Outcomes of revascularization strategies in ischemic heart failure: percutaneous coronary intervention versus coronary artery bypass grafting

Résultats des stratégies de revascularisation dans l'insuffisance cardiaque ischémique : intervention coronaire percutanée versus pontage aorto-coronarien

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Summary

Introduction : Revascularization in heart failure remains debated. While coronary artery bypass graft (CABG) is well established in guidelines, percutaneous coronary interventions(PCI) is more controversial.

Objective: This study aimed to evaluate short- and mid-term outcomes after PCI and CABG in patients with reduced ejection fraction (HFrEF).

Methods: We conducted a retrospective study (Jan 2020–Sept 2023) including patients with LVEF ≤ 40 % and multivessel coronary disease treated by PCI or CABG. The primary endpoint was 30-day and mid-term major adverse cardiac and cerebrovascular events (MACE).

Results: The study included 120 patients (80 PCI, 40 CABG). LVEF was lower in the PCI group (32.9 ± 5.6% vs 35.4 ± 4.1%, p=0.014), while three-vessel disease (80% vs 41.3%, p<0.001) and anatomical complexity (45% vs 12.5%, p<0.001) were higher in CABG. Complete revascularization was more frequent with CABG (90% vs 46.3%, p<0.001). At 30 days, MACE was lower in PCI (7.5% vs 30%, p=0.001), driven by higher mortality after CABG (27.5% vs 6.3%, p=0.001). Median follow-up was 30 months; overall MACE was similar (45% vs 50%, p=0.605), though PCI had lower mortality but higher rates of MI and target vessel revascularization (TVR).

Conclusion: In-hospital mortality after CABG in HFrEF patients was higher, negatively affecting long-term outcomes and favoring PCI for all-cause mortality, whereas CABG was superior to PCI for recurrent MI and target vessel revascularization.

Keywords

Heart failure; Percutaneous coronary intervention; Coronary artery bypass graft;Comparison

Résumé

Introduction: La revascularisation chez les insuffisants cardiaques reste un sujet de débat. Si le pontage aorto-coronarien (PAC) est bien établi dans les recommandations, l'intervention coronaire percutanée (ICP) est plus controversée.

Objectif: Évaluer les résultats cliniques à court et moyen terme après ICP ou PAC chez des patients à fraction d'éjection réduite (FEVGr)

Méthodes : Étude rétrospective (janv. 2020–sept. 2023) incluant des patients FEVG ≤ 40 % avec maladie coronaire tritronculaire traités par ICP ou PAC. Critère principal : événements cardiaques et cérébrovasculaires majeurs (MACE) à 30 jours à et moyen terme.

Résultats : L'étude a inclus 120 patients : 80 dans le groupe ICP et 40 dans le groupe PAC. La FEVG était plus basse dans le groupe ICP (p = 0,014), tandis que la maladie tritronculaire et la complexité anatomique étaient plus fréquentes dans le groupe PAC (p < 0,001). Le PAC permettait plus souvent une revascularisation complète (p < 0,001). À 30 jours, les MACE étaient moins fréquents après ICP (p = 0,001), principalement en raison d'une mortalité plus élevée après PAC (p = 0,001). Après un suivi médian de 30 mois, les MACE étaient comparables entre les groupes (p = 0,605), l'ICP étant associée à une mortalité plus faible mais à davantage d'infarctus et de revascularisations du vaisseau cible.

Conclusion : La mortalité hospitalière après PAC chez les patients à FEVGr a été plus élevée, défavorisant le PAC pour la mortalité toutes causes, tandis que ce dernier restait supérieur à l'ICP pour les récidives d'IDM et la revascularisation du vaisseau cible.

Mots-clés

Insuffisance cardiaque ; Intervention coronarienne percutanée ; Pontage coronarien; Comparaison

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INTRODUCTION

Heart failure (HF) is a complex clinical syndrome. Its prevalence ranges between 1% and 3% in the general adult population(1). It is projected to increase substantially due to the availability of better diagnostic tools and medical treatments prolonging life after diagnosis of HF. Coronary artery disease (CAD) is the most common cause of HF with reduced ejection fraction (HFrEF)(1).

