IJMA

International Journal of Medical Arts

2/2022 (volume 4, Issue 2)

http://ijma.journals.ekb.eg/

Print ISSN: 2636-4174

Online ISSN: 2682-3780

Available online at Journal Website
https://ijma.journals.ekb.eg/
Main Subject [Surgery]
[Cardiothoracic Surgery]

Original Article

Coronary Artery Bypass Grafting Versus Percutaneous Coronary Intervention in Patients with Distal Left Main Coronary Disease

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Article information

Received: 25-10-2021

Accepted: 18-02-2022

DOI: 10.21608/ijma.2022.102723.1382

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Citation: Helyl MA, Gamil EE, Mahmoud HB, Mahmoud MH. Coronary Artery Bypass Grafting Versus Percutaneous Coronary Intervention in Patients with Distal Left Main Coronary Disease. IJMA 2022; 4 [2]: 2171-2175. doi: 10.21608/ijma.2022.102723.1382

ABSTRACT

Background and Aim: Conflicting results about coronary artery bypass grafting [CABG] versus percutaneous coronary interventions [PCI] in patients with left main coronary artery [LMCA] disease were published. Therefore, we aimed to compare CABG versus PCI for revascularization of LMCA disease and identify factors affecting the outcome.

Patients and Methods: This prospective non-randomized study was conducted on 78 patients with LMCA disease presented between 2019 and 2021. The heart team assigned patients to either CABG or PCI, and each group had 38 patients. The study outcome was one year's major adverse cerebral and cardiovascular events [MACCE].

Results: There were no differences in the demographics between both groups. Body mass index was higher in patients with PCI [27.79 ± 3.09 vs. 30.78 ± 5.45 Kg/m^2; P= 0.005]. Diabetes mellitus was more common among CABG patients [27 [71.1%] vs 20 [52.6%]; P= 0.005]. EuroSCORE II was significantly higher in CABG patients [1.3 [0.76 – 2.85] vs. 0.81 [0.5 – 3.68]; P<0.001]. Hospital complications other than MACCE were significantly higher in patients who had CABG [13 [34.2%] vs. 5 [13.2%]; P= 0.03]. After 12 months, there were no differences in the rate of MI, stroke, revascularization, and mortality between both groups. Factors affecting MACCE were age [OR: 1.44; P=0.04], diabetes mellitus [OR: 1.82; P 0.02], prior myocardial infarction [OR: 1.89; P=0.001], ejection fraction [OR: 1.42; P= 0.01] and SYNTAX score [OR: 1.84, P= 0.02].

Conclusion: PCI could be an alternative to CABG in patients with distal left main coronary artery disease with comparable periprocedural and 1-year risk.

Keywords: Left Main Coronary; Disease; Coronary Artery Bypass Grafting; Percutaneous; Coronary Revascularization.

INTRODUCTION

Medical management of left main coronary artery [LMCA] disease is associated with a high mortality [1]. For many years, coronary artery bypass grafting [CABG] has been the gold standard for managing the distal left main disease. Recently, several studies suggested using drug-eluting stents as an alternative to CABG in LMCA disease [2]. Conflicting results comparing percutaneous coronary interventions [PCI] versus CABG in left main disease were published. The Evaluation of XIENCE versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization [EXCEL] trial showed that everolimus-eluting stents for the left main disease were non-inferior to CABG. Patients included in this study had low or intermediate Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery [SYNTAX] scores, and the primary composite endpoint was death, stroke, or myocardial infarction [MI] at three years [3]. However, the Nordic–Baltic–British Left Main Revascularization [NOBEL] trial reported superior results for CABG compared to PCI regarding the 5-year major adverse events [4]. Therefore, we aimed to compare CABG versus PCI for revascularization of LMCA disease and identify factors affecting the outcome.

PATIENTS AND METHODS

We performed a prospective non-randomized study to compare CABG versus PCI in patients with distal LMCA disease. The study was conducted at the Cardiothoracic Surgery Department, Nasr City Insurance Hospital- Cairo, Elmokattem Insurance Hospital- Cairo, and the Cardiology Department of Beni Suef University Hospital- Beni Suef between September 2019 and June 2021.

