCI [14]. Thus, it is logical to postpone LMCA revascularization if the culprit lesion is located in the right coronary artery (RCA). However, PCI of culprit lesion located either in LAD or CX in the presence of significant LMCA lesion is a hazardous clinical issue and may necessitate concurrent LMCA intervention. Short and long-term data on simultaneous PCI of LMCA and non-LMCA culprit vessel are not well-defined.

#### Short case series

Herein we describe our short case series and discuss treatment strategies. The cases described here were collected at the International Medicine Hospital of Kosovo. We performed 10 cases of ST-elevated MI with significant LMCA stenosis. Among them, five culprit lesions were located in LAD, two in CX and three in the RCA. We did not perform LMCA interventions with a culprit lesion of RCA in the same session. We initially performed three primary PCIs of RCAs, and we postponed LMCA interventions for elective

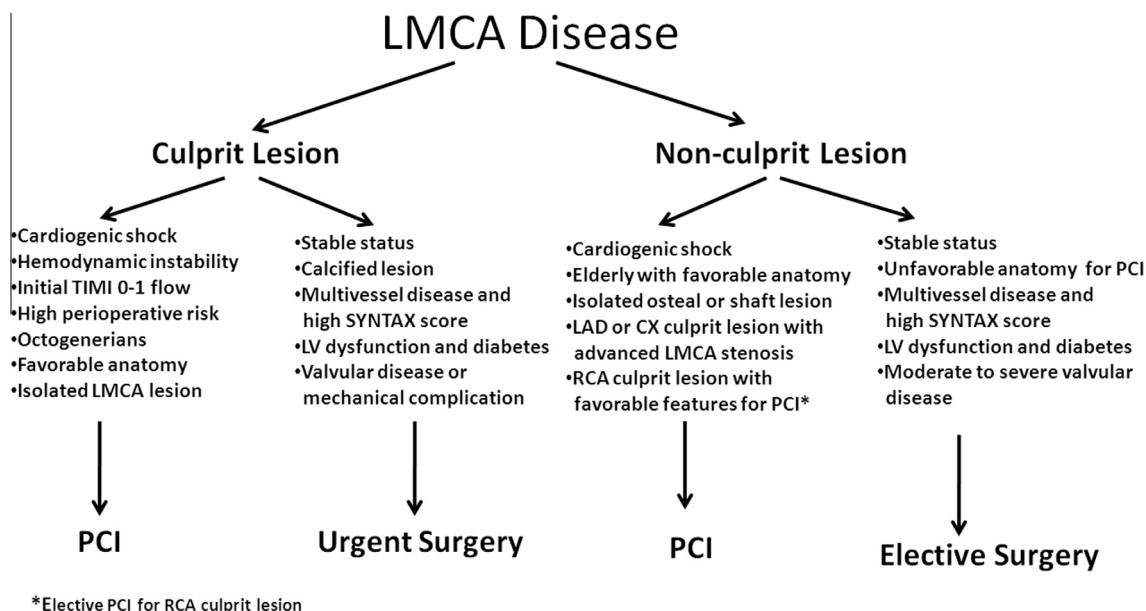


Figure 1. A systematic algorithm for LMCA disease in patients with acute coronary syndrome.

procedures. In patients with culprit lesions located in the left coronary system, our primary goal was to open culprit lesions initially and then after myocardial salvation; and finally to perform LMCA intervention. In one patient with LAD lesion, LMCA stenosis was over the 95% which necessitated initial LMCA intervention. In all procedures, we used DES and LMCA intervention performed without IVUS support. We could not use IVUS due to affordability. Only one case pertained to distal LMCA bifurcation lesion; the rest were either ostial or shaft lesions. The mean euroSCORE value was 13.0. All patients were discharged without in-hospital complications, and control examinations at six months were uneventful.

This short series may indicate the feasibility of concurrent LMCA and non-LMCA culprit vessel interventions in selected patients. In the presence of the following clinical features, PCI may be the preferred option:

- Cardiogenic shock
- Critical LMCA stenosis which complicates secure PCI of culprit lesion placed either in LAD or CX
- Isolated LMCA ostial and/or shaft lesion accompany culprit lesion.
- Elderly with favorable anatomy providing complete revascularization if elective procedure is not possible (patient demands)

In stable patients with moderately stenotic distal LMCA lesion, target vessels should be

revascularized initially, and elective LMCA assessment and intervention should be scheduled after a certain period of time. A systematic algorithm for LMCA disease in patients with acute coronary syndrome is summarized in Fig. 1.

### Conclusion

In the setting of acute coronary syndromes, percutaneous intervention of unprotected LMCA lesions can be performed with reliable results in selected patients. Cardiogenic shock and hemodynamic instability are obligatory indications for PCI, although associated major adverse cardiac events are more frequent. Surgery can be selected for stable patients with multi-vessel diseases and/or higher SYNTAX score. Concurrent LMCA and non-LMCA culprit vessel intervention can also be performed securely with good long-term results in selected patients.

### Acknowledgements

The authors report no conflict of interest regarding this work. This work was not supported by any company.

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