Long-term Mortality Outcomes of Coronary Artery Bypass Grafting vs. Percutaneous Coronary Intervention in Elderly Patients with Multivessel Coronary Artery Disease: A Nationwide Cohort Study in Taiwan

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Abstract

Background: As the global population ages, coronary artery disease (CAD) in elderly patients presents increasing clinical challenges. In Taiwan, older adults frequently exhibit complex coronary pathology and multiple comorbidities, yet remain underrepresented in major revascularization trials.

Objective: To compare all-cause mortality outcomes between percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) in patients aged ≥ 70 years with multivessel coronary artery disease.

Methods: This retrospective cohort study utilized the Longitudinal Health Insurance Database 2000 (LHID 2000) to identify patients aged ≥ 70 years who underwent first-time PCI or CABG between 2002 and 2012. After application of the exclusion criteria, 1,463 remaining patients were included. Propensity score matching (PSM), based on demographic, clinical and treatment variables, yielded 191 matched pairs. Mortality rates were calculated per 1,000 person-months, and Cox proportional hazards models were used to estimate adjusted hazard ratios (aHRs). Subgroup analyses evaluated interactions by age, sex and vessel count.

Results: After matching, mortality rates were 7.55 for PCI (95% CI: 6.04-9.44), and 9.14 for CABG (95% CI: 7.42-11.26). The aHR for CABG vs. PCI was 1.169 (95% CI: 0.851-1.605), indicating no significant difference. Subgroup analysis revealed higher mortality with CABG in patients aged ≥ 80 years and those with two-vessel disease.

Conclusion: Among elderly patients with multivessel CAD, PCI showed long-term survival comparable to that of CABG. Given its less invasive nature and shorter hospitalization, PCI may be a favorable revascularization strategy for this elderly population.

Keywords: percutaneous coronary intervention, coronary artery bypass grafting, elderly, multivessel coronary artery disease

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Introduction

The global population of elderly persons is steadily increasing, including in Taiwan, where demographic shifts are reshaping healthcare demands.[1] Advancing age is a well-established risk factor for numerous chronic conditions, with coronary artery disease (CAD) being the most prevalent among older adults. In addition to CAD, elderly individuals commonly present with comorbidities such as hypertension, diabetes mellitus, dyslipidemia and chronic kidney disease. These factors contribute to increased frailty and elevate the risk of adverse outcomes during invasive procedures. Furthermore, older patients often exhibit more advanced forms of coronary atherosclerosis, including multivessel disease, left main coronary artery involvement, and acute myocardial infarction, complicating both diagnosis and treatment strategies.[2]

Unfortunately, elderly patients are frequently under-represented or excluded from major clinical trials,[3] complicating evidence-based decision-making for optimal treatment strategies in this population. As a result, clinicians often adopt a more conservative approach, favoring less aggressive therapies. However, emerging evidence from meta-analyses suggests that invasive revascularization may confer significant benefits, even in older adults, challenging the traditional paradigm of conservative management in this group.

Coronary artery bypass grafting (CABG) has traditionally been considered a major surgical intervention, often associated with higher procedural risk and mortality, particularly among elderly patients. By contrast, percutaneous coronary intervention (PCI) is viewed as a less invasive alternative, offering shorter hospital stays and potentially lower early mortality. However, multiple clinical trials have demonstrated a survival advantage with CABG over PCI in patients with complex coronary artery disease, especially those with a SYNTAX score greater than 33.[4-6] It is important to note, though, that the majority of participants in these studies were relatively young, resulting in limited data on outcomes in patients over 70 years of age.

Given the unique clinical considerations in elderly patients, balancing the benefits and risks of PCI vs. CABG remains a significant challenge. To address this gap, our study focused on patients aged over 70 years who underwent revascularization (either PCI or CABG), and compared their respective mortality outcomes.

Methods

Data Source and Study Design

We conducted this retrospective, population-based cohort study using data from the Longitudinal Health Insurance Database 2000 (LHID 2000), a representative subset of the Taiwan National Health Insurance Research Database (NHIRD). The NHIRD is maintained by the Health and Welfare Data Science Center (HWDC) under Taiwan's Ministry of Health and Welfare, which integrates the NHIRD with other national health-related databases to facilitate standardized data management and advanced epidemiological analyses.[7]

The NHIRD contains comprehensive healthcare information, including demographic characteristics, outpatient and inpatient medical claims, diagnostic codes, procedure codes, pharmacy dispensing records, and healthcare facility profiles. During the study period (1998-2013), all disease diagnoses in the NHIRD were coded according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Medication information was recorded using the National Health Insurance Drug Codes, which were cross-referenced with the World Health Organization's Anatomical Therapeutic Chemical (ATC) Classification System to ensure consistency in pharmacoepidemiological analyses.