We included all patients with distal LM disease > 50% or osteal left anterior descending [LAD] or LCx >50%. All patients were discussed by the Heart -team committee, which had cardiac surgeons, interventional cardiologists, and cardiologists, regarding feasibility and suitability for intervention. We excluded patients with concomitant valvular heart disease, recent heart failure, low ejection fraction [<40%], recent MI, and those with contra-indication to dual antiplatelet therapy. The Local Ethical Committee approved the study, and consents were obtained from patients before enrollment. [Reference number 0000018, from Al-Azhar University]

Study data and groups: Baseline data included demographic data and co-morbidities and EuroSCORE II. All patients had baseline electrocardiography, chest X-ray, transthoracic echocardiography, and coronary angiography. The SYNTAX score was calculated before the intervention, and a high score was considered high-risk for PCI. In PCI patients, a single stent strategy was used in most patients with a successful angiographic outcome. All CABG procedures were performed on cardiopulmonary bypass with the left internal mammary artery [LIMA] anastomosed to the LAD artery. Patients were grouped into two groups. The first group included patients who had CABG [n= 38], and the second group included PCI patients [n= 38].

Follow-up and outcomes: We followed the patients at the outpatient department for 12 months. Patients who were lost for follow-up were excluded from the study. Coronary angiography was performed for symptomatic patients to assess graft stenosis or occlusion, or stent restenosis. The primary outcome was MACCE [major adverse cerebral and cardiovascular events], including death, MI, stroke, and revascularization at 12 months. Secondary endpoints were hospital complications and ejection fraction [EF].

Statistical analysis: Data were analyzed using IBM SPSS software package version 26 [IBM Corp- Armonk-NY- USA]. Qualitative data were described using numbers and percentages. Quantitative data were described using median [minimum and maximum] and mean [standard deviation]. The Chi-Square test was used for the comparison of 2 or more groups. Fisher exact test was used as a correction for the Chi-Square test when more than 25% of cells count less than 5. Student t-test was used to compare continuous variables in 2 independent groups. For non-parametric analysis, the Mann-Whitney "U" test was used to compare two independent groups. Univariate and multivariate logistic regression analysis was used to detect the risk factors of binary categorical outcomes. A P-value of less than 0.05 was considered statistically significant.

RESULTS

There were no differences in the demographic data between both groups. Body mass index [BMI] was higher in PCI patients [27.79 ± 3.09 vs. 30.78 ± 5.45 Kg/m^2; P= 0.005]. Diabetes mellitus was more common among CABG patients [27 [71.1%] vs 20 [52.6%]; P= 0.005]. EuroSCORE II was significantly higher in patients who had CABG [1.3 [0.76 – 2.85] vs. 0.81 [0.5 – 3.68]; P < 0.001]. CABG group had significantly higher prior MI and lower ejection fraction. The SYNTAX score was significantly higher in patients with CABG, and the number of two or three-vessels diseases was higher in this group [Table 1]. The number of vascularized vessels was significantly more in the CABG group. Hospital complications other than MACCE were significantly higher in patients who had CABG [13 [34.2%] vs. 5 [13.2%]; P= 0.03]. Thirteen patients in the CABG group were complicated by either postoperative bleeding and reopening, sternal wound infection and dehiscence, rewiring, and postoperative arrhythmias. Five patients in the PCI group were complicated by access site bleeding, dye anaphylaxis, contrast-induced nephropathy, coronary artery dissection, and arrhythmias. 30-day mortality occurred in 2 patients [5.3%] in each group [P>0.99]. After 12 months, there were no differences in the rate of MI, stroke, revascularization, mortality, and MACCE between both groups [Table 2]. By multivariable analysis, factors affecting MACCE were age [OR: 1.44; P=0.04], diabetes mellitus [OR: 1.82; P 0.02], prior MI [OR: 1.89; P=0.001], EF [OR: 1.42; P= 0.01] and SYNTAX score [OR: 1.84, P= 0.02] [Table 3].

