의학박사 학위논문

연령이 좌주간부 관상동맥질환에서 경피적 관상동맥중재술과 관상동맥우회술의 비교 임상결과에 미치는 영향: IRIS-MAIN 하위연구

Effect of age on comparative clinical outcomes between percutaneous coronary intervention and coronary artery bypass graft in left main coronary artery disease: IRIS-MAIN substudy

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이 논문을 의학박사학위 논문으로 제출함

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Abstract

Introduction: Unprotected left main coronary artery(LMCA) disease was treated with coronary artery bypass grafting(CABG) and percutaneous coronary intervention(PCI). Age has emerged as a determinant in revascularization therapy decisions. With IRIS-MAIN registry, analysis of age-related clinical outcomes will offer critical insights into the optimal treatment strategies for LMCA disease.

Objectives: This study examined long-term comparative outcomes after percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), focusing on age.

Methods: The authors evaluated a total of 5,354 patients with left main coronary artery disease who underwent CABG (n=1,534) or PCI (n=3,820) from the IRIS-MAIN (Interventional Research Incorporation Society-Left MAIN Revascularization) registry. The age was categorized into young age (age< 55 years old), mid-age (≥55 to <70 years old), and old age (≥70 years old) groups. The primary outcome was a composite of death, myocardial infarction, or stroke.

Results: Among the overall patient population, 960 (17.9 %) patients were < 55 years old, 22,734 (51 %) patients were ≥55 to <70 years old, and 1,660 (31 %) patients were ≥70 years old. Compared with CABG, PCI showed relatively favoring outcomes after revascularization with mid-age group. CABG and PCI showed similar adjusted risk of primary outcomes in patients regardless of age groups (hazard ratio(HR) 0.92; 95% confidence interval(CI) 0.43-2.0 for young age, HR 1.14; 95% CI 0.80-1.62 for mid-age, HR 1.17; 95% CI 0.86-1.60, p for interaction 0.855).

Conclusion: The age did not significantly impact the 5 year risk of death, myocardial infarction, or stroke among LMCA patients treated with PCI or CABG.

Key words: coronary artery disease, percutaneous coronary intervention, coronary artery bypass

Abstract word count: 285

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Abbreviations and Acronyms

CABG = coronary artery bypass grafting

CAD = coronary artery disease

IPTW = inverse probability of treatment weighting

IRIS-MAIN = Interventional Research Incorporation Society-Left MAIN Revascularization

IVUS = intravenous ultrasound

LMCA = left main coronary artery

MI = myocardial infarction

PCI = percutaneous coronary intervention

Introduction

Unprotected left main coronary artery disease has the potential to lead to life-threatening complications such as myocardial infarction, heart failure, and death. [1-3] Coronary artery bypass grafting (CABG) has traditionally been the preferred strategy for left main coronary artery disease (LMCA) treatment. However, percutaneous coronary intervention (PCI) has arisen as a potential alternative to CABG, with numerous studies demonstrating its efficacy and safety. Emerging data indicate that PCI may offer comparable outcomes to CABG in selected LMCA. [4-9] As a result, guidelines now recommend PCI for selected LMCA patients with high-risk clinical and anatomic characteristics. [10, 11]

While left main coronary artery disease is generally considered more severe due to the extensive area of myocardium at risk, multivessel disease can also be hazardous, especially if it involves major arteries supplying critical regions of the heart. Recent research has highlighted the impact of age on the choice and outcomes of revascularization therapy in patients with multivessel coronary artery disease, with younger patients showing a lower incidence of mortality when undergoing PCI compared to CABG. [12, 13] Similarly, favorable outcomes for PCI in LMCA have been reported. [14] This age-specific perspective has prompted further exploration into the role of age in clinical outcomes within the realm of left main coronary artery disease, expanding our understanding of how age influences treatment choices.

However, it has not yet been established whether long-term outcomes after CABG and PCI for LMCA disease are differentially affected by age. This journal delves into the critical considerations surrounding left main coronary artery disease treatment choices, specifically focusing on how age impacts clinical outcomes within the IRIS-MAIN registry.

Methods

Study population

The study population comprised a part of the prospective, ongoing IRIS-MAIN registry. Details on the study design have been published previously. [9] IRIS-MAIN is a nonrandomized, multinational, observational registry, and patients with unprotected LMCA disease, defined as stenosis of > 50%, treated with PCI, CABG, or medication alone are enrolled. The study patients were recruited from 50 academic and community hospitals in Asia (China, India, Indonesia, Japan, Malaysia, South Korea, Taiwan, and Thailand). This study had an "all-comers" design to evaluate characteristics, treatments, and clinical outcomes of patients with LMCA disease in a real-world setting. The patients who had terminal malignancy with expected life expectancy <1 year were excluded. The research protocol was approved by the research ethics committee of each participating hospital, and written informed consent was obtained from all participants.