For the present study, we analyzed longitudinal claims data of one million beneficiaries randomly selected from all insured individuals in the year

2000 and followed up continuously between 1998 and 2013. To protect patient confidentiality, all personal identifiers were anonymized and encrypted before the data were released for research purposes.

Study Population

We identified patients aged 70 years or older who were hospitalized and underwent their first coronary revascularization procedure, either PCI or CABG, between 1998 and 2013. The date of the first revascularization procedure was defined as the index date.

We excluded patients who met any of the following criteria: (1) index year before 2002 or after 2012, (2) underwent both PCI and CABG within 90 days of the index date, (3) died within 14 days following the index procedure, (4) received only a single-vessel intervention within 90 days, or (5) did not receive any antiplatelet therapy within 28 days after the index date.

After applying these exclusion criteria, we classified eligible patients into the PCI or CABG cohort, based on their index procedure. Only those who underwent multivessel revascularization within 90 days of the index hospitalization were included in the final analysis.

Covariates and Comorbidities

We assessed baseline characteristics within one year prior to the index date, including age, sex, urbanization level, income status and length of hospital stay before the index admission, and identified comorbidities using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes recorded in inpatient or outpatient claims. These comorbidities included myocardial infarction (ICD-9-CM: 410-412), heart failure (428), diabetes mellitus (250), hypertension (401-405), hyperlipidemia (272), ischemic stroke (433-438), peripheral artery disease (440-444), and chronic kidney disease (585).

We identified co-medications prescribed within one year before the index date using their Anatomical Therapeutic Chemical (ATC) Classification System codes, including statins (C10AA), β-blockers (C07), angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) (C09), and calcium-channel blockers (C08). These variables were selected based on their clinical relevance to cardiovascular outcomes and potential influence on treatment selection and prognosis.

Propensity Score Matching

We used propensity score matching (PSM) to minimize selection bias and achieve baseline comparability between the PCI and CABG cohorts. We calculated the propensity scores using a multivariable logistic regression model that included age, sex, urbanization level, income status, length of hospitalization before the index date, comorbidities and co-medications within one year prior to the index procedure.

We matched patients in the PCI and CABG groups in a 1:1 ratio using the nearest-neighbor method without replacement, applying a caliper width of 0.2 of the standard deviation of the logit of the propensity score to ensure close matching. After matching, we evaluated covariate balance between the two groups using absolute standardized differences (ASDs), with an ASD of less than 0.1 indicating adequate balance.[8]

Outcome Measure

The primary outcome was all-cause mortality, defined as death from any cause occurring during the follow-up period, ascertained through linkage to inpatient and outpatient claims records in the NHIRD. We identified deaths based on discharge diagnoses and termination of insurance coverage attributable to death. Follow-up commenced on the index date and continued until the date of death, withdrawal from the National Health Insurance program, or December 31, 2013, whichever occurred first. Patients who remained alive at the end of follow-up were censored at their last available claims record.

Statistical Analysis

We compared the baseline characteristics between the PCI and the CABG cohorts using the chi-square test for categorical variables and Student's t-test for continuous variables, as appropriate. Mortality rates were expressed as the number of deaths per 1,000 person-months, with corresponding 95% confidence intervals (CIs) estimated under the Poisson distribution.

We applied the Cox proportional hazards regression model to estimate crude and adjusted hazard ratios (HRs and aHRs) for all-cause mortality, with the PCI group serving as the reference. The adjusted models included age, sex, urbanization level, income status, length of hospitalization before the index date, and comorbidities. We plotted Kaplan–Meier survival curves to illustrate the cumulative probability of survival and used the log-rank test to compare between groups. We further conducted subgroup analyses to explore potential effect modification by sex (male vs. female), age (70-79 vs. ≥80 years), and number of vessels treated (two vs. three vessels), with interaction terms tested in the Cox models.

All analyses were performed both before and after propensity score matching (PSM) to ensure robustness of the findings, with PSM results reported as the primary analysis. Statistical significance was defined as a two-sided P value < 0.05. All statistical analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC, USA).