Table [1]: Comparison of the baseline data between both groups

	Total [n=76]	CABG group [n= 38]	PCI group [n= 38]	P-value
Age [Years]	62.38 ± 7.49	61.61 ± 6.75	63.16 ± 8.17	0.37
Male	55 [72.4%]	30 [78.9%]	25 [65.8%]	0.20
Smoking	38 [50.0%]	17 [44.7%]	21 [31.6%]	0.24
Diabetes mellitus	47 [61.8%]	27 [71.1%]	20 [52.6%]	0.01
Hypetension	48 [63.2%]	25 [65.8%]	23 [60.5%]	0.60
Dyslipidemia	42 [55.3%]	23 [65.8%]	19 [50%]	0.21
Body mass index [Kg/m2]	29.28 ± 4.65	27.79 ± 3.09	30.78 ± 5.45	0.01
EuroSCORE II	1.03 [0.50–3.68]	1.3 [0.76 – 2.85]	0.81 [0.5 – 3.68]	<0.001
Serum creatinine [mg/dl]	0.99 ± 0.29	1.03 ± 0.31	0.95 ± 0.26	0.27
Chronic stable angina	52 [68.4%]	28 [73.7%]	24 [63.2%]	0.24
Unstable angina	24 [31.6%]	10 [26.3%]	14 [36.8%]	0.23
Prior myocardial infarction	15 [19.7%]	11 [28.9%]	4 [10.5%]	0.04
Prior percutaneous coronary intervention	9 [11.8%]	6 [15.8%]	3 [7.9%]	0.29
Ejection fraction [%]	61.91 ± 7.76	59.11 ± 8.54	64.71 ± 5.75	0.001
SYNTAX score	26.11 ± 8.01	29.63 ± 7.70	22.58 ± 6.71	0.001
Number of vessels				
One vessel	33 [43.4%]	11 [28.9%]	22 [57.9%]	0.001
Two vessels	23 [30.3%]	10 [26.3%]	13 [34.2%]	
Three vessels	20 [26.3%]	17 [44.7%]	3 [7.9%]	

[Continuous variables were presented as mean and SD or median [minimum-maximum] and categorical variables as numbers and percentages]

Table 2: Comparison of the procedure outcomes between groups

	Total [n=76]	CABG group [n= 38]	PCI group [n= 38]	P-value
Number of [grafted/stented] vessels				
One vessel	22 [28.9%]	1 [2.6%]	21 [55.3%]	< 0.001
Two vessels	30 [39.5%]	14 [36.8%]	16 [42.1%]	
Three vessels	18 [23.7%]	17 [44.7%]	1 [2.6%]	
Four vessels	4 [5.3%]	4 [10.5%]	0 [0%]	
Five vessels	2 [2.6%]	2 [5.3%]	0 [0%]	
Hospital Complications other than MACCE	18 [23.7%]	13 [34.2%]	5 [13.2%]	0.03
12-months outcomes				
Myocardial infarction	10 [13.2%]	6 [15.8%]	4 [10.5%]	0.17
Death	5 [6.6%]	3 [7.9%]	2 [5.3%]	0.62
Stroke	3 [3.9%]	3 [7.9%]	0 [0%]	0.13
Revascularization	3 [3.9%]	2 [5.3%]	1 [2.6%]	0.20
MACCE	21 [26.9%]	14 [3	7 [18.4%]	0.7
Ejection fraction [%]	60.94 ± 7.54	57.05 ± 6.53	64.87 ± 5.95	< 0.001

[Continuous variables were presented as mean and SD or median [minimum-maximum] and categorical variables as numbers and percentages]
MACCE: major adverse cerebral and cardiovascular events

Table [3]: Univariable and multivariable analysis of factors affecting MACCE

	Univariable analysis P-value	Multivariable analysis		
		OR	95% CI of OR	P value
Age	0.01	1.44	1.06-2.45	0.04
Male	0.39	-	-	-
Bodyweight	0.49	-	-	-
Smoking	0.01	1.52	1.241 - 2.28	0.054
Dibates mellitus	< 0.001	1.82	1.27- 2.98	0.02
Hypetension	0.18	-	-	-
Prior MI	0.001	1.89	1.34-3.09	0.001
Prior PCI	0.15	-	-	-
Chronic stable angina	0.21	-	-	-
Unstable angina	0.18	-	-	-
Ejection fraction	0.03	1.45	1.12- 1.95	0.01
EuroSCORE II	0.001	0.74	0.33- 0.93	0.17
Syntax score	0.001	1.84	1.26- 2.40	0.02

[MI: myocardial infarction; PCI: percutaneous coronary intervention]

DISCUSSION

Left main coronary artery disease is associated with high morbidity and mortality [5]. Surgery remains the gold standard of care for those patients. The role of PCI in those patients is the subject of ongoing studies [6]. The results of the SYNTAX trial were encouraging for the use of PCI in LMCA disease. The subgroup analysis of this trial generated a hypothesis for future studies comparing PCI and CABG for LMCA disease [7]. In six randomized trials of patients with LMCA disease, favorable outcomes were achieved after one year in patients with PCI with drug-eluting stents with rapid recovery and few periprocedural morbidities [8]. However, these trials reported conflicting long-term results [9].

