Ten-Year Outcomes of Percutaneous Coronary Intervention Versus Coronary Artery Bypass Grafting for Patients with Type 2 Diabetes Mellitus Suffering from Left Main Coronary Disease: A Meta-Analysis

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ABSTRACT

Introduction: In this meta-analysis, we aimed to systematically compare the 10-year outcomes of percutaneous coronary intervention (PCI) versus coronary artery bypass grafting (CABG) in patients with type 2 diabetes mellitus (T2DM) suffering from left main coronary artery disease (LMCD).

Methods: Medical Literature Analysis and Retrieval System Online (MEDLINE), http://www.ClinicalTrials.gov, Excerpta Medica data-BASE (EMBASE), Cochrane Central, Web of Science, and Google scholar were searched for publications comparing 10-year outcomes of PCI versus CABG in patients with T2DM suffering from LMCD. Cardiovascular outcomes were considered as the clinical endpoints. Statistical analysis was carried out using RevMan software (version 5.4). Risk ratios (RR) with 95%

confidence intervals (CI) were used to represent the data after analysis.

Results: Eight studies (three randomized trials and five observational studies) with a total number of 3835 participants with T2DM were included in this analysis; 2340 participants were assigned to the PCI group and 1495 participants were assigned to the CABG group. Results of this analysis showed that mortality (RR 0.85, 95% CI 0.73–1.00; $P = 0.05$), myocardial infarction (RR 0.53, 95% CI 0.35–0.80; $P = 0.002$), repeated revascularization (RR 0.34, 95% CI 0.26–0.46; $P = 0.00001$), and target vessel revascularization (RR 0.26, 95% CI 0.18–0.38; $P = 0.00001$) were significantly higher with PCI when compared to CABG in these patients with diabetes and LMCD. Major adverse cardiac and cerebrovascular events were also significantly higher with PCI at 10 years (RR 0.67, 95% CI 0.49–0.92; $P = 0.01$). However, CABG was associated with a significantly higher risk of stroke (RR 2.16, 95% CI 1.39–3.37; $P = 0.0007$).

Conclusions: During a long-term follow-up time period of 10 years, PCI was associated with worse clinical outcomes compared to CABG in these patients with T2DM suffering from LMCD. However, a significantly higher risk of stroke was observed with CABG. This piece of information might be vital in order to carefully choose and prevent complications following revascularization in such patients.

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Key Summary Points

Why carry out this study?

Diabetes mellitus and cardiovascular disease often co-exist.

Until now, no meta-analysis has assessed 10-year outcomes of percutaneous coronary intervention (PCI) versus coronary artery bypass grafting (CABG) in patients with type 2 diabetes mellitus (T2DM) suffering from left main coronary disease (LMCD).

What was learned from this study?

During a long-term follow-up time period of 10 years, PCI was associated with worse clinical outcomes compared to CABG in these patients with T2DM suffering from LMCD. However, a significantly higher risk of stroke was observed with CABG in patients with T2DM at 10-year follow-up.

DIGITAL FEATURES

This article is published with digital features, including a summary slide, to facilitate understanding of the article. To view digital features for this article go to https://doi.org/10.6084/m9.figshare.13721461.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVD) often co-exist [1]. Silent myocardial infarction and left main coronary artery disease (LMCD) have often been observed as cardiovascular complications in patients with T2DM [2]. It should be highlighted that a significant lesion in the left main coronary artery is considered as the most prognostically important coronary lesion because this artery supplies blood to approximately 70% of the left ventricular myocardial tissues [3].

Fortunately, owing to advances in medical and invasive treatments, both coronary artery bypass surgery (CABG) and percutaneous coronary intervention (PCI) are possible revascularization techniques which have been used to prevent further cardiovascular events in these patients with T2DM [4].

Several meta-analyses have been carried out to compare PCI versus CABG [5, 6]. However, several limitations were also noted in those studies. For example, many meta-analyses were based on patients with multivessel coronary disease [7], while other meta-analyses were restricted to a follow-up time period of up to 5 years only [8]. In addition, only a few studies comprised specifically patients with T2DM.

Results from previous meta-analyses are controversial. A most comprehensive and updated meta-analysis which was published in 2017 demonstrated no difference between PCI and CABG for LMCD [9]. The authors stated that both revascularization procedures could be used to manage and treat patients. In another meta-analysis which was published during the same year, the authors concluded that PCI was non-inferior to CABG during the short term; however, CABG was more safe and effective in patients with LMCD during the long-term follow-up [10]. Still in 2017, another study demonstrated that PCI was associated with less major cardiac events during the short term but with increased cardiac events during the long term in comparison to CABG [11]. It was not clear whether the outcomes increased with increased duration of follow-up.

However, this trend changed in the year 2020 with upcoming new studies. A study comparing 5-year outcomes with PCI versus CABG for LMCD showed CABG to have a significant advantage over PCI in terms of major adverse cardiac and cerebrovascular events [12]. Nevertheless, all these studies were carried out in the general population with LMCD.

In this meta-analysis, we aimed to systematically compare the 10-year outcomes of PCI

versus CABG in patients with T2DM suffering from LMCD.