Study patients were categorized according to the age at the index hospitalization. The age was categorized into young age (age< 55 years old), mid-age (≥55 to <70 years old), and old age (≥70 years old) groups. The patients presented with ST-segment elevation myocardial infarction was excluded, since ST-segment elevation myocardial infarction disease had different pathophysiology compared with other types of coronary artery disease.[15, 16]

Study Outcome and follow-up

The primary outcome of the study was a composite of death, myocardial infarction (MI), or stroke. Secondary outcomes included individual components of the primary outcome, and the incidence of major adverse cardiac and cerebrovascular events (MACCE). The MACCE was defined as a composite of death, MI, stroke, or repeat revascularization. Death from any cause was primarily considered. MI was defined as follows: 1) if occurring within 48 h after the index treatment, an increase in the creatinine kinase-myocardial band values > 5 times the upper limit of normal with any of the following: the development of new pathological Q waves or a new bundle branch block, a documented new graft or new coronary occlusion on angiography, and a new or worsening regional wall motion abnormality or loss of viable myocardium on imaging studies; and 2) if occurring after 48 h after the index revascularization, any increase in the creatinine kinase-myocardial band above the upper limit of normal with symptoms or signs suggestive of ischemia. A stroke was defined as a sudden onset of neurological deficit confirmed by a neurologist using imaging studies. The index hospitalization was defined as the hospitalization in which an LMCA intervention was performed for the first time. Repeat revascularization included any percutaneous or surgical revascularization procedure after the index revascularization, regardless of whether the procedure was performed on a target or nontarget lesion. All clinical events were confirmed by source documentation collected from each hospital and were centrally adjudicated by an independent group of clinicians blinded to the index revascularization treatment.

Clinical follow-up was performed at 1 month, 6 months, and 1 year after the index treatment and then annually thereafter via an office visit or telephone follow-up. Information on baseline demographic and clinical characteristics, including LV function, coronary angiographic findings, procedural or operative data, and in-hospital and follow-up outcome data, was collected from each participating center using a pre-specified electronic case report form and periodically monitored by independent study personnel.

Statistical Analysis

The primary purpose of this study was to evaluate whether there are differences in long-term clinical outcomes between CABG and PCI according to age. Baseline characteristics of the study population, including demographics and clinical characteristics, coronary angiographic findings, and procedural or operative data, were compared according to the age and revascularization strategy. Categoric variables were reported as frequencies with percentages and were compared using either the Pearson chi-square test or the Fisher exact test as appropriate. Continuous variables were presented as mean ± SD and were compared using the Student's t-test or Wilcoxon rank sums test. Restricted cubic splines were fitted with 3 degrees of freedom concerning age as the continuous variable to investigate the association of age with clinical outcomes. Missing values were fulfilled using multiple imputation by Markov chain Monte Carlo method. Cumulative event rates and incidence curves for clinical outcomes after CABG and PCI were generated using the Kaplan-Meier method and compared with log-rank tests.

Considering the differences in baseline characteristics between 2 revascularization strategies and model overfitting due to the relatively small number of patients in young age, stabilized inverse probability of treatment weighting (IPTW) using the propensity score was used to reduce the effects of observed confounding. Propensity scores were estimated via multiple logistic regression analysis using the pretreatment variables listed in Table 1 and time periods based on the generation of stents used in PCI. For each group of age, a separate propensity score was calculated. We examined the similarities in baseline characteristics between the treatment groups before and after IPTW. Weighted standardized mean differences were estimated for all baseline covariates, and values < 0.10 for a given covariate indicated a relatively small imbalance. Weighted Cox proportional hazards regression models with stabilized IPTW were used to compare the effect of the revascularization strategy according to age. Formal interaction tests were conducted in the weighted Cox regression models to assess the interaction between age and the relative treatment effect.

All reported p values were 2-sided, and $p < 0.05$ was considered significant for all tests. No adjustment for multiple testing was undertaken. Because of the potential for type I error due to multiple comparisons, all findings of this study should be interpreted as exploratory. Statistical analyses were performed using SPSS version 22.0 (IBM Corporation, Armonk, New York) and R software version 3.6.2. (R Foundation for Statistical Computing, Vienna, Austria).

Results

Study population and baseline characteristics

Between January 2003 and December 2022, a total of 6,379 patients were included in IRIS-MAIN registry. Among them, we identified 5,354 patients with LMCA disease who met our inclusion and exclusion criteria (Figure 1), of whom 3,820 (71.3%) underwent PCI and 1,534 (28.6%) underwent CABG. In this overall patients, 960 patients were young age (age< 55 years old), 2,734 were mid-age (≥55 to <70 years old), and 1,660 were old age (≥70 years old), respectively. Baseline clinical and anatomic characteristics according to the age groups are summarized in Table 1. Overall and in each age group, patients with LMCA who had insulin-requiring diabetes mellitus, low left ventricular ejection fraction, combined right coronary artery disease, more extended coronary artery disease, or more total lesions tended to receive CABG rather than PCI.

Detailed information on procedural or operative characteristics and pharmacological treatment according to the age groups is summarized in Table 2. In the PCI arm, patients with older age had more stents inserted at diseased coronary vessels, especially at the left main lesion. Old age groups had longer total stent lengths and used mechanical circulatory support more than younger groups. Young age groups had more complete revascularization treatment and final kissing procedure. The stent technique and IVUS use were not significantly different according to the age groups. In the CABG arm, patients with young age had more use of arterial grafts compared with older groups. In medication use, old age groups had less prescription of antiplatelet agents and calcium-channel blockers but more prescription of angiotension II receptor blockers. In the use of on-pump or off-pump technique, use of LIMA graft, use of radial artery graft, and total number of grafts did not show significant differences between age groups.

Long term clinical outcomes

In the overall population, the median follow-up duration was 4.49 years. The spline curve according to age showed similar risks of primary clinical outcomes between PCI and CABG after primary adjustment (Figure 2). The unadjusted rates of primary and secondary outcomes after PCI versus CABG according to age groups are shown in Table 3. The incidence of the primary composite outcome of death, MI, or stroke and all-cause mortality proportionally increased according to age, and the relative outcomes after revascularization favored PCI over CABG in patients with older age. This trend was especially significant in the mid-age group. Incidence of MI and MACCE did not show significant differences between age groups.