In association with guideline-directed medical therapy, myocardial revascularisation is recommended in this high-risk population(2) with the aim of an improved survival and quality of life. Coronary artery bypass graft (CABG) is the standard approach of myocardial revascularization in current guidelines with differences on strength of recommendation (2).However, no RCT has compared Percutaneous Coronary Intervention (PCI) to CABG in this specific patient population (3) proving the superiority of CABG over PCI.

PCI has advantages over CABG including more rapid recovery, fewer complications and lower cost which make it an interesting revascularization technique of HFrEF patients especially for high-risk clinical features(4). The study aimed to evaluate and compare short- and mid-term clinical outcomes of PCI versus CABG in patients with left ventricular dysfunction, acknowledging that guideline-based practices may have variable applicability in our population and healthcare setting.

METHODS

This retrospective, monocentric study was conducted at La Rabta Hospital from January 2020 to September 2023. It included patients with LVEF ≤40% undergoing PCI or CABG for multivessel coronary artery disease (≥70% stenosis in ≥2 major epicardial arteries, including left main (LM) or proximal left anterior descending artery(LAD)). Patients were excluded if they had prior cardiac surgery, ST-segment elevation myocardial infarction (STEMI) requiring urgent revascularization, cardiogenic shock, concomitant valve surgery, unsuitable vascular anatomy, incomplete PCI due to non-viable myocardium, or lack of follow-up.

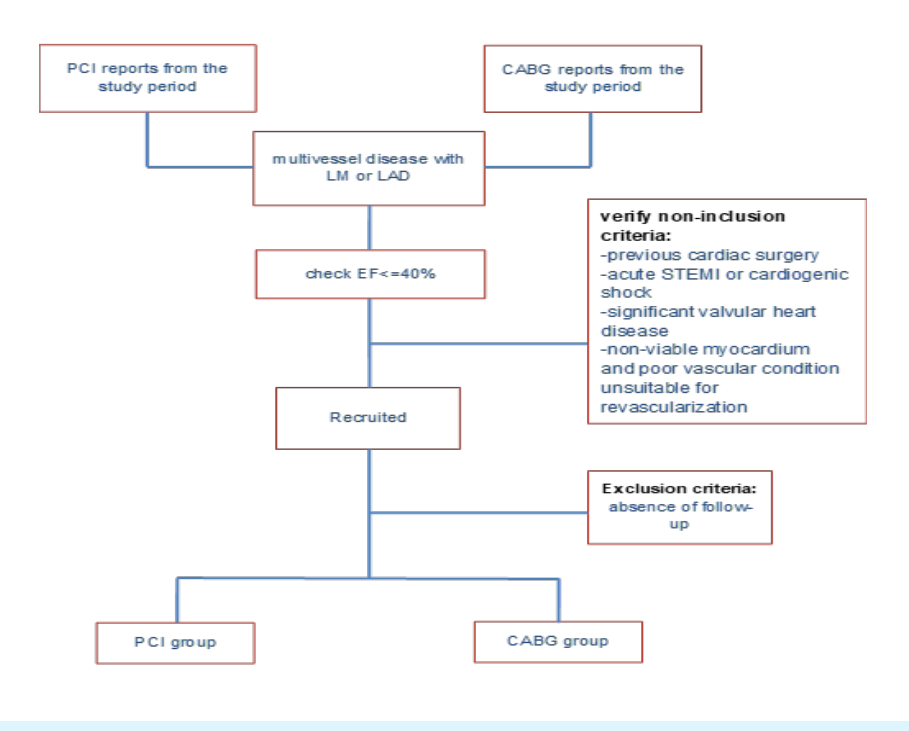

Figure 1. Fibroelastoma on the mitral leaflets free edge and chordae.

Abbreviations: CABG: coronary artery bypass graft, EF: ejection fraction, LAD: left anterior descending artery, LM: left main, PCI: percutaneous coronary intervention, STEMI: ST-segment elevation myocardial infarction

Endpoints

The primary endpoint of the study was to determine the incidence of major adverse cardiac and cerebrovascular events (MACE) including all cause death, acute myocardial infarction (MI), target vessel revascularization (TVR), stroke and hospitalisation for HF in the short and mid-term in PCI and CABG groups.

Follow up

Follow-up was conducted using hospitalization records, outpatient visits, and phone calls, with evaluations at 1 month and every 6 months for at least 12 months.

Short term MACE were defined as any cardiovascular event occurring during the first 30 days after the procedure including all cause death, cardiovascular death, hospitalisation for HF, MI, angina and repeat revascularization and stroke events.