Results

Study Population and Matching

From the LHID 2000 dataset, we identified 5,168 patients aged ≥70 years, who underwent their first PCI or CABG between 1998 and 2013. A total of 1,463 patients with multivessel coronary artery disease remained after we applied the exclusion criteria, which included: index year outside 2002-2012 (n = 1,084), dual revascularization within 90 days (n = 61), early mortality within 14 days (n = 119), single-vessel intervention (n = 2,152), and lack of antiplatelet therapy (n = 2). Of this total, 1,022 patients were in the PCI cohort and 441 were in the CABG cohort. Subsequent propensity score matching (PSM) yielded 191 matched pairs.

Baseline Characteristics

Before matching, significant differences were observed between the PCI and CABG groups in index year, age distribution, sex, urbanization level, and several clinical variables including valvular heart disease, peripheral arterial occlusive disease (PAOD), dementia and co-medication use (e.g., statins, ACE inhibitors/ARBs). After PSM, all baseline characteristics were well balanced, with no statistically significant differences (all $p > 0.05$), confirming comparability between the cohorts (Table 1).

Mortality Outcomes

During follow-up, the crude mortality rate per 1,000 person-months was 8.05 in the PCI group (95% CI: 7.29-8.87) and 8.93 in the CABG group (95% CI: 7.81-10.22). After matching, mortality rates were 7.55 for PCI (95% CI: 6.04-9.44) and 9.14 for CABG (95% CI: 7.42-11.26). The adjusted hazard ratio (aHR) for all-cause mortality in the CABG group compared to the PCI group was 1.169 (95% CI: 0.851-1.605), indicating no statistically significant difference (Table 2).

Subgroup Analysis

Subgroup analyses revealed consistent mortality trends across sex and age strata (Table 3). Notably, among patients aged ≥80 years, CABG was associated with a higher mortality rate (17.32 vs. 12.36 per 1,000 person-months; aHR: 1.391, 95% CI: 0.988-1.958). A significant interaction was observed for the number of vessels treated (p for interaction = 0.0437). In patients with two-vessel disease, CABG was associated with higher mortality (aHR: 1.599, 95% CI: 1.080-2.368), whereas outcomes were comparable in those with three-vessel disease (aHR: 1.003, 95% CI: 0.758-1.329).