METHODS

Data Sources

Medical Literature Analysis and Retrieval System Online (MEDLINE), http://www.ClinicalTrials.gov, Excerpta Medica dataBASE (EMBASE), Cochrane Central, Web of science and Google scholar were searched for publications comparing 10-year outcomes of PCI versus CABG in patients with T2DM suffering from LMCD.

Search Strategy

The search terms or phrases included:

– Percutaneous coronary intervention versus coronary artery bypass grafting and left main coronary disease
– Percutaneous coronary intervention versus coronary artery bypass grafting and left coronary artery disease
– Percutaneous coronary intervention versus coronary artery bypass grafting and left main coronary disease and diabetes mellitus
– PCI, CABG, left main coronary disease
– Coronary stenting, coronary artery bypass grafting, and left main coronary disease

Inclusion and Exclusion Criteria

The inclusion criteria were:

– Studies that compared PCI versus CABG for LMCD
– Studies that consisted of participants with T2DM
– Studies that involved a follow-up time period of 10 years
– Studies that were published in English

The exclusion criteria were:

– Studies that compared PCI versus CABG for LMCD with a follow-up time period of less than 10 years
– Studies that did not comprise patients with T2DM
– Studies that were review articles or case studies
– Studies that were published in a different language apart from English
– Studies that were repeatedly obtained in different search databases, or duplicated studies involving the same trial

Definitions, Outcomes, and Follow-Up

Table 1 lists the outcomes which were reported in the original studies. All the studies consisted of patients with T2DM suffering from LMCD and had a follow-up time period of 10 years.

The outcomes which were analyzed in this study included:

– Mortality (cardiac and non-cardiac)
– Myocardial infarction (MI) including fatal and non-fatal MI
– Major adverse cardiac and/or cerebrovascular events (MACCEs) consisting of mortality (cardiac and all-cause mortality), fatal or non-fatal MI, fatal or non-fatal stroke (both ischemic and hemorrhagic) and/or revascularization
– Stroke including both ischemic and hemorrhagic
– Target vessel revascularization (TVR) defined as any repeated PCI or CABG due to re-stenosis or re-occlusion in/of the target vessel
– Repeated revascularization consisting of target lesion revascularization and TVR

Data Extraction and Methodological Quality Assessment

The authors independently extracted data. Any disagreement which occurred during the data extraction process was resolved by consensus.

The following data were extracted: the authors' names, the year of publication, the

Table 1 Outcomes reported

Studies	Outcomes reported	Type of participants	Follow-up time period (years)
Benedetto 2014 [16]	Mortality, revascularization, TVR	T2DM with LMCD	10
Goy 2008 [17]	Mortality, MI, TLR, TVR, MACEs	T2DM with LMCD	10
Lee 2020 [18]	Mortality, MACEs, TVR	T2DM with LMCD	10
Li 2017 [19]	Mortality, stroke, revascularization, MI, MACCEs	T2DM with LMCD	10
Merkle 2014 [20]	Mortality, revascularization	T2DM with LMCD	10
Park 2010 [21]	Mortality, MI, stroke, MACCEs, revascularization, TVR, TLR	T2DM with LMCD	10
Park 2020 [22]	MACCEs, mortality, MI, stroke, revascularization, stent thrombosis	T2DM with LMCD	10
Thuijs 2019 [23]	Mortality	T2DM with LMCD	10

TVR target vessel revascularization, *MI* myocardial infarction, *TLR* target lesion revascularization, *MACE* major adverse cardiac event, *MACCE* major adverse cardiac and/or cerebrovascular event, *T2DM* type 2 diabetes mellitus, *LMCD* left main coronary disease

total number of participants who were assigned to the PCI and CABG groups respectively, the cardiovascular outcomes which were reported, the duration of follow-up time period, the types of participants and the types of studies which were involved, the participants' enrollment time period, the baseline features of the participants including age, gender, and comorbidities, and the total number of events associated with each outcome.

The methodological quality assessment of the randomized trial was carried out on the basis of the recommendations of the Cochrane Collaboration [13], whereas the quality assessment of the observational cohorts was carried out using the Newcastle Ottawa Scale (NOS) [14]. A grade ranging from A to C was allotted to each study, whereby a grade A denoted a low risk of bias, and a grade C denoted a high risk of bias.

Statistical Analysis

The statistical analysis was carried out using the latest version of RevMan software (version 5.4). Heterogeneity was assessed by two statistical methods: (a) the Q statistic test whereby an analysis was considered to be statistically significant if the associated P value was less or equal to 0.05, and (b) the I^2 statistical test whereby the heterogeneity increased with an increasing I^2 value.

A fixed or a random statistical model was used during the analysis and based on the I^2 value. A fixed effect model was used if the I^2 value was less than 50%, whereas a random effect model was used if the I^2 value was above 50%.

Risk ratios (RR) with 95% confidence intervals (CI) were used to represent the data following analysis.

A sensitivity analysis was also carried out by an exclusion method and the result obtained was finally compared with the main result of this analysis to observe for any significant change. In addition, publication bias was also visually estimated by assessing funnel plots.