Long term MACE were defined as cumulative cardiovascular events occurring since procedure to the last follow-up.

Statistical analysis

Qualitative variables were presented as counts and percentages, quantitative variables as means ± SD or medians. Comparisons used Chi-square/Fisher's Exact tests or t-tests. Prognostic factors were explored with univariate analysis, and survival was assessed using Kaplan–Meier curves with Log-rank tests. Statistical significance was set at $p < 0.05$.

RESULTS

Population

Thestudy population included 120 patients, with 40 undergoing CABG and 80 undergoing PCI. The mean age of our population was 63.2 ± 9.4 years old with a male predominance (80%). Acute coronary syndrome was the main presentation (84.1%).

At admission, 36% of patients presented with acute left heart failure. The mean LVEF was 33.75 ± 5.2%, ranging from 20% to 40%, with 40 patients (33.3%) exhibiting severe LVEF ≤30%. Six patients (5%) were classified as high risk for in-hospital mortality according to EuroSCORE II (≥8%) and four patients (3.3%) had a high 30-day operative mortality risk according to STS score (≥8%).

Percutaneous coronary intervention data

Median delay of a PCI procedure was 5 days ranging from 0 to 360 days.

Radial access was the standard approach in our practise and it accounted for 66 (82.5%) cases. Most patients (77.5%) had one revascularization procedure. Only 23 (28.8%) patients had complete revascularization on a single procedure.

Most bifurcation lesions were treated with provisional stenting. Only 3 patients (3.75%) had a two-stent technique which was a T with small protrusion (TAP) stenting. Rotational atherectomy was used in 1 case (1.25%).

Coronary artery bypass graft data

Median surgical delay was 33.5 days with extremes going from 2 days to 231 days.

All CABG procedures in our study were done on cardiopulmonary bypass(CPB).

Average number of grafts per patient was 3± 0.67. Most patients (57.5%) had 3 grafts per intervention.All Arterial CABG was performed in 3 cases (7.5%) of cases.

Left internal mammary artery (LIMA) grafts were used in 100% of cases and implanted on LAD in all cases. LIMA on LAD only represented 33(82.5%) of cases. Sequential bypass on LAD and diagonal arteries was performed in 7 cases (17.5%). (RIMA) was used in addition to LIMA in 8 cases (20%) and implanted on OM in all cases.

After CPB, 77.5% of patients required low-dose inotropes and vasoactive agents, while 22.5% needed high-dose circulatory support; 12.5% also required intra-aortic balloon pump. Fast-track extubation (≤8 h) was achieved in 47.5%, and prolonged ventilation (>48 h) was needed in 12.5%. Median intensive care unit (ICU) stay was 5 days, with a median catecholamine duration of 3 days. The most common postoperative complications were hospital-acquired infections (40%, mostly pulmonary), pulmonary edema (35%), acute kidney injury (27.5%, 10% requiring dialysis), and atrial fibrillation (25%). One patient (2.5%) developed acute lower limb ischemia. Surgical revision was performed in 15% of patients, primarily for mediastinitis or postoperative hemorrhage.

Comparative subgroup analysis: Clinical and procedural characteristics

The two groups were generally comparable in demographics, cardiovascular risk factors, and clinical presentation. The LVEF was lower in the PCI group compared to the CABG group (32.9% vs 35.4% ,p=0.014).

Three-vessel disease was significantly predominant in the CABG group (80% vs 41.3%, p<0.001) .SYNTAX I score was higher in the CABG group (29.8 vs 21.8, p<0.001). No difference in mortality risk scores was shown.

Table 1. Repartition of PCI and CABG patients on clinical and procedural parameters