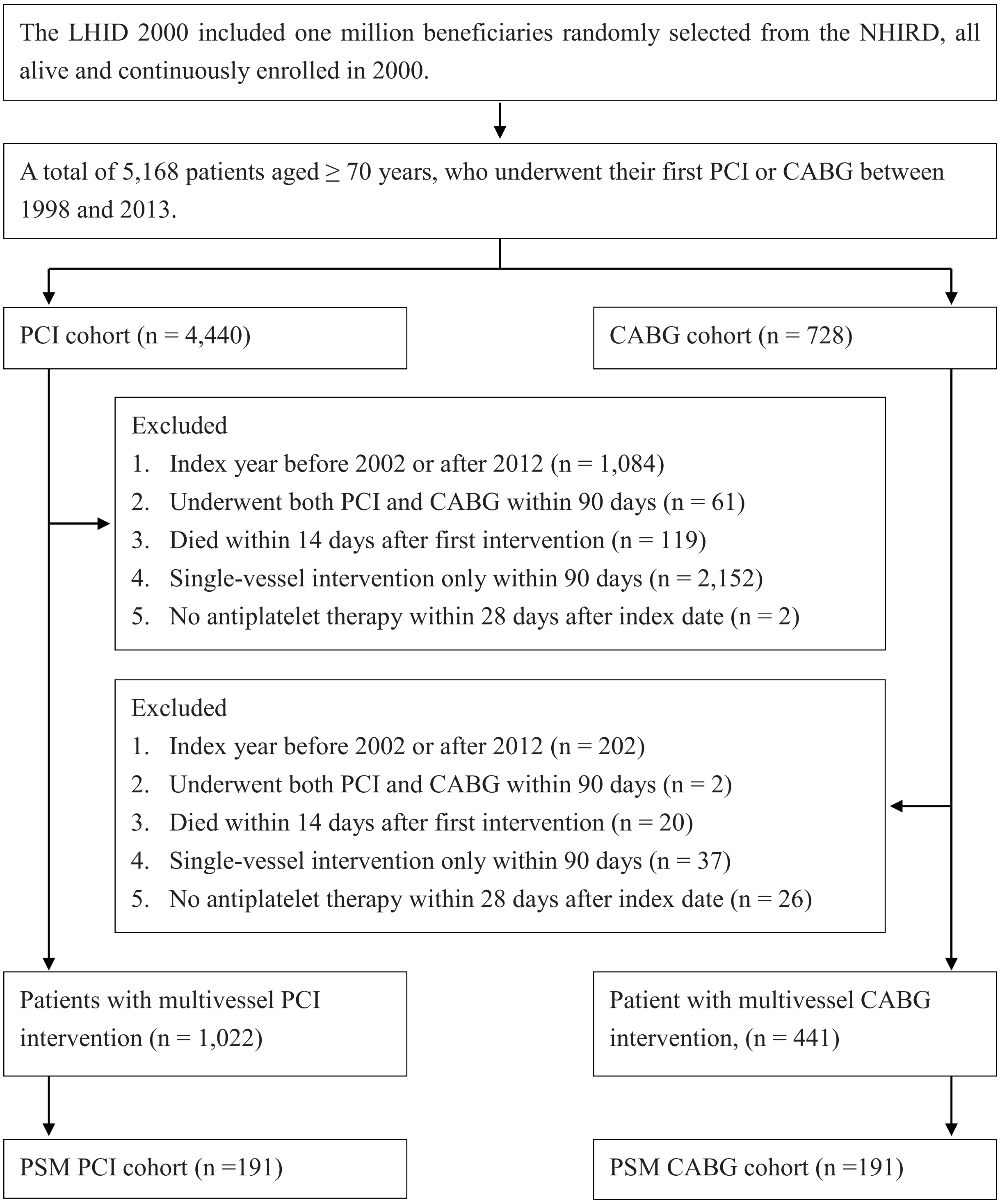


Figure 1. PRISMA flow diagram.

Table 1. Baseline characteristics in multivessel revascularization patients.

	Before PSM			After PSM		
	PCI	CABG	p	PCI	CABG	p
N	1022	441		191	191	
Index year			<.0001			0.2107
2002-2006	339 (33.17%)	213 (48.30%)		83 (43.46%)	71 (37.17%)	
2007-2012	683 (66.83%)	228 (51.70%)		108 (56.54%)	120 (62.83%)	
Age			<.0001			0.7073
70-79	671 (65.66%)	365 (82.77%)		152 (79.58%)	149 (78.01%)	
≥ 80	351 (34.34%)	76 (17.23%)		39 (20.42%)	42 (21.99%)	
Sex			0.0024			0.7339
Female	361 (35.32%)	120 (27.21%)		56 (29.32%)	53 (27.75%)	
Male	661 (64.68%)	321 (72.79%)		135 (70.68%)	138 (72.25%)	
Urbanization			0.0060			0.7117
Urban	509 (49.80%)	255 (57.82%)		102 (53.40%)	110 (57.59%)	
Sub-urban	343 (33.56%)	136 (30.84%)		64 (33.51%)	58 (30.37%)	
Rural	170 (16.63%)	50 (11.34%)		25 (13.09%)	23 (12.04%)	
Low income	8 (0.78%)	(0.23%)	0.2120	1 (0.52%)	1 (0.52%)	1.0000
LOH before index date			<.0001			0.7039
0 day	624 (61.06%)	191 (43.31%)		102 (53.40%)	103 (53.93%)	
1-6 days	176 (17.22%)	133 (30.16%)		45 (23.56%)	39 (20.42%)	
≥7 days	222 (21.72%)	117 (26.53%)		44 (23.04%)	49 (25.65%)	

(Continued)