The unadjusted and adjusted risks for 5-year primary composite outcome and secondary outcomes are shown in Table 4 and Figure 3. The adjusted risk for the primary outcome was comparable between PCI and CABG in whole age groups. A nonsignificant trend was observed for the adjusted risks of all-cause mortality, MI, and MACCE. The adjusted risk of stroke was higher in CABG than PCI in the mid-age group.

Discussion

The comprehensive analysis conducted within the IRIS-MAIN registry, which spans nearly two decades, has provided invaluable insights into the management of left main coronary artery disease. The study evaluated 5,354 patients, and divided them into three groups – young, mid-age, and old- with a primary focus on their impact on coronary revascularization strategies. The study showed that age did not impact the risk of death, myocardial infarction, or stroke among LMCA patients treated with PCI or CABG.

A meta-analysis of four randomized LMCA trials showed similar results. In this analysis, the patients <65 years tended to favor PCI over CABG, but no statistically significant interaction was observed (HR 0.84, CI 0.57-1.24 for <65 years; HR 1.23, CI 0.99-1.51 for ≥ 65 years; p for interaction 0.091).[14] Five-year follow-up of Evaluation of XIENCE versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization (EXCEL) trial showed similar results which stratified age group by 67 years old.[17] Age-specific subgroup analysis of Nordic-Baltic-British Left Main

Revascularization (NOBLE) study divided the patients by 67 years old, the same as the EXCEL trial. It showed older patients had lower 5-year MACCE after CABG than PCI. The incidence of MI was higher in the older age group.[18] However, no significant interaction was present between age and treatment. Our trial showed a similar incidence of MACCE according to age and revascularization treatment. This difference may be due to the main NOBLE study result, which suggested LMCA patient had inferior outcomes after PCI compared with CABG.

Interestingly, the relative benefits of the revascularization procedures showed a trend of favoring PCI over CABG, most notably within the mid-age group in the spline curve before adjustment. No studies divided the patients into three age groups in LMCA disease, but only in two groups. Since there may be few LMCA patients in the young age group (< 55 years), the young and mid-age groups are comparable to those in other LMCA diseases. In this regard, our study showed results similar to those of other LMCA diseases, which showed a trend favoring PCI in the younger age group without statistical significance.[14, 17-19]

The unadjusted incidence rates of primary composite outcome, as well as death, escalated with advancing age. Even though there was no significant difference, the relative adverse clinical outcomes after revascularization were lower in PCI group than CABG group, especially in old age (≥70 years). Some studies that compared PCI and CABG in LMCA patients in very old patients (≥75 years) showed comparable results, which seemed to favor PCI over CABG in the elderly.[20, 21] Therefore, PCI can be an viable option for elderly patients with LMCA.

Limitation

The journal presents several notable limitations. First, its nonrandomized, observational design introduces a susceptibility to selection bias, potentially affecting the study's ability to draw definitive conclusions applicable to broader patient populations. We used propensity score matching to reduce this potential bias. Second, the exclusion of data from the bare-metal stent (BMS) era of 1995 to 2002 may limit the historical context and the understanding of how treatment strategies have evolved. Third, since we excluded ST-segment elevation MI patients, the major adverse event can be different from other studies that included MI patients. Regarding this disease can cause high mortality rates, further studies, including MI patients, need to be evaluated. Additionally, the relatively short-term follow-up duration of 5 years might not capture long-term trends and complications that could manifest beyond this period. These limitations underscore the need for a cautious interpretation of the study's findings and emphasize the necessity for further research to address these shortcomings and provide a more robust understanding of the subject matter.

Conclusion

The age did not significantly impact the 5 year risk of death, myocardial infarction, or stroke among LMCA patients treated with PCI or CABG. Also, similar results were shown in individual components of composite outcomes. However, in the whole group, the PCI showed a trend of low clinical outcomes compared with CABG. With the development of PCI strategy and devices, future studies will provide more insights in choosing optimal revascularization strategy in LMCA disease.