Compliance with Ethical Guidelines

This article was based on previously conducted studies and did not contain any study with human participants or animals performed by any of the authors.

RESULTS

Search Outcomes

The Preferred Reporting Items in Systematic Reviews and Meta-Analyses (PRISMA) guideline was followed [15]. A total number of 4312 publications were obtained. Following an initial check, 3798 publications were eliminated because of irrelevance. Therefore, 514 full-text articles were assessed for eligibility. The abstracts and titles were again carefully assessed.

On the basis of the inclusion and exclusion criteria, further eliminations were carried out: 293 articles were eliminated because they were based on a follow-up time period less than 10 years; 62 publications were meta-analyses, systematic reviews, or literature reviews; 21 articles were case studies; and 130 articles were duplicated studies. Finally, only eight studies [16–23] including three randomized trials and five observational cohorts were selected for this analysis as shown in Fig. 1.

Main and Baseline Features of the Studies

Eight studies with a total number of 3835 participants with T2DM were included in this analysis; 2340 participants were assigned to the PCI group whereas 1495 participants were assigned to the CABG group as shown in Table 2.

The baseline features of the participants are listed in Table 3. The mean age of the participants varied from 41.9 to 67.0 years. The study by Merkle [20] consisted of the eldest participants in the PCI group with a mean age of 67.0 years, whereas the study by Thuijs [23] consisted of the eldest participants who underwent CABG with a mean age of 65.0 years. In contrast, the study by Li [19] involved the youngest participants with a mean age of 41.9 years for those who were categorized in the PCI group and 42.0 years for those who were categorized within the CABG group. The mean percentage of male participants ranged between 60.0% and 90.9%. The study by Li [19] consisted of the highest number of male participants (> 90%) in both groups in comparison to the other studies. In addition, the percentages of participants with comorbidities such as hypertension (23.0–86.8%), dyslipidemia (33.6–81.5%), and current smoker (4.00–66.0%) have also been listed. As shown in Table 3, the study by Merkle [20] consisted of the highest percentage of patients with hypertension, whereas the study by Park [21] consisted of the lowest number of participants with hypertension. In addition, dyslipidemia was highest in the study by Thuijs [23], whereas cigarette smoking was lowest in this same study.

Main Results of this Analysis

Results of this current analysis showed that, during this 10-year follow-up time period, mortality (RR 0.85, 95% CI 0.73–1.00; $P = 0.05$), MI (RR 0.53, 95% CI 0.35–0.80; $P = 0.002$), repeated revascularization (RR 0.34, 95% CI 0.26–0.46; $P = 0.00001$), and TVR (RR 0.26, 95% CI 0.18–0.38; $P = 0.00001$) were significantly higher with PCI when compared to CABG in these patients with T2DM as shown in Fig. 2. MACCEs were also significantly higher with PCI at 10 years (RR 0.67, 95% CI 0.49–0.92; $P = 0.01$) as shown in Fig. 3. However, CABG was associated with a significantly higher risk of stroke (RR 2.16, 95% CI 1.39–3.37; $P = 0.0007$) in these patients with T2DM at 10 years as shown in Fig. 2.

The results are summarized in Table 4.