	PCI N=80	CABG N=40	Total N=120	P value
Demographics				
Age	63.76 ± 10.1	62.18 ± 8	63.23 ± 9.4	0.388
Male sex	62 (77.5)	34 (85)	96 (80)	0.333
CV risk factors				
Hypertension	46 (57.5)	16 (40)	62 (51.7)	0.071
Diabetes	45 (56.2)	26 (65)	71 (59.2)	0.164
Dyslipidemia	31 (38.8)	16 (40)	47 (39.2)	0.895
Smoking	48 (60)	25 (62.5)	73 (60.8)	0.962
Medical history				
History of CAD	25 (31.2)	18 (45)	43 (35.8)	0.320
Myocardial infarction	18 (22.5)	14 (35)	32 (26.7)	0.220
PAD	7 (8.7)	6 (15)	13 (10.8)	0.611
Stroke	6 (7.5)	2 (5)	8 (6.7)	0.605
Chronic kidney disease	18 (22.5)	12 (30)	30 (25)	0.371
Dialysis	3 (3.8)	1 (2.5)	4 (3.3)	0.719
Atrial fibrillation	8 (10)	4 (10)	12 (10)	1.000
Clinical presentation				
CCS	9 (11.2)	10 (25)	19 (15.8)	0,052
NSTEMI	34 (42.5)	15 (37.5)	49 (40.8)	0.599
STEMI	37 (46.3)	15 (37.5)	52 (43.3)	0.362
Echographic parameters				
LVEF	32.9 ± 5.6	35.4 ± 4.1	33.7 ± 5.2	0.014
LVEF<=20	3 (3.8)	0 (0)	3 (2.5)	0.027
21 - 30%	30 (37.5)	7 (17.5)	37 (30.8)	
31 - 40%	47 (58.8)	33 (82.5)	80 (66.7)	
LV dilation	30 (37.5)	30 (75)	60 (50)	<0.001
preserved RV function	66 (82.5)	37 (92.5)	103 (85.8)	0.139
Reduced RV function	14 (17.5)	3 (7.5)	17 (14.2)	
PH	41 (51.2)	17 (42.5)	58 (48.3)	0.664
Angiographic characteristics				
Right dominance	70 (87.5)	35 (87.5)	105 (87.5)	1
2-vessel disease	47 (58.8)	8 (20)	55 (45.8)	<0.001
3-vessel disease	33 (41.3)	32 (80)	65 (54.2)	
Left Main	16 (20)	26 (65)	42 (35)	<0.001
1 CTO	25 (31.3)	17 (42.5)	42 (35)	0.257
2 CTO	3 (3.8)	3 (7.5)	6 (5)	
Mean SYNTAX I	21.8 ± 8.1	29.8 ± 8.8	24.47 ± 9.1	<0.001
SYNTAX I <=22	49 (61.3)	9 (22.5)	58 (48.3)	<0.001
SYNTAX I 23 – 32	21 (26.3)	13 (32.5)	34 (28.3)	
SYNTAX I >=33	10 (12.5)	18 (45)	28 (23.3)	
Mortality risk scores				
EuroSCORE II	2.62 ± 1.9	2.71 ± 3.5	2.65 ± 2.5	0.161
STS score	2.15 ± 1.8	3.35 ± 7.2	2.55 ± 4.4	0.857
SYNTAX II PCI 4-year mortality	21.31 ± 17.5	21.12 ±16.5	21.25 ± 17.1	0.953
SYNTAX II CABG 4-year mortality	8.32 ± 7.4	8.36 ± 5.3	8.34 ± 6.8	0.976

Abbreviations: Values are mean ± SD or n (%); CABG: Coronary Artery Bypass graft surgery; CAD: coronary artery disease; CCS: chronic coronary syndrome, CTO: chronic total occlusion, CV: cardiovascular, LV: left ventricle, LVEF: Left Ventricle Ejection Fraction; NSTEMI: Non-ST Elevation Myocardial Infarction; PAD: peripheral arterial disease, PH: pulmonary hypertension, PCI: Percutaneous Coronary Intervention; RV: right ventricle, STEMI: ST Elevation Myocardial Infarction

Compared to PCI, the CABG group underwent more delayed but more complete revascularization (90% vs 46.3%, p<0.001), whereas PCI provided earlier treatment of culprit lesions. There were no significant differences in acute renal failure (27.5% vs 23.8%, p=0.65) or need for hemodialysis, while major bleeding occurred predominantly in the CABG group (15% vs 1.3%, p=0.002).

Comparison of short and long-term outcomes

Thirty-day outcomes:

Thirty-day follow-up revealed a significantly higher incidence of adverse events in the CABG group compared to PCI (30% vs 7.5%, p=0.001), driven primarily by increased postoperative mortality (27.5% vs 6.3%, p=0.001) (Table 2).