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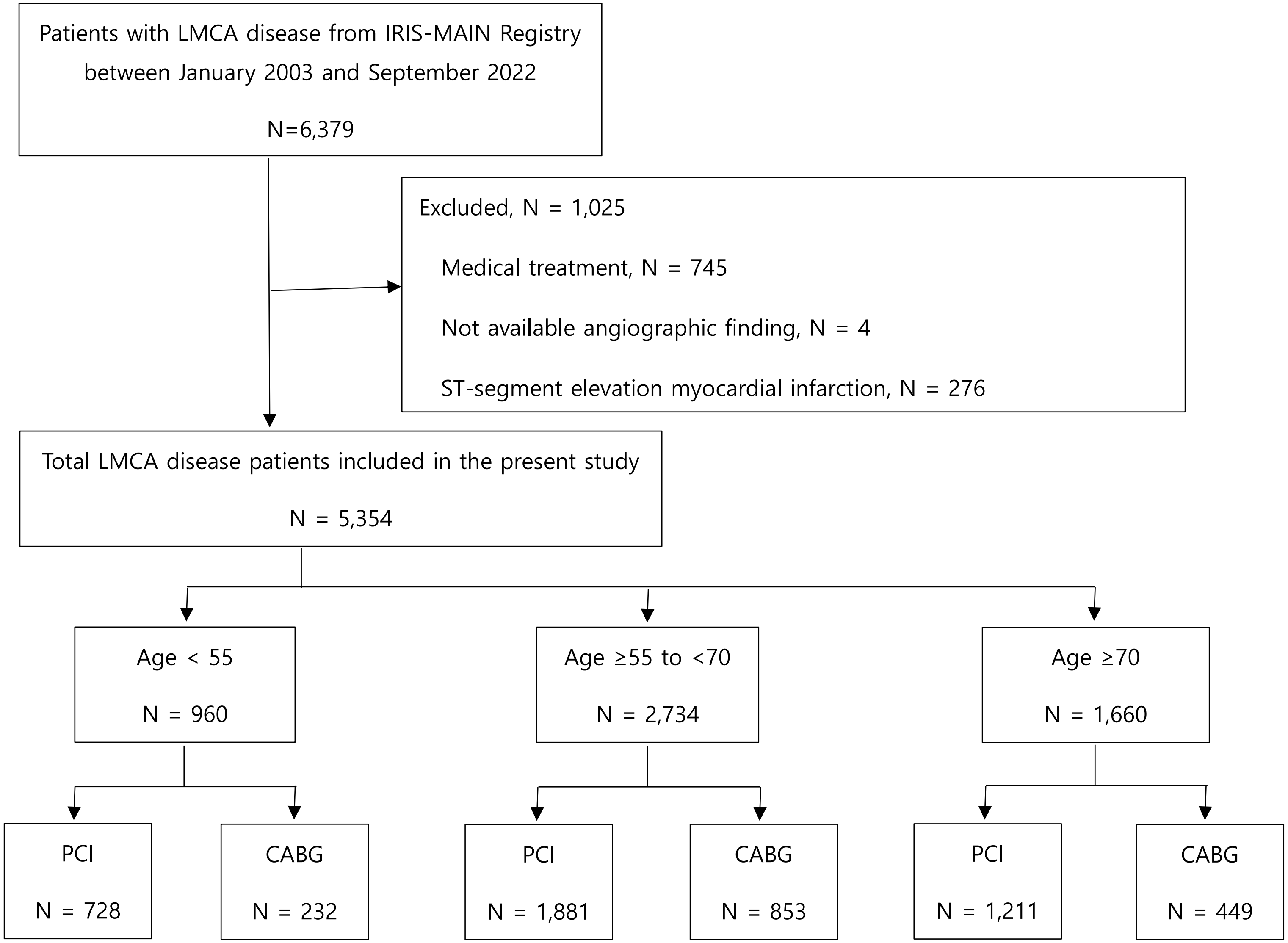
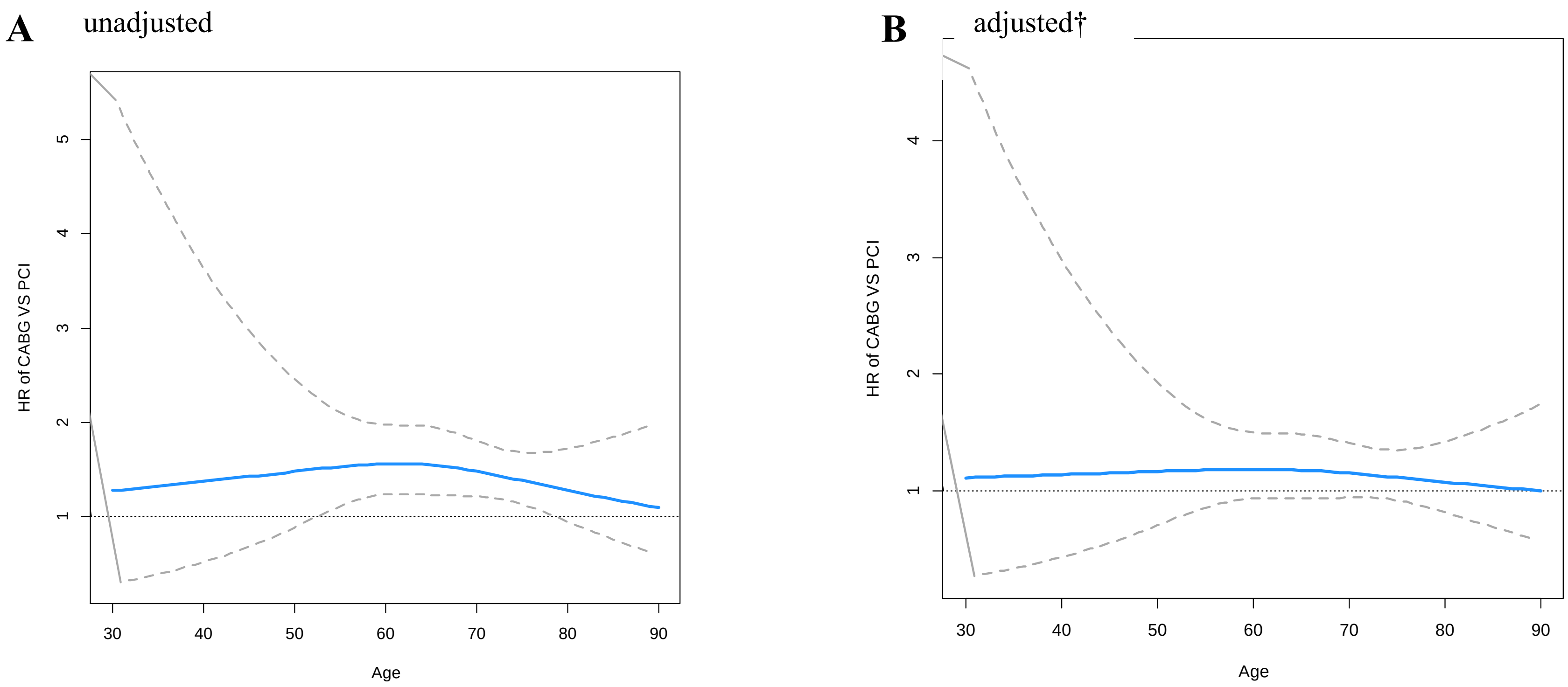
Figure 1. Study Flowchart