Sensitivity analysis led to consistent results throughout. There was little evidence of
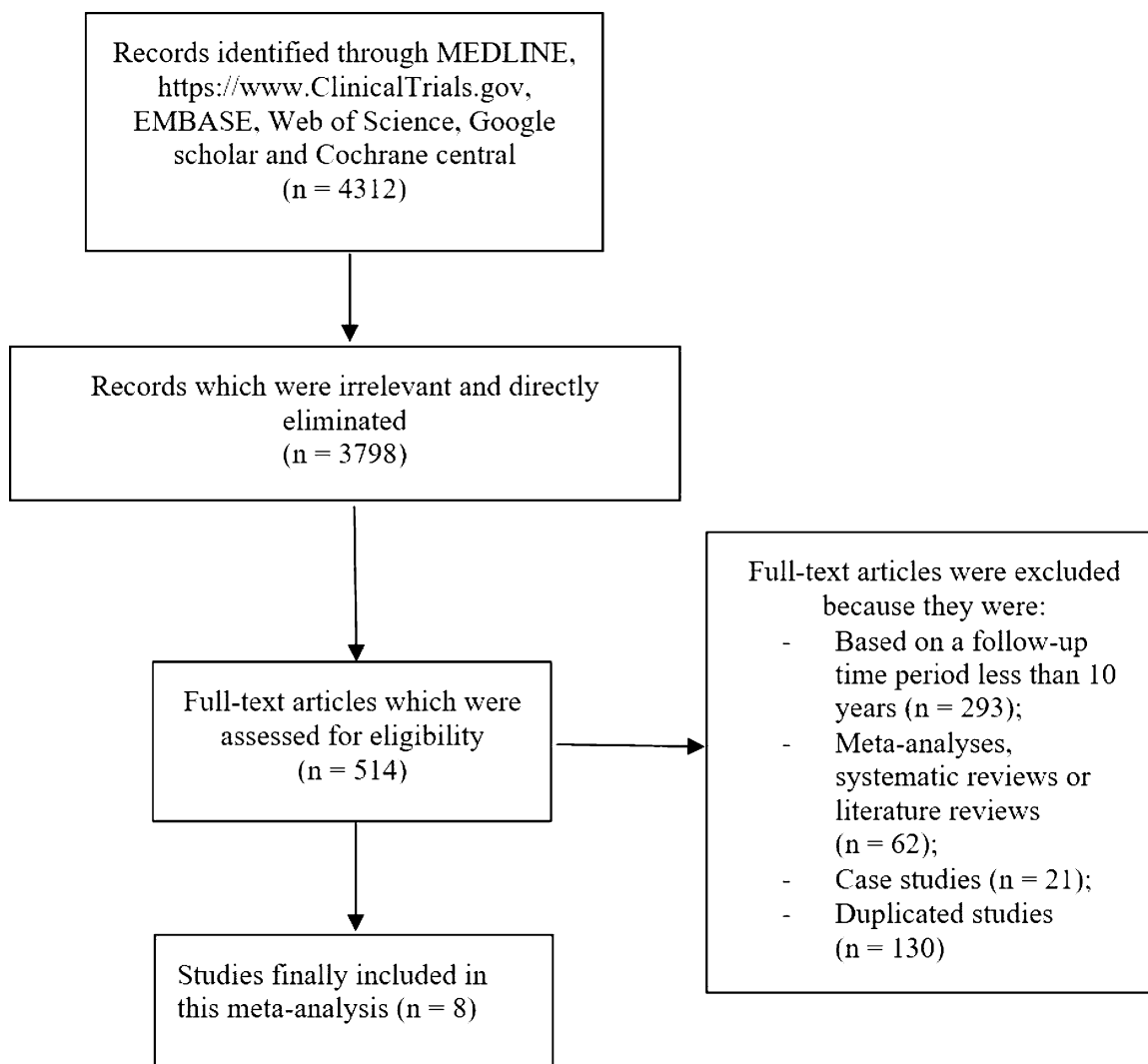
Records identified through MEDLINE, https://www.ClinicalTrials.gov, EMBASE, Web of Science, Google scholar and Cochrane central (n = 4312)

↓

Records which were irrelevant and directly eliminated (n = 3798)

↓

Full-text articles which were assessed for eligibility (n = 514) →

Full-text articles were excluded because they were:
- Based on a follow-up time period less than 10 years (n = 293);
- Meta-analyses, systematic reviews or literature reviews (n = 62);
- Case studies (n = 21);
- Duplicated studies (n = 130)

↓

Studies finally included in this meta-analysis (n = 8)

Fig. 1 Flow diagram showing the study selection

publication bias among the studies that assessed 10-year clinical outcomes between CABG and PCI according to visual assessment of the funnel plot shown in Fig. 4.

DISCUSSION

Currently available randomized and observational data comparing PCI with CABG for the treatment of LMCD lacks statistical power because of a limited number of patients. This analysis compared 10-year outcomes of PCI versus CABG in 3835 patients with T2DM suffering from LMCD.

A pooled analysis of individual patient-level data including patients with LMCD from the PRECOMBAT (Bypass Surgery Versus Angioplasty Using Sirolimus-Eluting Stent in Patients with Left Main Coronary Artery Disease) and SYNTAX (Synergy Between PCI with TAXUS and Cardiac Surgery) trials showed 5-year outcomes in 1305 participants to be similar, more specifically in mortality, MI, or stroke [24]. However, outcomes with even longer follow-up (10 years) were assessed in this current analysis.

Table 2 Main features of the studies

Studies	Type of study	Enrollment time period	No. of participants with T2DM assigned to PCI (n)	No. of participants with T2DM assigned to CABG (n)	Bias risk
Benedetto 2014	OC-retrospective	2001–2013	45	58	B
Goy 2008	RCT	1994–1998	7	8	B
Lee 2020	OC	2000–2006	327	395	B
Li 2017	OC	2006–2016	1501	517	B
Merkle 2014	OC-retrospective	2006–2012	17	31	B
Park 2010	OC-retrospective	2003–2004	21	82	B
Park 2020	RCT	2004–2009	102	90	B
Thuijs 2019	RCT	2005–2007	320	314	B
Total no of patients (n)			2340	1495	

