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Coronary Artery Bypass Grafting (CABG) versus Percutaneous Coronary Intervention (PCI) in treatment of left main coronary artery disease: A review

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REVIEW

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ABSTRACT

Background
Coronary artery bypass graft surgery (CABG) has been widely used for left main coronary artery disease (LMCAD). Percutaneous coronary intervention (PCI) has become an option for this condition.

Aims
To summarize the current evidence that compare between CABG *vs.* PCI in regards to cardiac death, stroke, and myocardial infarction.

Methods
We searched randomized trials of treatment of LMCAD with PubMed, Google Scholar, and EBSCO.

Results
Five randomized studies were retrieved, which compared the efficacy between CABG *vs.* PCI in treatment of LMCAD.

Conclusion
PCI may be reasonable management of patients with LM stenosis involving distal bifurcation or with coexisting multivessel disease.

Key Words
Coronary Artery Bypass Grafting (CABG), Percutaneous Coronary Intervention (PCI), coronary artery disease

What this study adds:

1. What is known about this subject?
In all patient with significant left main coronary artery stenosis (more than 50 per cent narrowing), GABC in conjugation with other lifestyle modification are considered the optimal therapy.

2. What new information is offered in this study?
The current review summarizes the available evidence that compare CABG to PCI in left main coronary artery disease.

3. What are the implications for research, policy, or practice?
PCI may be reasonable in management of patients with LM stenosis involving distal bifurcation or with coexisting multivessel disease. Recent RCTs in LMCAD support PCI as

management option in select patients with less complex LM anatomy.

Background

Patients with left main coronary artery Stenosis, they require medical intervention by revascularization using Coronary artery bypass graft surgery (CABG) mainly.[1] But in the recent years due to the high improvement of stent technology, percutaneous coronary interventions (PCIs) can also be another alternative option.[2,3] Many studies were conducted to compare CABG to PIC combined with drug-eluting stent, it showed comparable results regarding, myocardial infarction, stroke or death.[4] So the recent recommendations mention PCIs as an efficient alternative to CABG.[5] but the long term effect of this should be taken into considerations as few data are available about it.

Method

A systematic electronic search was conducted including the Pub Med, Google Scholar, and EBSCO using the following terms in different combinations Coronary Artery Bypass Grafting, Percutaneous Coronary Intervention and Left main Coronary Artery Disease. A full text randomized controlled trials that available in English, aimed to compare between CABG *vs.* PCI in regards to cardiac death, stroke, and myocardial infarction were included. Studies published in abstract form only were excluded. The abstracts and full texts were screened independently by two authors (WA, BK). The authors extracted the data, and then the author's names, year and region of publication, the study type, period of study, and the result were reported. (Table1).

Results

The search of the mentioned databases returned a total of 43 studies that were included for title screening. 32 of them were included for abstract screening, which lead to the exclusion of 19 articles. The remaining 13 publications full texts were reviewed. The full-text revision lead to the exclusion of 7 studies, and 5 were enrolled for final data extraction (Table 1).[6-9]

Discussion

Coronary artery bypass grafting (CABG) results have also enhanced using different arterial grafts, minimally invasive procedures and optimal surgical therapy. Although the new technologies decrease the variations between CABG and PCI, the need for revascularization after PCI is more common than CABG.[10]

Several considerations should have an effect on the patient's recommendations on the most effective revascularization process, and the existence of multivessel diseases such as diabetes should benefit from CABG. A showed that mortality was still similar in the left main coronary artery in 10 year follow-up in patients underwent PCI and CABG, whereas patients with multivessel disease had lower mortality after CABG.[11] Previous study reported that left main coronary artery patients managed by PCI or CABG do not show significant difference in early or 5-year mortality. Higher stroke rates at 30 days and 1 year was associated with CABG, while increase in MI and need for repeat revascularization at 5 years was associated with PCI.[12]

With the introduction of drug eluting stents, the field of international cardiology has improved significantly and to a lesser degree, there have been similar developments in cardiac surgery. Considering a higher rate of repeat revascularization even with use of second-generation drug-eluting stents for ULMCA stenosis, repeated repeat revascularization may be an intrinsic limitation in stent-related therapy.[13] Recently published studies comparing drug eluting stenting and CABG reported that unprotected left main coronary artery disease treatment with PCI results in decreased or similar rates of cardiovascular events.[14-17] SYNTAX trial, PCI was performed with new generation of drug eluting stents have shown improved up to 3 years of follow up outcomes, in-cluding reduction of all cause death.[18]

In a SYNTAX study; 56 per cent of patients with left main coronary artery disease who underwent PCI in had a distal left main lesion.[19] EXCEL study found that 80.5 per cent of distal lesion patients that involved a bifurcation or trifurcation lesion, and subgroup analyses according to the presence or absence of a distal bifurcation or trifurcation lesion found no significant interaction which suggest that PCI can alternate CABG in patients with complex diseases and non-complex left main lesions.[20]