Table 1. *(Continued)*

	Before PSM			After PSM		
	PCI	CABG	p	PCI	CABG	p
Co-morbidities						
Atrial fibrillation	105 (10.27%)	43 (9.75%)	0.7606	11 (5.76%)	18 (9.42%)	0.1763
MI	434 (42.47%)	187 (42.40%)	0.9824	76 (39.79%)	79 (41.36%)	0.7546
Heart failure	384 (37.57%)	181 (41.04%)	0.2110	72 (37.70%)	75 (39.27%)	0.7524
Valvular heart disease	91 (8.90%)	80 (18.14%)	<.0001	26 (13.61%)	24 (12.57%)	0.7616
PAOD	47 (4.60%)	8 (1.81%)	0.0102	7 (3.66%)	6 (3.14%)	0.7778
Subclinical atherosclerosis	56 (5.48%)	29 (6.58%)	0.4107	11 (5.76%)	15 (7.85%)	0.4164
Ischemic Stroke	255 (24.95%)	118 (26.76%)	0.4670	53 (27.75%)	49 (25.65%)	0.6436
Hypertension	866 (84.74%)	378 (85.71%)	0.6302	158 (82.72%)	162 (84.82%)	0.5789
Diabetes mellitus	490 (47.95%)	224 (50.79%)	0.3172	103 (53.93%)	99 (51.83%)	0.6818
Hyperlipidemia	462 (45.21%)	181 (41.04%)	0.1410	85 (44.50%)	84 (43.98%)	0.9180
Gout	187 (18.30%)	82 (18.59%)	0.8931	32 (16.75%)	34 (17.80%)	0.7866
Liver disease	94 (9.20%)	43 (9.75%)	0.7390	20 (10.47%)	21 (10.99%)	0.8687
Gallstone related disease	39 (3.82%)	13 (2.95%)	0.4105	6 (3.14%)	7 (3.66%)	0.7778
Renal failure	147 (14.38%)	69 (15.65%)	0.5321	26 (13.61%)	28 (14.66%)	0.7690
Cancer	77 (7.53%)	36 (8.16%)	0.6792	11 (5.76%)	13 (6.81%)	0.6732
Gastrointestinal bleeding	43 (4.21%)	21 (4.76%)	0.6342	7 (3.66%)	7 (3.66%)	1.0000
Intracranial bleeding	13 (1.27%)	3 (0.68%)	0.3180	4 (2.09%)	3 (1.57%)	0.7029
Urinary tract bleeding	27 (2.64%)	13 (2.95%)	0.7419	7 (3.66%)	7 (3.66%)	1.0000

(Continued)

Table 1. *(Continued)*

	Before PSM			After PSM		
	PCI	CABG	p	PCI	CABG	p
Peptic ulcer	273 (26.71%)	108 (24.49%)	0.3741	43 (22.51%)	46 (24.08%)	0.7165
COPD	233 (22.80%)	108 (24.49%)	0.4826	44 (23.04%)	53 (27.75%)	0.2901
Dementia	45 (4.40%)	7 (1.59%)	0.0076	5 (2.62%)	5 (2.62%)	1.0000
Co-medication						
Statin	570 (55.77%)	190 (43.08%)	<.0001	99 (51.83%)	102 (53.40%)	0.7585
β blocker	695 (68.00%)	302 (68.48%)	0.8574	138 (72.25%)	134 (70.16%)	0.6513
ACE inhibitor or ARB	808 (79.06%)	305 (69.16%)	<.0001	138 (72.25%)	142 (74.35%)	0.6436
Calcium-channel blocker	741 (72.50%)	322 (73.02%)	0.8405	135 (70.68%)	138 (72.25%)	0.7339
LOH at first revascularization			<.0001			<.0001
1-6 days	490 (47.95%)	5 (1.13%)		89 (46.60%)	1 (0.52%)	
7-13 days	254 (24.85%)	67 (15.19%)		50 (26.18%)	27 (14.14%)	
14-27 days	153 (14.97%)	212 (48.07%)		28 (14.66%)	89 (46.60%)	
≥28 days	125 (12.23%)	157 (35.60%)		24 (12.57%)	74 (38.74%)	
Vessels for intervention			<.0001			0.5789
2	822 (80.43%)	61 (13.83%)		61 (31.94%)	56 (29.32%)	
3	200 (19.57%)	380 (86.17%)		130 (68.06%)	135 (70.68%)	
Dual antiplatelet therapy			<.0001			0.8912
Only Aspirin	35 (3.42%)	166 (37.64%)		24 (12.57%)	21 (10.99%)	
Only Thienopyridine	68 (6.65%)	49 (11.11%)		20 (10.47%)	20 (10.47%)	
Dual antiplatelet	919 (89.92%)	226 (51.25%)		147 (76.96%)	150 (78.53%)	

Table 2. Mortality rates in the study population.