T2DM type 2 diabetes mellitus, *PCI* percutaneous coronary intervention, *CABG* coronary artery bypass grafting, *OC* observational cohort, *RCT* randomized controlled trials
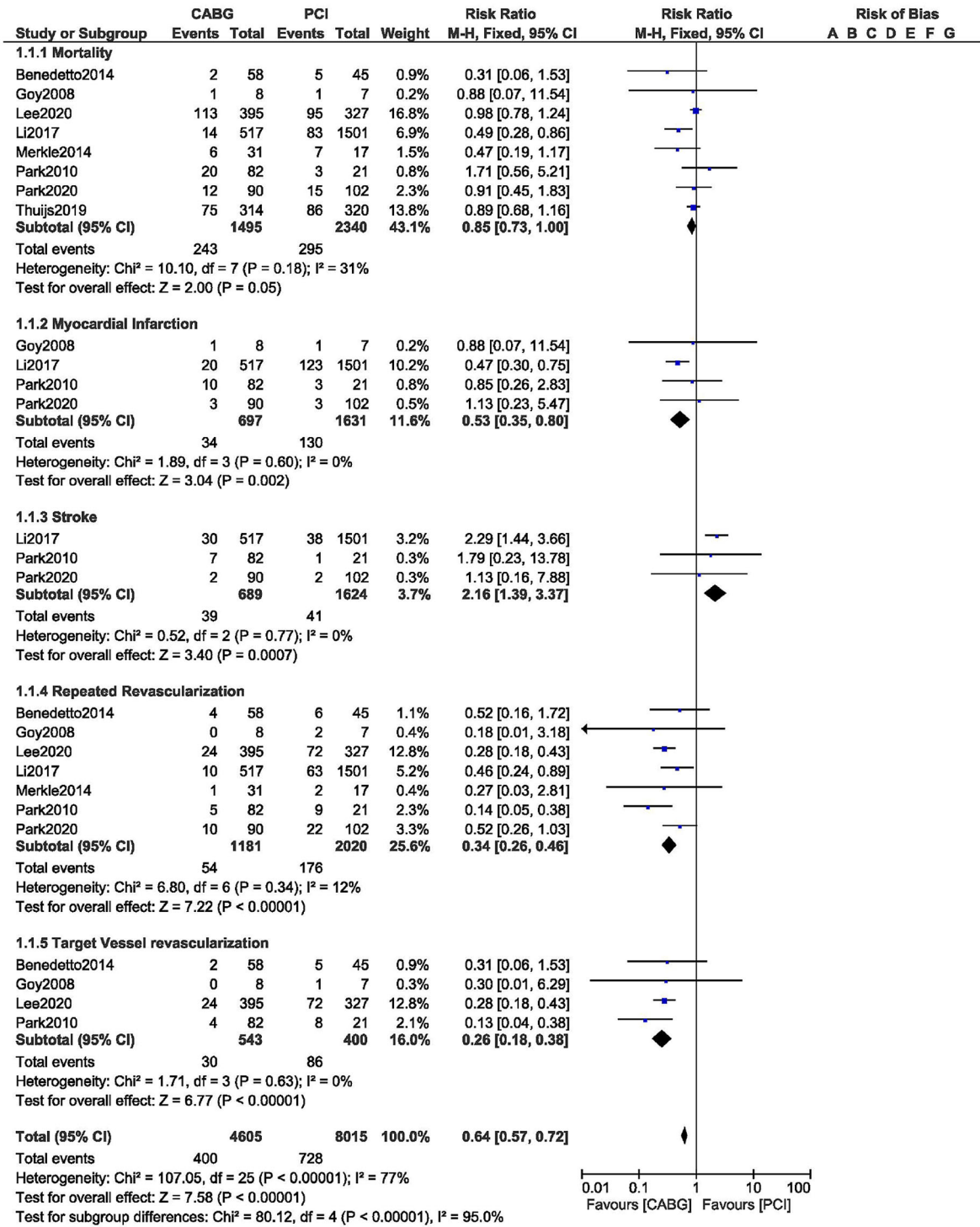
Table 3 Baseline features

Studies	Age (years) PCI/CABG	Males (%) PCI/CABG	HBP (%) PCI/CABG	DL (%) PCI/CABG	CS (%) PCI/CABG
Benedetto 2014		73.7/82.8	53.6/70.0	63.6/81.5	14.5/7.60
Lee 2020	63.5/63.6	69.7/74.4	60.2/57.7	33.6/35.2	22.0/27.1
Li 2017	41.9/42.0	90.1/90.9	60.8/63.5	–	66.0/65.3
Merkle 2014	67.0/64.0	78.0/84.0	73.7/86.8	41.4/79.2	20.2/23.6
Park 2010	55.1/60.7	60.0/74.4	23.0/50.0	34.0/46.0	36.0/27.2
Park 2020	61.8/62.7	76.0/77.0	54.3/51.3	42.3/40.0	29.7/27.7
Thuijs 2019	65.2/65.0	76.0/79.0	69.0/64.0	79.0/77.0	4.00/5.00

PCI percutaneous coronary intervention, *CABG* coronary artery bypass grafting, *HBP* high blood pressure, *DL* dyslipidemia, *CS* current smoker

Our current analysis showed that during a long-term follow-up time period of 10 years, CABG was associated with a significantly lower risk of mortality, MI, and repeated revascularization in patients with T2DM suffering from LMCD. However, it was associated with a significantly higher risk of stroke when compared to PCI.

