Left Main Percutaneous Coronary Intervention

Neil Ruparelia, DPhil, MRCP[a,b], Alaide Chieffo, MD[a,*]

KEYWORDS

• Left main stem • Percutaneous coronary intervention • Coronary artery bypass grafting
• Drug-eluting stents • Guidelines • Heart team • Intravascular imaging

KEY POINTS

- Each patient presenting with significant unprotected left main stem disease should be thoroughly evaluated by the heart team on an individual basis before deciding on the optimal revascularization strategy: percutaneous coronary intervention or coronary artery bypass grafting.
- Percutaneous coronary intervention is a viable treatment option, particularly in patients with favorable coronary anatomy (low or intermediate SYNTAX (Synergy Between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery) scores).
- The stenting strategy should be determined by coronary anatomy.
- The use of adjunctive tools, including intravascular imaging and fractional flow reserve, is essential to confirming diagnosis and optimizing clinical outcomes.

INTRODUCTION

A finding of significant (>50%) disease in an unprotected left main stem (ULMS) is observed in approximately 5% to 7% of patients undergoing coronary angiography.[1] In view of the large distribution of myocardium that it supplies, ULMS disease is of prognostic importance. Medical treatment is associated with a 3-year mortality rate of 50%.[2,3] The disease may present in asymptomatic patients as stable angina, an acute coronary syndrome, in the presence of heart failure, or sudden cardiac death.

The diagnosis of ULMS disease using invasive coronary angiography can be surprisingly challenging; the role of adjunctive tools, including intravascular imaging and coronary physiology, play important roles. Treatment of ULMS is similarly nuanced. Coronary artery bypass grafting (CABG) has been regarded as the gold standard treatment of this group of patients with a significant mortality benefit in comparison with medical therapy alone.[4,5] With the introduction of drug-eluting stents (DES) (which are associated with lower rates of restenosis and target lesion revascularization [TLR] when compared with bare-metal stents[6–8]), in addition to improvements in operator experience and adjunctive pharmacotherapy, percutaneous coronary intervention (PCI) has been shown to be feasible, safe, and efficacious in this patient group.[9,10] This finding has resulted in a revision of the both the European Society of Cardiology (ESC)[11] and the American College of Cardiology (ACC)/American Heart Association (AHA)[12] guidelines on myocardial revascularization that now regard PCI as an alternative to CABG in patients without complex anatomy.

There are many factors that need to be taken account when considering ULMS PCI. During the course of this article, the authors review the evidence, current guidelines, and technical aspects of ULMS PCI.

CURRENT EVIDENCE

Data from several observational retrospective registries (Table 1) initially demonstrated that

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[a] Department of Interventional Cardiology San Raffaele Scientific Institute, Via Olgettina 60, Milan 20132, Italy;
[b] Department of Cardiology Imperial College, Du Cane Road, London W12 0HS, UK
* Corresponding author. San Raffaele Scientific Institute, Via Olgettina, 60, Milan 20132, Italy.
E-mail address: alaide.chieffo@hsr.it

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Table 1
Summary of retrospective studies

Study, Year	Patients (n)	Follow-up, (mo)	Cardiac Death (%)	MACE (%)
Palmerini et al,[13] 2006	311	12	NA	NA
Lee et al,[14] 2006	173	12	1.6 vs 2.0	25.0 vs 17.0
Sanmartin et al,[15] 2007	335	12	NA	11.4 vs 10.4
Chieffo et al,[16] 2010	249	60	11.9 vs 7.5	38.3 vs 32.4
Park et al,[17] 2010	2240	60	9.9	NA

Abbreviations: MACE, major adverse cardiovascular event; NA, not available.
Data from Refs.[13–17]

there were no differences between CABG and PCI for the treatment of ULMS disease with regard to major adverse cardiovascular events (MACEs).[9,13–19] Subsequently, several prospective randomized trials have been conducted (or are ongoing) to further explore the efficacy of PCI in this patient group (Table 2).

The landmark Synergy Between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery (SYNTAX) trial was the first major randomized trial comparing CABG versus PCI with DES.[10] The study included a prespecified subgroup of patients with ULMS (PCI n = 357; CABG n = 348). At 12 months, there was noninferiority in MACE (PCI 15.8% vs CABG 13.7%; $P = .44$), although the rate of repeat revascularization among those undergoing PCI was higher (PCI 11.8% vs CABG 6.5%; $P = .02$). Conversely, the rates of cerebrovascular events were higher in the CABG group (2.7% vs 0.3%; $P = .01$). At the 5-year follow-up, there continued to be no significant difference in overall MACE rates (PCI 36.9% vs CABG 31.0%; $P = .12$).[23] However, subgroup analysis revealed that patients with low (0–22) and intermediate[24–33] SYNTAX scores had similar outcomes regardless of treatment strategy (30.4% vs 31.5%; $P = .74$; 32.7% vs 32.3%; $P = .88$, respectively). However, patients with high SYNTAX scores (>33) had lower MACE rates with CABG (29.7% vs 46.5%; $P = .003$).[34] The Premier of Randomized Comparison of Bypass Surgery versus Angioplasty Using Sirolimus-Eluting Stent in Patients with Left Main Coronary Artery Disease (PRECOMBAT), similarly published 5-year follow-up data of 600 patients randomized to PCI (n = 300) with sirolimus-eluting stents or CABG (n = 300). At 5 years, MACE was not statistically different with PCI and CABG (17.5% vs 14.3%; $P = .26$).[35] It is important to note that both of these studies used first-generation DES. Their use has now been superseded by second- and

Table 2
Summary of randomized controlled trials

Study, Year	Patients (n)	Age (y)	SYNTAX Score	Death (%)	MACE (%)
Buszman et al,[19] 2008	105 PCI: 52 CABG: 53	61	25	7.5 vs 1.9, $P = .37$	24.5 vs 28.8, $P = .29$
SYNTAX left main,[20] 2009	705 PCI: 357 CABG: 348	65	30	4.4 vs 4.2, $P = .88$	13.7 vs 15.8, $P = .44$
Boudriot et al,[21] 2010	201 PCI: 100 CABG: 101	68	24	5.0 vs 2.0, $P<.01$	13.9 vs 19.0, $P = .19$
PRECOMBAT,[22] 2011	600 PCI: 300 CABG: 300	62	25	2.7 vs 2.0, $P = .45$	6.7 vs 8.7, $P = .12$

Abbreviations: Le Mans, Study of Unprotected Left Main Stenting Versus Bypass Surgery; PRECOMBAT, Premier of Randomized Comparison of Bypass Surgery versus Angioplasty Using Sirolimus-Eluting Stent in Patients with Left Main Coronary Artery Disease; SYNTAX, Synergy between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery.
Data from Refs.[19–22]