	Before PSM		After PSM	
	PCI (n=1022)	CABG (n=441)	PCI (n=191)	CABG (n=191)
Follow up person-months	49597	23844	10203	9630
Event of death	399	213	77	88
Mortality rate† (95% C.I.)	8.05 (7.29-8.87)	8.93 (7.81-10.22)	7.55 (6.04-9.44)	9.14 (7.42-11.26)
Crude HR (95% C.I.)	Reference	1.121 (0.948-1.324)	Reference	1.224 (0.840-1.786)
aHR‡ (95% C.I.)	Reference	1.164 (0.973-1.393)	Reference	1.169 (0.851-1.605)

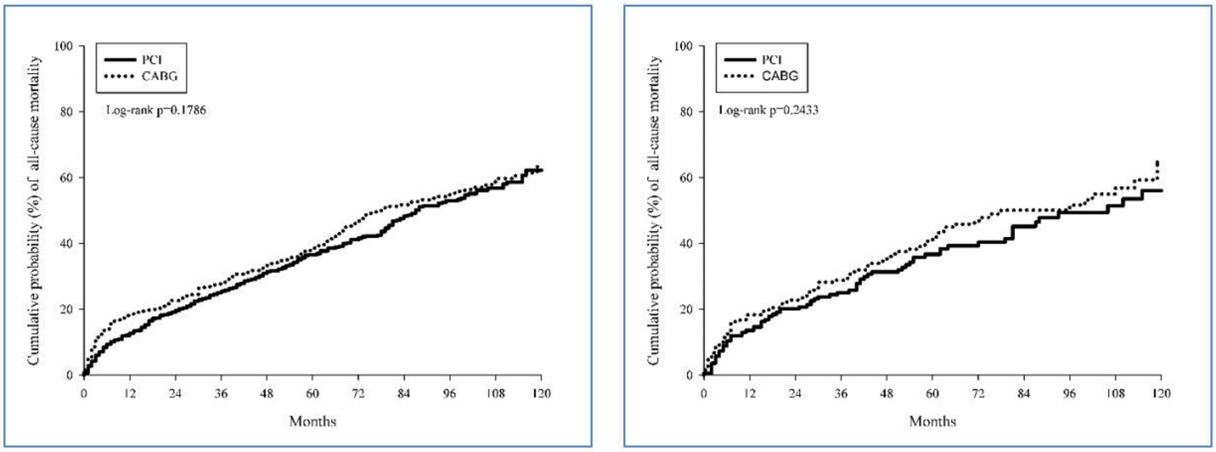
† Per 1000 person months
‡ aHR, adjusted hazard ratio, the co-variates included age, sex, urbanization, income, length of hospital stay before index date, and co-morbidities.

Table 3. Subgroup analysis.

Subgroup	Mortality rate, per 1000 person-months		aHR‡ (95% CI)	p for interaction
	PCI (n=1022)	CABG (n=441)		
Sex				0.9790
Female	7.72 (6.55-9.09)	7.56 (5.79-9.87)	1.126 (0.793-1.600)	
Male	8.24 (7.29-9.31)	9.52 (8.15-11.12)	1.186 (0.957-1.469)	
Age				0.4218
70-79	6.36 (5.59-7.25)	7.70 (6.59-8.99)	1.089 (0.877-1.352)	
≥ 80	12.36 (10.64-14.35)	17.32 (13.23-22.67)	1.391 (0.988-1.958)	
Vessel for intervention				0.0437
2	7.72 (6.92-8.63)	10.31 (7.37-14.43)	1.599 (1.080-2.368)	
3	9.50 (7.68-11.75)	8.71 (7.53-10.09)	1.003 (0.758-1.329)	

‡ aHR: Adjusted hazard ratios for all-cause mortality in the CABG group compared with the PCI group were estimated, adjusting for co-variates including age, sex, urbanization, income, length of hospital stay prior to the index date, and comorbidities.

(A) Before PSM (B) After PSM



Central illustration

K-M curves for cumulative probability of all-cause mortality

Discussion

In this study of elderly patients, the all-cause mortality rates were comparable between the PCI and the CABG group. Although the difference did not reach statistical significance, a numerically lower mortality rate was observed in the PCI group. Subgroup analyses revealed consistent mortality trends across sex and age strata. Notably, CABG was associated with a higher mortality rate among patients aged ≥ 80 years.