Similarly, a recent meta-analysis comparing drug-eluting stents with CABG for patients with

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.1 Mortality						
Benedetto2014	2	58	5	45	0.9%	0.31 [0.06, 1.53]
Goy2008	1	8	1	7	0.2%	0.88 [0.07, 11.54]
Lee2020	113	395	95	327	16.8%	0.98 [0.78, 1.24]
Li2017	14	517	83	1501	6.9%	0.49 [0.28, 0.86]
Merkle2014	6	31	7	17	1.5%	0.47 [0.19, 1.17]
Park2010	20	82	3	21	0.8%	1.71 [0.56, 5.21]
Park2020	12	90	15	102	2.3%	0.91 [0.45, 1.83]
Thuijs2019	75	314	86	320	13.8%	0.89 [0.68, 1.16]
Subtotal (95% CI)		1495		2340	43.1%	0.85 [0.73, 1.00]
Total events	243		295			

Heterogeneity: Chi² = 10.10, df = 7 (P = 0.18); I² = 31%
Test for overall effect: Z = 2.00 (P = 0.05)

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.2 Myocardial Infarction						
Goy2008	1	8	1	7	0.2%	0.88 [0.07, 11.54]
Li2017	20	517	123	1501	10.2%	0.47 [0.30, 0.75]
Park2010	10	82	3	21	0.8%	0.85 [0.26, 2.83]
Park2020	3	90	3	102	0.5%	1.13 [0.23, 5.47]
Subtotal (95% CI)		697		1631	11.6%	0.53 [0.35, 0.80]
Total events	34		130			

Heterogeneity: Chi² = 1.89, df = 3 (P = 0.60); I² = 0%
Test for overall effect: Z = 3.04 (P = 0.002)

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.3 Stroke						
Li2017	30	517	38	1501	3.2%	2.29 [1.44, 3.66]
Park2010	7	82	1	21	0.3%	1.79 [0.23, 13.78]
Park2020	2	90	2	102	0.3%	1.13 [0.16, 7.88]
Subtotal (95% CI)		689		1624	3.7%	2.16 [1.39, 3.37]
Total events	39		41			

Heterogeneity: Chi² = 0.52, df = 2 (P = 0.77); I² = 0%
Test for overall effect: Z = 3.40 (P = 0.0007)

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.4 Repeated Revascularization						
Benedetto2014	4	58	6	45	1.1%	0.52 [0.16, 1.72]
Goy2008	0	8	2	7	0.4%	0.18 [0.01, 3.18]
Lee2020	24	395	72	327	12.8%	0.28 [0.18, 0.43]
Li2017	10	517	63	1501	5.2%	0.46 [0.24, 0.89]
Merkle2014	1	31	2	17	0.4%	0.27 [0.03, 2.81]
Park2010	5	82	9	21	2.3%	0.14 [0.05, 0.38]
Park2020	10	90	22	102	3.3%	0.52 [0.26, 1.03]
Subtotal (95% CI)		1181		2020	25.6%	0.34 [0.26, 0.46]
Total events	54		176			

Heterogeneity: Chi² = 6.80, df = 6 (P = 0.34); I² = 12%
Test for overall effect: Z = 7.22 (P < 0.00001)

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.5 Target Vessel revascularization						
Benedetto2014	2	58	5	45	0.9%	0.31 [0.06, 1.53]
Goy2008	0	8	1	7	0.3%	0.30 [0.01, 6.29]
Lee2020	24	395	72	327	12.8%	0.28 [0.18, 0.43]
Park2010	4	82	8	21	2.1%	0.13 [0.04, 0.38]
Subtotal (95% CI)		543		400	16.0%	0.26 [0.18, 0.38]
Total events	30		86			

Heterogeneity: Chi² = 1.71, df = 3 (P = 0.63); I² = 0%
Test for overall effect: Z = 6.77 (P < 0.00001)

Study or Subgroup	CABG Events	Total	PCI Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Total (95% CI)		4605		8015	100.0%	0.64 [0.57, 0.72]
Total events	400		728			

Heterogeneity: Chi² = 107.05, df = 25 (P < 0.00001); I² = 77%
Test for overall effect: Z = 7.58 (P < 0.00001)
Test for subgroup differences: Chi² = 80.12, df = 4 (P < 0.00001), I² = 95.0%

Scale: 0.01 0.1 1 10 100 — Favours [CABG] Favours [PCI]

Risk of Bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

◀**Fig. 2** Ten-year outcomes of PCI versus CABG in patients with T2DM and left main coronary disease

diabetes and LMCD showed that PCI was associated with a significantly higher risk of all-cause death, MI, and repeated revascularization compared to CABG [25]. In addition, similar to our current result, the study also showed CABG to be associated with a higher risk of stroke in these patients with T2DM.