Patient selection and grouping. The numbers of patients excluded and enrolled in the present study are shown, CABG = coronary artery bypass grafting; IRIS-MAIN = interventional Research Incorporation Society-Left Main Revascularization; LMCA = left main coronary artery; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention

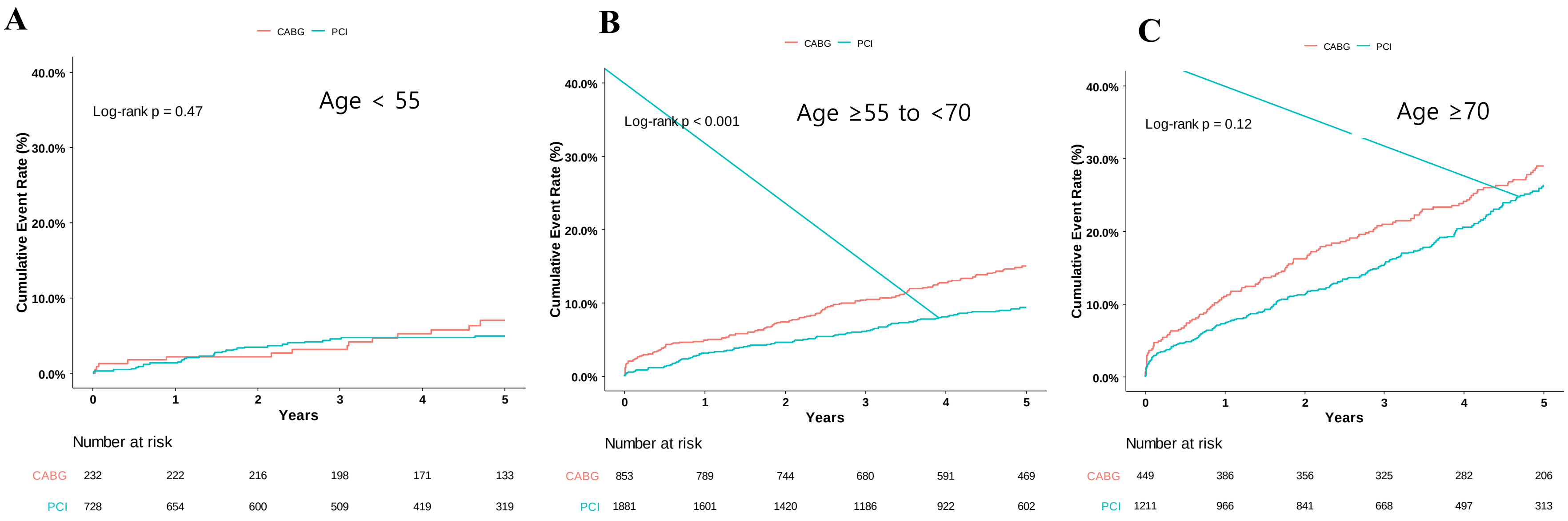
Figure 2. Unadjusted and adjusted hazard ratios for the primary composite outcome by age in patients who underwent CABG or PCI for LMCA diseases

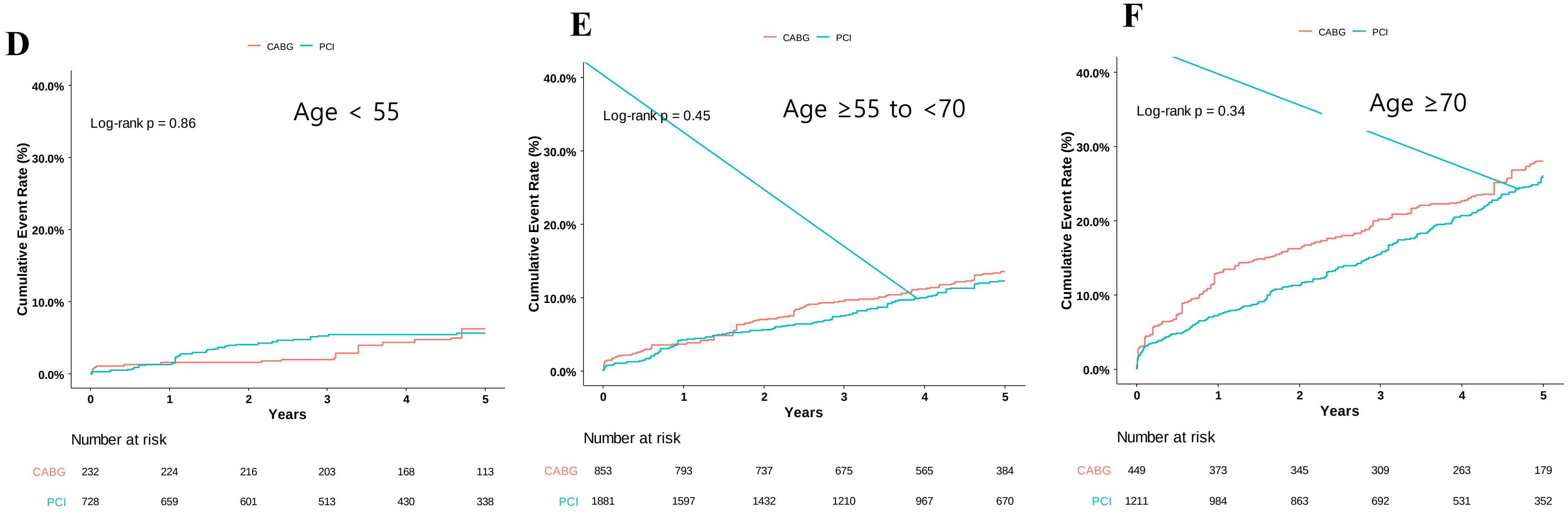


*Hazard ratios are for the PCI group compared to the CABG group.