We compared CABG and PCI in 78 patients with LMCA disease, and we did not find a difference in MI, stroke, revascularization, and mortality after one year. Post-hoc analysis of the NOBLE trial, MACCEs were better in CABG at five years in patients older than 67 years. In younger patients, there was no difference between PCI and CABG [10]. The EXCEL trial reported a higher composite endpoint of death, MI, or stroke in patients with the distal disease who had CABG, but the differences were not statistically significant [11]. In the ten-year follow-up after PCI or CABG for LMCA disease, Park and colleagues found no difference in MACCE between both arms [12]. In LE MANS trial, the ten-year follow-up showed favorable outcomes in the PCI group, but it did not reach a statistically significant level [13].

We reported higher post-procedure complications in the CABG group. Several studies reported fewer postprocedural complications after PCI with fast recovery compared to CABG patients [14,15]. PCI with drug-eluting stents in patients with LMCA disease was associated with better hospital outcomes, lower complications, and shorter hospital stay [12,16].

We found an increased risk of MACCE in patients with LMCA disease in older age, diabetics, and with a history of MI, low EF, and high SYNTAX score. In a study by Mahmoud and colleagues, they found that diabetes, smoking, body mass index, hypertension, the complexity of the vessel, and ejection fraction were predictors of MACCE after PCI for LMCA disease [17]. The SYNTAX score was a predictor of mortality and MACCE in patients with PCI for LMCA disease [18].

In summary, Hospital complications were higher in CABG patients compared to PCI for LMCA disease; however, MACCE after a 12-months follow-up was comparable between both groups.

Study limitations and future directions: The main limitation of the study is the lack of randomization. The baseline data differed significantly between groups. The difference in the baseline data could have affected the outcomes. Additionally, patient selection was based on the heart-team discussion, and patients were assigned to each group based on their suitability for the intervention. Therefore, the study is confounded by indication. Another limitation of the study is the small sample size compared to the published series. The results of the study should be interpreted according to these limitations. A future randomized clinical study is required to compare CABG and PCI in patients with LMCA disease in Egyptian patients.

Conclusions: PCI could be an alternative to CABG in patients with distal left main coronary artery disease with comparable periprocedural and 1-year risk.