Further supporting our current results, in another recently published meta-analysis based on patients with non-insulin-treated T2DM, the authors demonstrated CABG to be associated with significantly lower mortality rate, MI, repeated revascularization, and MACCEs in comparison to PCI for LMCD [26]. However, PCI was associated with a significantly lower risk of stroke when compared to CABG. When we classified T2DM according to insulin and non-insulin therapy, another meta-analysis based on patients with insulin-treated T2DM
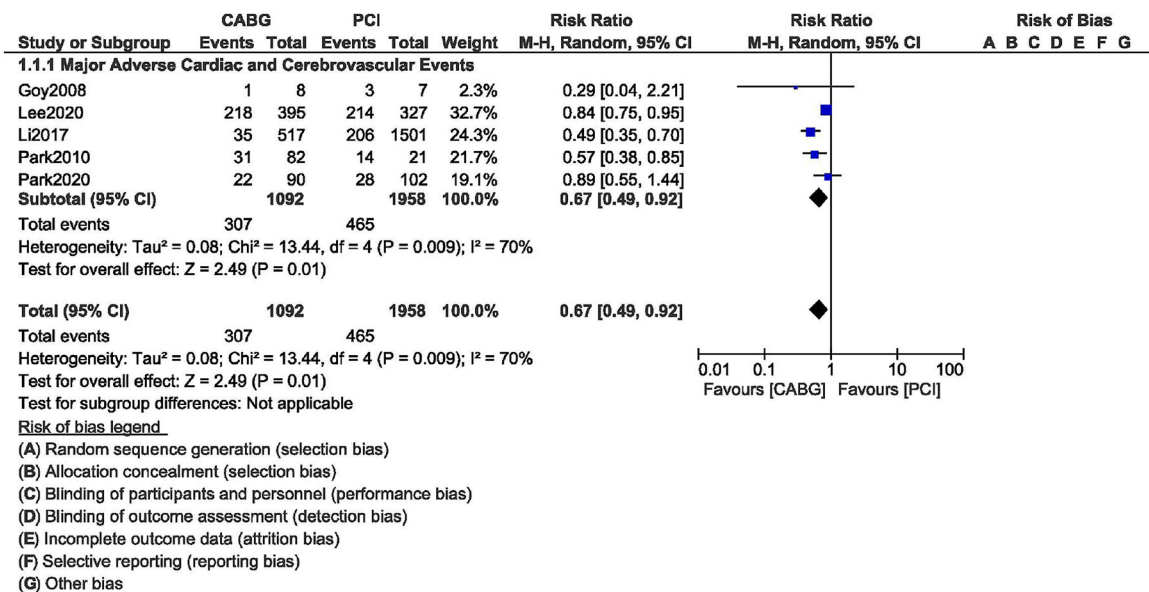
Fig. 3 Ten-year major adverse cardiac and cerebrovascular events between PCI versus CABG in patients with T2DM and left main coronary disease

Table 4 Results of this analysis

Outcomes	RR with 95% CI	P value	I^2 value (%)
Mortality	0.85 [0.73–1.00]	0.05	31
Myocardial infarction	0.53 [0.35–0.80]	0.002	0
Stroke	2.16 [1.39–3.37]	0.0007	0
MACCEs	0.67 [0.49–0.92]	0.01	70
Repeated revascularization	0.34 [0.26–0.46]	0.00001	12
Target vessel revascularization	0.26 [0.18–0.38]	0.00001	0

RR risk ratios, *CI* confidence intervals, *MACCEs* major adverse cardiac and cerebrovascular events
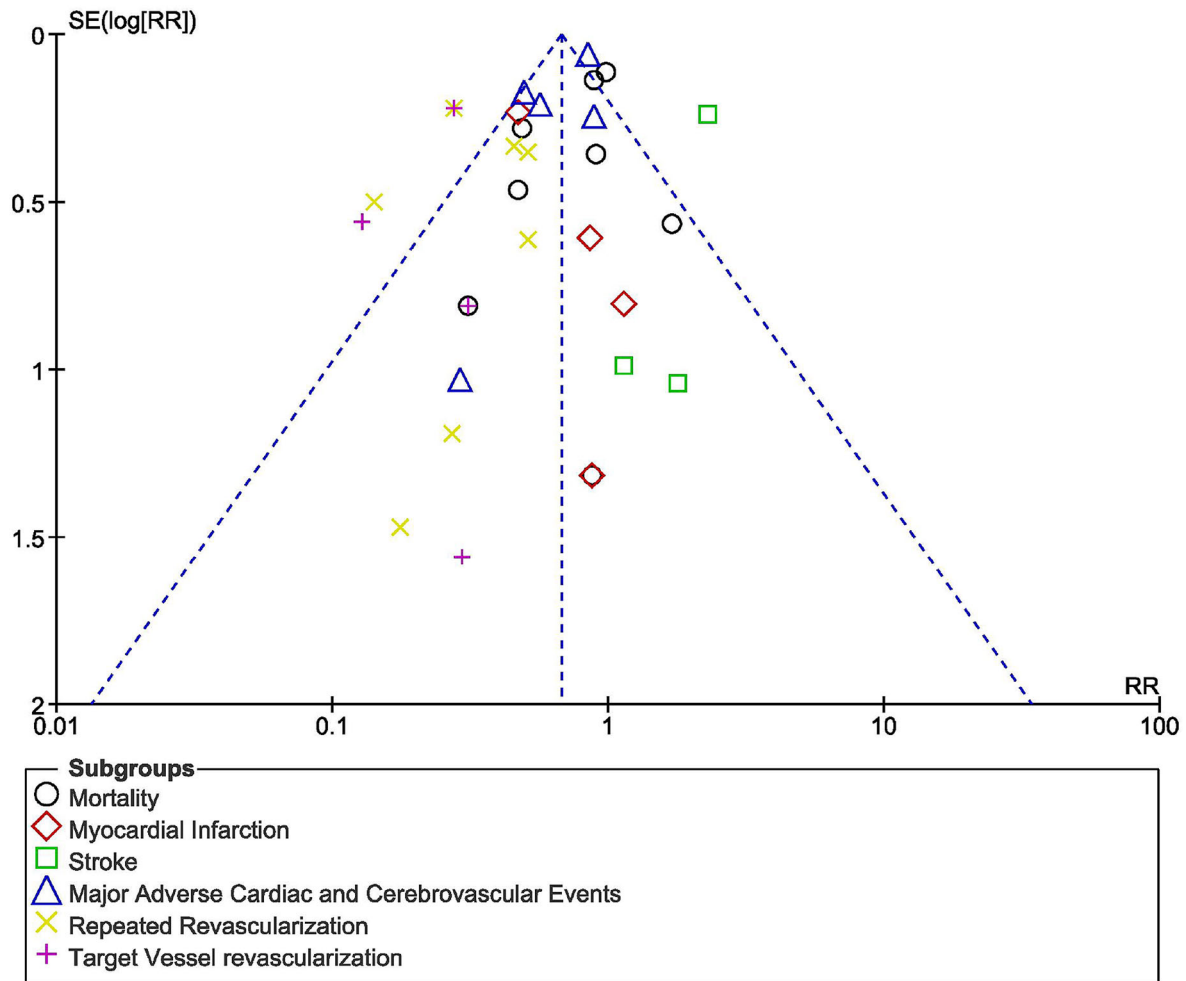
Fig. 4 Funnel plot for visualization of potential publication bias