Conclusion

Left main coronary artery disease (LMCAD) represents greater prognostic risk as a result of large myocardial territory at risk, depending mostly on superiority of the left coronary circulation. PCI may be reasonable in management of patients with LM stenosis involving distal bifurcation or with coexisting multivessel disease. Recent RCTs in LMCAD support PCI as management option in select patients with less complex LM anatomy.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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Table 1: Author, country, year of publication, methodology and results

Author–Year	Methods	Results
Holm et al.[6] **(2019).**	**Study design:** prospective, randomised, open-label, non-inferiority trial. **Intervention:** PCI with first-generation paclitaxel-eluting stents (n= 598)) versus coronary artery bypass grafting (n=603). **Follow-up duration**: 10 years. **Follow-up duration:** 5 years. **Primary endpoint:** major adverse cardiac or cerebrovascular events (MACCE).	**Study Participants:** 1201 **Result:** The 5-year estimates of MACCE were 28% (165 events) for PCI and 19% (110 events) for CABG. Furthermore, CABG was found to be superior to PCI for the primary composite endpoint (p=0.0002). All-cause mortality was estimated in 9% after PCI versus 9% after CABG (p=0.68); non-procedural myocardial infarction was estimated in 8% after PCI versus 3% after CABG (p=0.0002); and repeat revascularisation was estimated in 17% after PCI versus 10% after CABG (p=0.0009). **Conclusion:** In revascularisation of left main coronary artery disease, PCI was associated with an inferior clinical outcome at 5 years compared with CABG.
Boudriot et al.[7] **(2011).**	**Study design:** Prospective, multicenter, randomized trial. **Intervention:** Drug-eluting stenting (n=100) or CABG using predominantly arterial grafts (n=101). **Follow-up duration:** 12 months **Primary endpoint:** Major Adverse Cardiac or Cerebrovascular Event (MACCE)	**Study Participants:** 201 **Result:** The combined primary end point was reached in 13.9% of patients after surgery, as opposed to 19.0% after PCI (p=0.19 for noninferiority). The combined rates for death and myocardial infarction were comparable (surgery, 7.9% *vs.* stenting, 5.0%; noninferiority p=0.001), but stenting was inferior to surgery for repeat revascularization (5.9% *vs.* 14.0%; noninferiority p=0.35). **Conclusion:** In patients with ULM stenosis, PCI with sirolimus-eluting stents is inferior to CABG at 12-month follow-up.
Giustino et al.[8]	**Study design:** Multicentre, open-label, randomised controlled trial. **Intervention:** Drug-eluting stenting (n=948) or CABG using predominantly arterial grafts (n=957)).	**Study Participants:** 1905 **Result:** During 3-year follow-up, there were 346 repeat revascularization procedures among 185 patients. PCI was associated with higher rates of any repeat revascularization (12.9% *vs.* 7.6%; p=0.0003).

(2020).	**Follow-up duration:** 3 years. **Primary endpoint:** Major Adverse Cardiac or Cerebrovascular Event (MACCE)	**Conclusion:** In the EXCEL trial, repeat revascularization during follow-up was performed less frequently after CABG than PCI and was associated with increased mortality after both procedures.
Ahn J-M, et al.[9] **(2015).**	**Study design:** Prospective, open-label, randomized trial. **Intervention:** PCI with a sirolimus-eluting stent (n=300) or CABG (n=300). **Follow-up duration:** 5 years **Primary endpoint:** Major Adverse Cardiac or Cerebrovascular Event (MACCE)	**Study Participants:** 600 **Result:** At 5 years, MACCE occurred in 52 patients in the PCI group and 42 patients in the CABG group (p=0.26). The two groups did not differ significantly in terms of death from any cause, myocardial infarction, or stroke as well as their composite (p=0.66). **Conclusion:** There is no significant difference regarding the rate of MACCE between patients who underwent PCI with a sirolimus-eluting stent and those who underwent CABG.
Thuijs et al.[10] **(2019).**	**Study design:** Multicentre, randomised controlled trial. **Intervention:** PCI with first-generation paclitaxel-eluting stents (n=903) versus coronary artery bypass grafting (n=897). **Follow-up duration**: 10 years. **Primary endpoint:** 10-year all-cause death.	**Study Participants:** 1800 **Result:** At 10 years, 244 (27%) patients had died after PCI and 211 (24%) after CABG (p=0.092). Among patients with three-vessel disease, 151 (28%) of 546 had died after PCI versus 113 (21%) of 549 after CABG, and among patients with left main coronary artery disease, 93 (26%) of 357 had died after PCI versus 98 (28%) of 348 after CABG. **Conclusion:** At 10 years, no significant difference existed in all-cause death between PCI using first-generation paclitaxel-eluting stents and CABG.