Financial and non-financial relationships and activities of interest

None

REFERENCES

1. Hariom T. TCTAP C-155 Primary Angioplasty of Left Main with Cardiogenic Shock & Pulmonary Oedema with Intra Aortic Balloon Pump & Ventilatory Support. J Am Coll Cardiol [Internet]. 2019 Apr 23;73 [15_Supplement]: S217–S217. doi: 10.1016/j.jacc.2019.03.349
2. Park D-W, Ahn J-M, Park S-J, Taggart DP. Percutaneous coronary intervention in left main disease: SYNTAX, PRECOMBAT, EXCEL and NOBLE—combined cardiology and cardiac surgery perspective. Ann Cardiothorac Surg. 2018;7[4]:521. doi: 10.21037/acs. 2018.04.04
3. Zhang J, Jiang T, Hou Y, Chen F, Yang K, Sang W, *et al*. Five-year outcomes comparing percutaneous coronary intervention with drug-eluting stents versus coronary artery bypass grafting in patients with left main coronary artery disease: a systematic review and meta-analysis. Atherosclerosis. 2020; 308:50–6. doi: 10.1016/j. atherosclerosis. 2020.06.024.
4. Park DW, Park SJ. Percutaneous Coronary Intervention of Left Main Disease: Pre- and Post-EXCEL [Evaluation of XIENCE Everolimus Eluting Stent Versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization] and NOBLE [Nordic-Baltic-British Left Main Revascularization Study] Era. Circ Cardiovasc Interv. 2017 Jun; 10 [6]: e004792. doi: 10.1161/ CIRCINTERVENTIONS. 117.004792.
5. Ruel M, Kawajiri H, Glineur D, Grau J, Gaudino M, Verma S. Left main coronary stenosis: surgery still reigns. Curr Opin Cardiol. 2017 Sep; 32 [5]: 590-593. doi: 10.1097/ HCO 0000000000000434.
6. De Rosa S, Polimeni A, Sabatino J, Indolfi C. Long-term outcomes of coronary artery bypass grafting versus stent-PCI for unprotected left main disease: a meta-analysis. BMC Cardiovasc Disord. 2017 Sep 6; 17[1]: 240. doi: 10.1186/s12872-017-0664-5.
7. Thuijs DJFM, Kappetein AP, Serruys PW, Mohr FW, Morice MC, Mack MJ, *et al*; SYNTAX Extended Survival Investigators. Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial. Lancet. 2019 Oct 12; 394 [10206]:1325-1334. doi: 10.1016/S0140-6736[19]31997-X.
8. Mäkikallio T, Holm NR, Lindsay M, Spence MS, Erglis A, Menown IB, *et al*; NOBLE study investigators. Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis [NOBLE]: a prospective, randomised, open-label, non-inferiority trial. Lancet. 2016 Dec 3;388 [10061]: 2743-2752. doi: 10.1016/S0140-6736[16]32052-9.
9. Morice MC, Serruys PW, Kappetein AP, Feldman TE, Ståhle E, Colombo A, *et al*. Five-year outcomes in patients with left main disease treated with either percutaneous coronary intervention or coronary artery bypass grafting in the synergy between percutaneous coronary intervention with taxus and cardiac surgery trial. Circulation. 2014 Jun 10;129 [23]: 2388-94. doi: 10.1161/ CIRCULATIONAHA.113.006689.
10. Stone GW, Kappetein AP, Sabik JF, Pocock SJ, Morice MC, Puskas J, *et al*; EXCEL Trial Investigators. Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease. N Engl J Med. 2019 Nov 7;381[19]:1820-1830. doi: 10.1056/NEJMoa1909406.
11. Dudek D, Dziewierz A, Stone G, Wijns W. The year in cardiology 2018: coronary interventions. Eur Heart J. 2019 Jan 7;40[2]:195-203. doi: 10.1093/eurheartj/ehy882.
12. Park DW, Ahn JM, Park H, Yun SC, Kang DY, Lee PH, *et al*. PRECOMBAT Investigators. Ten-Year Outcomes After Drug-Eluting Stents Versus Coronary Artery Bypass Grafting for Left Main Coronary Disease: Extended Follow-Up of the PRECOMBAT Trial. Circulation. 2020; 141[18]:1437-1446. doi: 10.1161/ CIRCULATIONAHA. 120.046039.
13. Buszman PE, Buszman PP, Banasiewicz-Szkróbka I, Milewski KP, Żurakowski A, Orlik B, *et al*. Left Main Stenting in Comparison with Surgical Revascularization: 10-Year Outcomes of the [Left Main Coronary Artery Stenting] LE MANS Trial. JACC Cardiovasc Interv. 2016 Feb 22; 9[4]:318-327. doi: 10.1016/j.jcin.2015.10.044.
14. Seung KB, Park DW, Kim YH, Lee SW, Lee CW, Hong MK, *et al*. Stents versus coronary-artery bypass grafting for left main coronary artery disease. N Engl J Med. 2008 Apr 24; 358[17]:1781-92. doi: 10.1056/NEJMoa0801441.
15. Stone GW, Kappetein AP, Sabik JF, Pocock SJ, Morice MC, Puskas J, *et al*; EXCEL Trial Investigators. Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease. N Engl J Med. 2019 Nov 7; 381[19]:1820-1830. doi: 10.1056/NEJMoa1909406.
16. Baron SJ, Chinnakondepalli K, Magnuson EA, Kandzari DE, Puskas JD, Ben-Yehuda O, *et al*.; EXCEL Investigators. Quality-of-Life After Everolimus-Eluting Stents or Bypass Surgery for Left-Main Disease: Results from the EXCEL Trial. J Am Coll Cardiol. 2017 Dec 26; 70 [25]: 3113-3122. doi: 10.1016/j.jacc.2017.10.036.
17. Mahmood M, Altaf A, Salahuddin M, Khan M, Shah KA, Shah H. Prognosis of Percutaneous Intervention of a Left Main Coronary Artery Stenosis Without the Use of Intravascular Imaging. Cureus. 2018 Jun 22;10 [6]: e2857. doi: 10.7759/cureus.2857.
18. Capodanno D, Di Salvo ME, Cincotta G, Miano M, Tamburino C, Tamburino C. Usefulness of the SYNTAX score for predicting clinical outcome after percutaneous coronary intervention of unprotected left main coronary artery disease. Circ Cardiovasc Interv. 2009; 2 [4]: 302-8. doi: 10.1161/CIRCINTERVENTIONS. 108.847137.

2/2022

International Journal of Medical Arts

https://ijma.journals.ekb.eg/
Print ISSN: 2636-4174
Online ISSN: 2682-3780