Table 2. Comparison of thirty-day MACE between CABG and PCI groups

	PCI N=80	CABG N=40	Total N=120	P value
30-day outcomes				
All-cause death	5 (6.3)	11 (27.5)	16 (13.3)	0.001
Cardiovascular death	4 (5)	8 (20)	12 (10)	0.01
MACE	6 (7.5)	12 (30)	18 (15)	0.001
Non fatal MI	1 (1.3)	0 (0)	1 (0.8)	0.478
TVR	1 (1.3)	0 (0)	1 (0.8)	0.478
Hospitalization for HF	2 (2.5)	1 (2,5)	3 (2.5)	1
Stroke	2 (2.5)	2 (5)	4 (3.3)	0.472

Values are n (%); CABG: Coronary Artery Bypass graft surgery; HF:Heart Failure; MACE: major adverse cardiovascular events; MI: myocardial infarction; PCI: Percutaneous Coronary Intervention; ; TVR: target vessel revascularization, P value between PCI and CABG group

Long-term outcomes

Mean follow-up was 31± 13.9 months. Mean survival free of cardiovascular events was 15 ± 14.2 months.

Cumulative incidence of all-cause death was substantially higher in CABG patients than in PCI patients (13.8% vs 35%, p=0.007).

On the other hand, TVR and MI incidence were significantly higher in the PCI group. DES thrombosis represented 7.5% of cases while arterial graft occlusion was seen in 2.5% of cases.

With a trend towards higher cardiovascular death incidence in CABG group, the difference was not statistically significant. (12.5% vs 25%, p=0.083)

No difference was shown in MACE events (45% vs 50%, P=0.605), hospitalization for heart failure (12.5% vs 15%, p=0.704) and stroke (6.3% vs 7.5%, p=0.796) (Table 3).

Table 3. Comparison of cumulative MACE between PCI and CABG group

	PCI N=80	CABG N=40	Total N=120	HR (95%CI)	P value
Long-term outcomes					
All-cause death	11 (13.8)	14 (35)	25 (20.8)	0.3 (0.1-0.7)	0.007
Cardiovascular death	10 (12.5)	10 (25)	20 (16.7)	0.4 (0.2-1.1)	0.083
MACE	36 (45)	20 (50)	56 (46.7)	0.8 (0.4-1.7)	0.605
Non fatal MI	12 (15)	1(2.5)	13 (10.8)	6.9 (0.9-55.0)	0.038
TVR	15 (18.7)	1 (2.5)	16 (13.3)	9 (1.1-70.8)	0.014
Hospitalisation for HF	10 (12.5)	6 (15)	16 (13.3)	0.8 (0.3-2.4)	0.704
Stroke	5 (6.3)	3 (7.5)	8 (6.7)	0.8 (0.2-3.6)	0.796

Values are n (%); CABG: Coronary Artery Bypass graft surgery; PCI: Percutaneous Coronary Intervention; MACE: major adverse cardiovascular events; MI: myocardial infarction; TVR: target vessel revascularization; HF: Heart Failure

In PCI group, in-stent restenosis was found in 15% of cases with DES restenosis accounting for 10% and BMS restenosis for 6.25% of patients.

Residual angina was more likely to be found in PCI group than in the CABG group for the surviving group (27.5% vs 7.7%, P=0.038).

No significant difference was seen in NYHA class in the two subgroups. 18.9% of patients were asymptomatic. Most patients were in NYHA class II representing 63.2% of cases. 17.9% of patients were in NYHA class III.

Mean LVEF was significantly different between the two subgroups in favour of CABG (47.1%± 6.8 vs 41.1% ± 9.1, p=0.003)

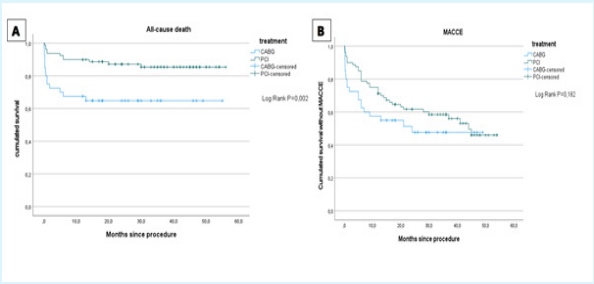

Figure 2. Cumulated Survival Curve for all-cause death (A) and freedom of MACE (B)