The all-cause mortality rates were comparable between the two groups in this study. These findings are consistent with subgroup analyses from prior East Asian trials, such as the PRECOMBAT[9] and BEST[10] studies, which similarly demonstrated no significant difference in mortality among patients aged ≥65 years. Current evidence suggests that CABG remains the standard of care for patients with complex coronary lesions. Multiple randomized trials have demonstrated a significant survival advantage with CABG, compared to PCI. The SYNTAX and SYNTAXES trials, which compared PCI and CABG in patients with multivessel coronary artery disease (MVCAD) with or without unprotected left main coronary artery disease (LMCAD), found that survival and event-free rates were closely associated with the SYNTAX score.[11] Subsequent trials such as FREEDOM[12] and NOBLE[13] further confirmed the superiority of CABG in patients with complex lesions, particularly those with diabetes, with significantly reduced rates of death and myocardial infarction, albeit with a higher incidence of stroke.

More recently, the 10-year follow-up of the SYNTAX trial reported similar all-cause mortality between PCI and CABG overall, but revealed significantly higher mortality among patients who underwent PCI with SYNTAX scores ≥33.[14] By contrast, the EXCEL trial demonstrated that, in patients with LMCAD and low to intermediate anatomical complexity, PCI and CABG yielded comparable outcomes in terms of death, stroke and myocardial infarction.[15]

According to current ESC[16] and ACC/AHA[17] guidelines, CABG is recommended over PCI or optimal medical therapy (OMT) in patients with chronic coronary syndrome (CCS), significant left main coronary artery stenosis, and low surgical risk. Conversely, in CCS patients who are deemed at high surgical risk, PCI may be considered as an alternative to medical therapy alone. The Taiwan Society of Cardiology (TSOC) guidelines align with these recommendations.[18] However, there remains a lack of robust evidence specifically addressing revascularization strategies in elderly patients aged > 70 years.

The proportion of elderly individuals is rapidly increasing worldwide. Aging itself is a significant risk factor for cardiovascular disease in both men and women. Multiple factors influence outcomes in this population. Elderly patients often present with more severe and more complex forms of coronary artery disease (CAD). In the elderly coronary artery, accelerated atherosclerotic plaque calcification can affect the completeness of revascularization. With advancing age, vascular stiffness progressively increases, leading to reduced coronary flow reserve and impaired microvascular function.[19] In addition, frailty, malnutrition, sarcopenia and cognitive impairment contribute to increased morbidity and mortality. Frailty is an independent predictor of adverse events and mortality following revascularization, and nutritional deficits and functional decline further compromise recovery and long-term survival. Moreover, comorbidities such as chronic kidney disease and anemia heighten bleeding risks. These long-term, chronic conditions frequently result in the under-utilization of secondary prevention therapies among elderly patients.[20-22] Despite all this, elderly patients are frequently under-represented or excluded from major clinical trials, meaning that there is limited evidence to inform guideline recommendations for this population.[3] Therefore, identifying optimal treatment strategies for elderly patients with CAD remains a critical area of investigation.

Rapid advancements in PCI technology, newer-generation drug-eluting stents (DES), intracoronary imaging modalities,[23,24] and devices for calcified plaque modification have significantly enhanced procedural precision. These innovations allow for more thorough assessment of coronary anatomy and facilitate more complete and optimized management of the target vessel, potentially improving long-term outcomes in complex lesions.

The study by Ono et al. demonstrated that in elderly patients (> 70 years) with complex CAD, the risks of all-cause mortality at 10 years and major adverse cardiac and cerebrovascular events (MACCE) at 5 years were not significantly different between a PCI and a CABG group. By contrast, among non-elderly patients (≤70 years), PCI was associated with a significantly higher risk of MACCE at 5 years, compared to CABG.[3] These findings suggest that the clinical advantages of CABG observed in younger populations may not be directly applicable to elderly patients.

Some may argue that OMT is the preferred approach for elderly patients with coronary artery disease, given their limited life expectancy and increased procedural risks. Unlike the ISCHEMIA trial, which primarily enrolled patients younger than 70 years,[25] findings from the TIMI trial suggest that patients aged 75 years or older who continue to experience angina despite standard pharmacological therapy derive greater benefit from revascularization than from OMT alone, particularly in terms of symptom relief and quality of life.[26] These results support the consideration of invasive assessment in this high-risk population, with revascularization to be pursued when anatomically and clinically appropriate.