favored CABG with significantly lower mortality, MI, and MACCEs [27]. However, the patients were studied for a duration of only 1 year or more. The study also showed CABG to be associated with a higher stroke rate in comparison to PCI; however, even if their result was not statistically significant, this current result showed significant outcome for stroke during a longer follow-up time period of 10 years.

According to the Society of Thoracic Surgeons CABG Adult Cardiac Surgery Database (STS ACSD), there is a 1.3% incidence of stroke after CABG [28]. Our analysis showed CABG to be associated with a significantly increased risk of stroke in patients with T2DM. Several studies have shown cerebral atherosclerosis to be associated with a higher risk of post-CABG stroke

[29]. Dyslipidemia in most of our participants could have resulted in undiagnosed cerebral atherosclerosis which might have finally increased the risk of stroke after CABG. Another reason for the occurrence of stroke after CABG could be due to the manipulation of the atherosclerotic aortic arch which could result in early embolism, thereby increasing the chances for stroke immediately after CABG [30]. Stresses including physical trauma and inflammation might trigger plaque rupture or platelet aggregation in patients with advanced atherosclerosis in the cervical and cranial vessels. Thus, stress post CABG might cause delayed embolism in patients with severe coronary artery disease [31]. Another reason for the increased in post-CABG stroke could be due to atrial fibrillation,

MI, and coagulopathy after the surgery [30]. Moreover, CABG is indicated in severe coronary artery disease whereby PCI would not be useful, for example, in patients with severe LMCD, triple-vessel diseases, with associated conditions such as dialysis dependency, severe chronic obstructive pulmonary disease, and so on [32]. Nevertheless, when on-pump and off-pump CABG were considered, an 11-year statewide analysis from New Jersey showed on-pump CABG to be associated with significantly higher stroke compared to off-pump CABG [33].

This meta-analysis is a pooled analysis comparing 10-year outcomes of CABG versus PCI in patients with T2DM and LMCD. Long-term outcomes of CABG versus PCI in patients with T2DM and LMCD have seldom been analyzed, and most of the previously published meta-analyses reported outcomes only for up to 5 years. Including a total number of 3835 participants with diabetes and LMCD, this analysis already shows a positive difference when compared to other respective original studies or other meta-analyses.

Limitations

This analysis also has limitations. First of all, the original studies which were included in this analysis consisted of patients with T2DM and different grades of CVD: stable coronary artery disease, acute coronary syndrome, coronary artery disease, and chronic kidney disease. However, all of the studies consisted of participants with LMCD. The duration of diabetes mellitus was not reported and this could be another limitation of this study. Another limitation was the fact that participants which were extracted from randomized trials and observational cohorts were both mixed together and analyzed. Also, one important outcome, more specifically stent thrombosis, was not reported in the original studies and therefore could not be assessed in our current analysis. Furthermore, because patients with T2DM were seldom classified into insulin-treated and non-insulin treated T2DM, we could not carry out any separate analysis based on 10-year outcomes in patients with or without insulin treatment in

these patients. Finally, the effect and types of antidiabetic medications or the duration of antidiabetic drugs and their effects on the outcomes were ignored in this analysis.

CONCLUSIONS

During a long-term follow-up time period of 10 years, PCI was associated with worse clinical outcomes compared to CABG in these patients with T2DM suffering from LMCD. However, a significantly higher risk of stroke was observed with CABG. This piece of information might be vital in order to carefully choose and prevent complications following revascularization in such patients.

ACKNOWLEDGEMENTS

Mohamad Anis Ahmed have nothing to disclose.

Compliance with Ethical Guidelines. This meta-analysis is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Data Availability. All data generated or analyzed during this study are included in this published article. References of the original papers involving the data source which have been used in this paper have been listed in the main text of this current manuscript. All data are publicly available in electronic databases.

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