†Analyses were adjusted for independent predictors of the primary composite outcome.

Figure 3. Unadjusted and adjusted 5-year event rates for the primary composite outcome according to the age groups who underwent PCI or CABG for LMCA disease





Unadjusted cumulative event curves after CABG and PCI are shown in (A) young age (age< 55 years old), (B) mid-age (≥55 to <70 years old), and (C) old age (≥70 years old) groups. Adjusted cumulative event curves are shown in (D) young age (age< 55 years old), (E) mid-age (≥55 to <70 years old), and (F) old age (≥70 years old) groups.

Table 1. Baseline Clinical and anatomic characteristics of the patients according to age and revascularization method

	Age <55			Age ≥55 to <70			Age ≥70		
	PCI (n=728)	CABG (n=232)	p value	PCI (n=1881)	CABG (n=853)	p value	PCI (n=1211)	CABG (n=449)	p value
Year of revascularization*			<0.001			<0.001			<0.001
2003-2006	115 (15.8)	89 (38.4)		175 (9.3)	319 (37.4)		77 (6.4)	125 (27.8)	
2007-2016	613 (84.2)	143 (61.6)		1706 (90.7)	534 (62.6)		1134 (93.6)	324 (72.2)	
Clinical characteristics									
Men	553 (76)	196 (84.5)	0.006	1523 (81)	681 (79.8)	0.488	879 (72.6)	332 (73.9)	0.580
BMI, kg/m^2	25.3±3.3	25.4±3.3	0.718	24.7±3	24.8±3	0.832	24.1±3.1	24.2±3.1	0.368
Hypertension	369 (50.7)	115 (49.6)	0.767	1214 (64.6)	545 (63.9)	0.730	899 (74.2)	328 (73.1)	0.625
Diabetes mellitus	200 (27.5)	89 (38.4)	0.002	727 (38.7)	379 (44.4)	0.004	453 (37.4)	183 (40.8)	0.212
Insulin requiring	24 (3.3)	21 (9.1)	<0.001	78 (4.1)	85 (10)	<0.001	78 (6.4)	32 (7.1)	0.618
Dyslipidemia	460 (63.2)	135 (58.2)	0.172	1273 (67.7)	479 (56.2)	<0.001	814 (67.2)	253 (56.3)	<0.001
Smoking	225 (30.9)	86 (37.1)	0.081	435 (23.1)	237 (27.8)	0.009	180 (14.9)	69 (15.4)	0798
Previous MI	50 (6.9)	34 (14.7)	<0.001	127 (6.8)	110 (12.9)	<0.001	94 (7.8)	48 (10.7)	0.058
Previous PCI	97 (13.3)	32 (13.8)	0.855	346 (18.4)	110 (12.9)	<0.001	246 (20.3)	58 (12.9)	0.001

Previous CVA	25 (3.4)	13 (5.6)	0.140	122 (6.5)	61 (7.2)	0.519	117 (9.7)	59 (13.1)	0.041
Previous PAD	11 (1.5)	7 (3)	0.163	57 (3)	69 (8.1)	<0.001	65 (5.4)	39 (8.7)	0.013
Chronic lung disease	3 (0.4)	5 (2.2)	0.023	28 (1.5)	27 (3.2)	0.004	47 (3.9)	21 (4.7)	0.467
Chronic renal failure	15 (2.1)	7 (3)	0.398	74 (3.9)	43 (5)	0.185	85 (7)	29 (6.5)	0.689
Dialysis	10 (1.4)	4 (1.7)	0.753	51 (2.7)	28 (3.3)	0.409	44 (3.6)	11 (2.4)	0.231
CHF	5 (0.7)	9 (3.9)	0.002	25 (1.3)	33 (3.9)	<0.001	42 (3.5)	20 (4.5)	0.347
Ejection fraction, %	59.9±8	56.4±11.3	0.001	59.6±9.6	55.6±11.4	<0.001	57.8±11	54.1±12.3	<0.001
Atrial fibrillation	4 (0.5)	1 (0.4)	>0.99	25 (1.3)	7 (0.8)	0.252	48 (4)	8 (1.8)	0.029
ACS	410 (56.3)	141 (60.8)	0.232	915 (48.6)	539 (63.2)	<0.001	634 (52.4)	289 (64.4)	<0.001
Clinical indication			0.014			<0.001			<0.001
Silent ischemia	29 (4)	14 (6.1)		98 (5.3)	53 (6.2)		79 (6.6)	37 (8.3)	
Stable angina	278 (38.8)	75 (32.6)		838 (45.3)	258 (30.4)		488 (40.6)	121 (27.1)	
Unstable angina	320 (44.6)	124 (53.9)		756 (40.8)	467 (54.9)		451 (37.6)	237 (53)	
NSTEMI	90 (12.6)	17 (7.4)		159 (8.6)	72 (8.5)		183 (15.2)	52 (11.6)	
Anatomic characteristics									
Extent of CAD			<0.001			<0.001			<0.001
Left main only	143 (19.6)	17 (7.3)		160 (8.5)	14 (1.6)		71 (5.9)	5 (1.1)	