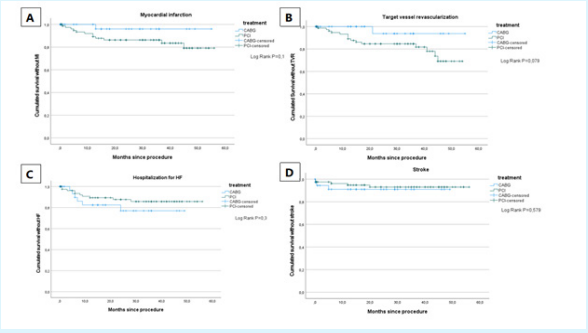

Figure 3. Cumulated Survival Curve free of MI (A), TVR (B) ,HF (C) and stroke (D)

DISCUSSION

This retrospective study was designed to evaluate and compare outcome following PCI and CABG in HFrEF patients, essentially MACE events in the short and mid-term.

From January 2020 to September 2023, 120 patients were included into the study and followed up (Mean follow up was 31± 13.9 months): 80 and 40 patients in PCI and CABG groups respectively.

Analysis of our study results

Clinical characteristics were similar to the literature, and risk scores showed no significant difference between PCI and CABG groups, supporting comparability. However, the SYNTAX II score may underestimate procedural risk in patients with severely reduced LVEF, as they were underrepresented in its development cohort accounting for only 2% (4).

Analysis of PCI characteristics

DES accounted for the majority of our PCI procedures. Comparative Studies of CABG and PCI using only DES in HF have shown that the two techniques had similar outcomes on mid-term regarding the major endpoint of mortality(5).

In our study, neither imaging nor physiological techniques were used to confirm procedural success.

In complex CAD, though it prolongs PCI procedure time and contrast use, intracoronary imaging guidance is of interest. It is shown to reduce the risk of post-procedural cardiovascular events (6). When Intracoronary imaging isn't feasible or not relevant, use of other physiological methods could be considered.

Fractional flow reserve or instantaneous wave-free ratio post PCI are able to confirm procedural success. It is relevant to precise that these measurements are affected by IABP use and are not clearly validated on LV support (7).

Though we did not report the use of mechanical support devices in our study, it is increasing lately in high-risk PCI procedures.

A recent meta-analysis, published in 2024 on the international journal of cardiology, on mid-term mortality after surgical and supported or unsupported percutaneous revascularization in severely reduced ejection fraction patients, suggest that supported PCI reduced one-year all-cause mortality compared to PCI without Impella (9.4% vs 10.6% RR 0.77 CI 0.6–0.89). On indirect comparison, supported PCI showed better results than CABG (8).

Analysis of CABG characteristics:

All our procedures were on-pump CABG. This was similar to the APPROACH trial(9) Although theoretically off-pump CABG is presumably associated with improved outcomes by

reducing the rate of perioperative myocardial injury however recent studies analyzing on and off-pump outcomes in HFrEF patients showed that off-pump CABG wasn't correlated with improved survival (10). In fact, in Cao et Al study, incidence of MACE was higher in the off-pump arm (10).

Bilateral internal mammary artery was used in 20% of cases. This is similar to literature findings on CABG procedures (11). A meta-analysis comparing a single or bilateral mammary artery use showed that bilateral mammary artery was associated with improved long-term survival (12). No radial artery conduit was used.

The most common complication in our study was post operative infection occurring in 40% of cases with the pulmonary site being the most represented. This finding was way higher than literature findings (10.2%) (13). Analysis of the STICH trial has shown that post operative infections are correlated to mid-term mortality in CABG with this influence mainly found in the first year (13).

In our study, LCOS incidence (12.5%) was lower than literature findings. In a study by Rana et Al assessing LCOS in on-pump CABG and its correlation with pre-operative LV dysfunction, LCOS was found in 15 vs 28% (p=0.038) in patients with preoperative LV EF ≥ 40% and < 40% respectively. Also, LCOS is strongly associated with mortality with at least 10 time fold increase (14). LCOS is a major turning point in CABG patients' prognosis, its early detection and adequate care is mandatory.

Completeness of revascularization and outcomes

In concordance with literature findings, complete revascularization was way more achieved in the CABG group than PCI group. Current European guidelines on myocardial revascularization precise that completeness of revascularization is a criterion when HFrEF patients are addressed to PCI. A residual SYNTAX score indicative of incomplete revascularisation portends a higher risk of mortality and major adverse cardiac events (15).