By comparison, Hess et al. conducted a comparative analysis of patients aged ≥75 years undergoing CABG versus PCI for MVCAD.[27] The rate of complete revascularization was significantly higher in the CABG group (86.8% vs. 21.8%; $P < 0.001$). While 30-day mortality rates were comparable between the two strategies, both 1-year and 5-year survival rates favored CABG. Additionally, although the cumulative incidence of all-cause hospital readmission and MACCE at 5 years was lower in the CABG cohort, these differences did not reach statistical significance. Notably, subgroup analysis of patients aged ≥80 years demonstrated a similar long-term survival advantage with CABG over PCI.

While CABG has traditionally been considered high risk in elderly patients, reported surgical mortality rates in octogenarians range from 4.1% to 9.0%.[28-31] In a study by Choi et al. involving 1,283 consecutive patients aged > 80 years who underwent primary isolated CABG, the overall operative mortality was 4%, with a significant decline observed over the study period.[28] This trend suggests that advancements in surgical techniques, technologies, and perioperative care may contribute to improved survival outcomes in elderly patients. While CABG in octogenarians carries inherent procedural risks, it may still offer favorable outcomes and enhanced long-term survival.

Conversely, Ratanapo et al. reported an in-hospital mortality rate of 7.67% following PCI in this age group, indicating that procedural mortality rates between CABG and PCI may be comparable among octogenarian patients.[32] To support clinical decision-making, risk stratification tools such as the EuroSCORE and STS score can help identify patients at elevated risk for surgical revascularization and guide individualized treatment strategies.[33,34]

Nevertheless, unlike in younger patients, the survival benefit of CABG over PCI may be underestimated in elderly individuals due to their inherently limited life expectancy. This perception can influence treatment decisions, often favoring less invasive strategies despite evidence supporting the long-term advantages of surgical revascularization. PCI offers potential benefits in terms of patient comfort, reduced hospital stays, and comparable rates of mortality, major adverse cardiovascular events (MACE), and stroke. Therefore, a multidisciplinary approach involving both a cardiac surgeon and an interventional cardiologist is essential to collaboratively review each case and determine the optimal revascularization strategy for elderly patients.

Limitations

This study had several limitations. First, it was a retrospective cohort analysis with a limited sample size and restricted data availability, which may have constrained the generalizability of the findings. Second, the results were subject to selection and information bias. In particular, surgical candidates may have represented a relatively healthier and less frail population, a factor not fully captured in the available data. Frailty stratification tools such as the Green score, FRAIL Scale, and Clinical Frailty Scale (CFS) were not applied. Furthermore, the absence of left ventricular ejection fraction (LVEF), coronary anatomy complexity, and SYNTAX score rendered the baseline status incomparable. In addition, the lack of information on stent type, graft quality, and completeness of revascularization precluded adequate assessment of both baseline characteristics and post revascularization quality. Moreover, immortal time bias and procedure selection bias were present. Finally, the absence of cause specific mortality data (cardiac vs. non cardiac) limits the ability to determine whether observed mortality was attributable to PCI or CABG. Consequently, survival comparisons between groups should be interpreted with caution.

Conclusion

This study suggested that, among elderly patients undergoing revascularization, particularly those with MVCAD, PCI was comparable to CABG in terms of clinical outcomes. Given the advantages of shorter hospital stays and improved patient comfort, PCI may represent a favorable revascularization strategy in this population. All patients with complex MVCAD should undergo multidisciplinary evaluation, with collaborative input from both a cardiac surgeon and an interventional cardiologist to determine the optimal revascularization strategy.

New Knowledge Gained

This study suggested that, among elderly patients undergoing revascularization, particularly those with MVCAD, PCI was comparable to CABG in terms of clinical outcomes. Given the advantages of shorter hospital stays and improved patient comfort, PCI may represent a favorable revascularization strategy in this population. All patients with complex MVCAD should undergo multidisciplinary evaluation, with collaborative input from both a cardiac surgeon and an interventional cardiologist to determine the optimal revascularization strategy.

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Not applicable

Declaration of Conflict of Interest

All authors declare no conflict of interest.

Abbreviations

CAD: Coronary artery disease
PCI: Percutaneous coronary intervention
CABG: Coronary artery bypass grafting
MACCE: Major adverse cardiovascular and cerebral events
MVCAD: Multivessel coronary artery disease
PAOD: peripheral artery occlusive disease
LMCAD: Left main coronary artery disease
OMT: Optimal medical therapy
CCS: Chronic coronary syndrome

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