Left main + 1VD	199 (27.3)	19 (8.2)		465 (24.7)	46 (5.4)		277 (22.9)	21 (4.7)	
Left main + 2VD	238 (32.7)	55 (23.7)		703 (37.4)	171 (20.0)		440 (36.3)	72 (16)	
Left main + 3VD	148 (20.3)	141 (60.8)		553 (29.4)	622 (72.9)		423 (34.9)	351 (78.2)	
Left main disease location			0.001			<0.001			<0.001
Ostium or shaft	431 (59.2)	109 (47)		1060 (56.4)	373 (43.7)		715 (59)	202 (45)	
Distal bifurcation	384 (52.7)	139 (59.9)	0.056	1131 (60.1)	558 (65.4)	0.008	705 (58.2)	302 (67.3)	0.001
Proximal LAD disease	460 (63.2)	164 (70.7)	0.037	1398 (74.3)	658 (77.1)	0.114	930 (76.8)	366 (81.5)	0.039
RCA disease	233 (32)	164 (70.7)	<0.001	838 (44.6)	687 (80.5)	<0.001	319 (51.1)	384 (85.5)	<0.001
No. of total lesions	2.1±1.2	3.6±1.7	<0.001	2.4±1.3	3.9±1.6	<0.001	2.6±1.3	4.1±1.6	<0.001

Values are n(%) or mean ± SD. *Historical periods were chosen based on the generation of stent used in PCI: the first-generation drug-eluting stent era for 2003 to 2006 and the second-generation drug-eluting stent era from 2007 to 2022

ACS = acute coronary syndrome; BMI = body mass index; CAD = coronary artery disease; CHF = congestive heart failure, CVA = cerebrovascular accident; LAD = left anterior descending artery; MI = myocardial infarction; PAD = peripheral artery disease; NSTEMI = non-ST-segment elevation myocardial infarction; RCA = right coronary artery; VD = vessel disease; other abbreviations as in Figure 1

Table 2. Procedural or operative characteristics and pharmacological treatment of the patients according to the age groups

	Age <55 (n = 960)	Age ≥55 to <70 (n = 2,734)	Age ≥70 (n = 1,660)	p value
Revascularization				<0.001
PCI	728 (75.8)	1881 (68.8)	1211 (73)	
CABG	232 (24.2)	853 (31.2)	449 (27)	
Characteristics of PCI procedure				
BMS	11 (1.5)	23 (1.2)	11 (0.9)	0.473
DES				<0.001
First-generation DES	158 (21.9)	290 (15.5)	126 (10.4)	
Second-generation DES	554 (76.6)	1562 (83.3)	1069 (88.6)	
Total number of stents per patient	2.0±1.2	2.3±1.3	2.3±1.2	<0.001
Total stent number at LM site	1.6±0.9	1.8±0.9	1.7±0.9	<0.001
Total stent length, mm	46.0±35	53.5±34.9	52.5±34.6	<0.001
Stent technique				<0.001

LM stent only	177 (24.5)	309 (16.5)	214 (17.7)	
Stenting crossing LAD	26 (3.6)	81 (4.3)	64 (5.3)	
Stenting crossing LCX	355 (49.1)	988 (52.8)	650 (53.8)	
Bifurcation 2 stents	165 (22.8)	494 (26.4)	281 (233.2)	
Final kissing	233 (31.8)	597 (31.4)	320 (25.9)	0.002
IVUS guidance	558 (77)	1444 (76.9)	932 (77.0)	>0.99
Use of MCS	20 (2.8)	47 (2.5)	53 (4.4)	0.012
Complete revascularization	522 (72)	1152 (61.4)	640 (52.8)	<0.001
Characteristics of CABG procedure				
Off-pump	137 (59.1)	497 (58.3)	282 (62.8)	0.276
On-pump	95 (40.9)	356 (41.7)	167 (37.2)	0.276
LIMA graft use	212 (91.4)	797 (93.7)	415 (92.6)	0.452
Radial artery graft use	2 (0.9)	9 (1.1)	5 (1.1)	0.952
Total number of grafts	3.0±0.9	3.1±0.9	3.0±1.0	0.129
Number of arterial grafts	2.0±1.0	1.9±1.0	1.7±1.0	<0.001
Cardiac-related medication				
Aspirin	938 (98.2)	2673 (98.2)	1607 (97.5)	0.221

P2Y12 inhibitor	109 (19.2)	235 (14.1)	94 (8.2)	<0.001
Clopidogrel	802 (84.2)	2342 (86.3)	1456 (88.3)	0.012
Ticagrelor	63 (11.1)	175 (10.6)	86 (7.5)	0.010
Prasugrel	46 (8.2)	60 (3.6)	8 (0.7)	<0.001
Beta-blocker	624 (65.4)	1659 (61.2)	1042 (63.3)	0.057
CCB	544 (57.9)	1528 (56.8)	867 (52.9)	0.015
ACE inhibitor	93 (9.8)	283 (10.6)	163 (10.0)	0.729
ARB	175 (18.4)	627 (23.2)	501 (30.5)	<0.001
Statin	515 (91.6)	1507 (91.2)	1034 (89.4)	0.171

Values are n (%) or mean ± SD.

BMS = bare-metal stent; DES = drug-eluting stent; IVUS = intravascular ultrasound; LAD = left anterior descending artery; LCX = left circumflex artery; LM = left main; LIMA = left internal mammary artery; MCS = mechanical circulatory support; ACE = angiotensin-converting enzyme; ARB = angiotensin II receptor blocker; CCB = calcium-channel blocker; other abbreviations as in Figure 1.