Analysis of the study published by Chen and Al, which initially showed superiority of CABG on long term heart failure hospitalisation, found that the endpoint of HF hospitalisation at 3 years in the CABG arm was not significantly different when compared to the complete revascularization of PCI subgroup (16).

Difference on mean LVEF at follow up was statistically significant, (47% vs. 41%, p=0.003) in CABG and PCI respectively, which is a mean increase of 12% and 8% compared to baseline echocardiography. According to literature, although PCI can restore LVF, its magnitude is comparatively lower. LVEF recovery is emerging as an important outcome with demonstrated survival and quality-of-life benefits after revascularization in ischemic cardiomyopathy (17).

Randomized clinical trials on myocardial revascularization in HFrEF

Comparison between PCI and CABG is primarily limited to analyses of RCTs enrolling patients in which the average LV function is preserved.

In reference to evidence from RCTs for HFrEF patients, the extended observation of the STICH trial(3), up to 10 years, showed that patients with stable ischemic heart disease (SIHD) and a LVEF <=35% can benefit from coronary revascularisation with CABG compared to OMT alone.

On a systematic review and meta-analysis of RCT by Iaconelli et Al published in the European heart journal in 2023, the impact of PCI on the primary endpoint of REVIVED, all-cause death and hospitalization for HF, for patients aged <70 years (HR 0.86, 95% CI 0.59–1.24) was similar to that for the primary all-cause death endpoint of STICH (HR 0.86, 95% CI 0.72–1.04), which included a small number patients aged >70 years.(2)

Another considerable limit of these major trials is that they didn't include ACS representing an important category of HF patients.

Outcomes: comparison of literature data with our study

Current evidence suggests a certain variability in treatment effects across studies, but most studies have favoured CABG over PCI in terms of all-cause death. These findings were related to the fact that long term follow-up have shifted the balance towards CABG. PCI and CABG were found to have similar mortality rates on intermediate term. A Meta-analysis by Khan et Al, including 17 studies between 2012 and 2020, showed that PCI and CABG had a similar 30-day and 3-year mortality. Difference showed on long-term follow-up of 6 years in favour of CABG (18).

In comparison with literature, mortality rates in our study were relatively similar in PCI but way higher in CABG. This was mainly due to post operative deaths.

These rates can partially be explained by substantial differences in baseline characteristics of our population like greater prevalence of smoking, diabetes, CKD, clinical setting of ACS. Also, the high prevalence of LM disease in CABG group in comparison with other trials.

Most studies agreed on the superiority of CABG on the occurrence of myocardial infarction and repeat revascularization.

This difference can easily be explained by the fact that in CABG, a graft is inserted beyond the lesion allowing CABG to prevent future ischemic changes arising from the culprit lesions at proximal segments (19).

A meta-analysis by Jaiswal and Al showed that the PCI group had higher odds of repeat revascularization (OR 3.57; 95% CI 2.56–4.97; P < 0.001), MI (OR 1.92; 95% CI 1.01–3.86; P = 0.048) compared to CABG for a mean follow-up of 3.75 years (19).

Survival curves free of MI and TVR in our study suggested CABG superiority in long term follow-up however analysis through the log rank test of overall survival didn't show a statistically significant difference. This result could be linked to our limited follow-up period or to our small study population.

There was evidence of heterogeneity of treatment effect among studies for stroke incidence, but more studies have favoured PCI. This higher risk in CABG is theoretically explained by aortic cross clamping and the embolic risk associated with CPB.

In our study, no significant difference was found between treatment options in regard of stroke incidence. In alignment with our results, the largest meta-analysis done to date by Sà et Al, including 20 studies, showed that the hazard ratio for stroke didn't significantly differ between the groups (HR 0.879; 95% CI 0.625-1.237; P=0.459) (20).

LIMITATIONS

The principal limitations of our study were the relatively small population and its monocentric character making it difficult to generalize our results on a wider population as well as its retrospective aspect of the study and data collection potentially affecting precision in some parameters that were not detailed and potentially affecting the results.

CONCLUSION

In HFrEF patients, PCI was associated with lower short-term and overall mortality compared with CABG, mainly driven by high postoperative mortality in the surgical group. However, CABG was superior in reducing recurrent MI and TVR, and achieved better LVEF recovery and higher rates of complete revascularization. Thus, while PCI may offer an early survival benefit in high-risk patients, CABG provides better long-term ischemic protection and functional improvement.

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