Table 3. Unadjusted 5-year clinical outcomes after PCI and CABG according to age groups

	Age <55			Age ≥55 to <70			Age ≥70		
	PCI (n=728)	CABG (n=232)	p value	PCI (n=1881)	CABG (n=853)	p value	PCI (n=1211)	CABG (n=449)	p value
Primary outcome									
Composite of death, MI, stroke	31 (5)	14 (7)	0.472	131 (9.4)	116 (1.5)	<0.001	224 (26.3)	120 (29)	0.117
Secondary outcome									
Death	20 (3.3)	11 (5.4)	0.252	99 (7.3)	83 (10.7)	0.003	188 (22.6)	108 (26.3)	0.058
MI	7 (1.2)	1 (0.6)	0.364	16 (1.2)	12 (1.7)	0.339	24 (3.1)	7 (9.1)	0.354
stroke	4 (0.6)	3 (1.5)	0.296	19 (1.4)	32 (4.6)	<0.001	28 (3.9)	14 (3.6)	0.624
MACCE	74 (12.3)	20 (9.6)	0.243	224 (15.6)	129 (16.6)	0.597	256 (29.7)	125 (30.1)	0.465

Values are n(%). Event rates were based on Kaplan-Meier estimates in time to first event analyses, and p values are derived using the log-rank test.

MI = myocardial infarction; MACCE = major adverse cardiac and cerebrovascular events

Table 4. Adjusted hazard ratios for 5-year clinical outcomes after PCI and CABG according to the age groups with the use of inverse probability-weighting*

	Age <55		Age ≥55 to <70		Age ≥70		P for interaction†
	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	
Unadjusted							
Primary composite of death, MI, stroke	1.24 (0.66-2.35)	0.492	1.65 (1.28-2.12)	<0.001	1.21 (0.67-1.51)	0.099	0.175
Secondary outcome							
Death	1.52 (0.73-3.17)	0.267	1.53 (1.15-2.05)	0.004	1.27 (1.00-1.61)	0.049	0.590
MI	0.40 (0.05-3.28)	0.396	1.43 (0.68-3.02)	0.350	0.67 (0.29-1.56)	0.357	0.298
stroke	2.12 (0.47-9.47)	0.33	3.21 (1.82-5.67)	<0.001	1.16 (0.61-2.21)	0.648	0.067
MACCE	0.74 (0.45-1.21)	0.225	1.05 (0.85-1.31)	0.646	1.10 (0.89-1.36)	0.391	0.344
Adjusted							
Primary composite of death, MI, stroke	0.92 (0.43-2.00)	0.840	1.14 (0.80-1.62)	0.482	1.17 (0.86-1.60)	0.320	0.855
Secondary outcome							
Death	1.17 (0.48-2.90)	0.729	0.94 (0.62-1.44)	0.786	1.29 (0.93-1.78)	0.128	0.515

MI	0.15 (0.12-1.22)	0.076	0.63 (0.25-1.57)	0.321	0.38 (0.14-1.02)	0.054	0.428
stroke	1.31 (0.29-5.99)	0.727	3.29 (1.48-7.33)	0.004	1;12 (0.40-3.15)	0.825	0.218
MACCE	0.67 (0.336-1.26)	0.216	0.80 (0.59-1.08)	0.146	1.04 (0.77-1.40)	0.810	0.324

*Hazard ratios are for the PCI group compared to the CABG group.

†p interaction for age and revascularization strategy (PCI vs. CABG).

MI = myocardial infarction; MACCE = major adverse cardiac and cerebrovascular events; CI = confidence interval; HR = hazard ratio

국문요약

서론: 보호되지 않은 좌측 주요 관상동맥 질환은 관상동맥 우회술과 경피적 관상동맥 중재술로 치료되었습니다. 나이는 재관류 치료 결정에 있어 결정적인 요소로 간주됩니다. IRIS-MAIN 레지스트리를 통한 연령이 임상 결과에 미치는 영향을 분석하는 것은 좌측 주요 관상동맥 질환의 적절한 치료 전략에 대한 중요한 통찰을 제공할 것입니다.

목적: 이 연구는 경피적 관상동맥 중재술 또는 관상동맥 우회술 후 장기적인 임상 결과를 연령에 초점을 맞추어 분석했습니다.

방법: 저자들은 IRIS-MAIN 레지스트리에서 관상동맥 우회술 환자 1,534명과 경피적 관상동맥 중재술을 시행한 3,820명을 포함한 총 5,354명의 좌측 주요 관상동맥 질환 환자를 평가했습니다. 연령은 젊은 연령군(55세 미만), 중년 연령군(55세 이상 ~ 70세 미만), 노년 연령군(70세 이상)으로 분류되었습니다. 주요 결과는 사망, 심근 경색, 뇌졸중의 복합 결과였습니다.

결과: 전체 환자 중 960명(17.9 %)이 55세 미만, 2,734명(51 %)이 55세 이상 ~ 70세 미만, 1,660명(31 %)이 70세 이상이었습니다. 관상동맥 우회술과 비교하여, 경피적 관상동맥 중재술은 중년 연령군에서 재관류 후 상대적으로 유리한 결과를 보였습니다. CABG와 PCI는 연령군에 상관없이 주요 결과의 유사한 위험도를 보였습니다.

결론: 경피적 관상동맥 중재술 또는 관상동맥 우회술로 치료받은 좌측 주요 관상동맥 질환 환자들 사이에서 연령은 5년간 사망, 심근 경색, 뇌졸중의 위험에 유의한 영향을 미치지 않았습니다.

중심 단어: 관상동맥 질환, 경피적 관상동맥 중재술, 관상동맥 우회술