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석 사 학 위 논 문

Three-year Clinical Outcome
Comparison of Imaging-guided
Percutaneous Coronary Intervention in
Acute Coronary Syndrome

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의 학 과

송 지 훈

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2 0 2 4 년 8 월

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이 논문을 석사학위 논문으로 제출함

2 0 2 4 년 8 월

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송 지 훈

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1. Introduction

Invasive coronary angiography-guided percutaneous coronary intervention (PCI) is the standard treatment for culprit lesions in patients with acute coronary syndrome (ACS). Furthermore, invasive intravascular imaging modalities provide benefits in the application of optimal stent deployment and obtaining detailed information on diseased lesions. Intravascular ultrasound (IVUS) has contributed to coronary lesion assessment and helped overcome the limitations of coronary angiography. Optical coherence tomography (OCT) provides a more accurate and faster delineation of the lumen or stent border, although it uses contrast media. IVUS provides additional information to physicians, which confirm complete apposition, good expansion, no edge dissection, and full lesion coverage, associated with lower cardiovascular death, myocardial infarction (MI), target lesion revascularization (TLR), and stent thrombosis (ST), compared with conventional coronary angiography alone (1,2). OCT-guided PCI represents a new angle of view to address the adequacy of stent deployment and permits the detection of features that may be missed by IVUS, such as malapposition, intra-stent plaque/thrombus protrusion, or dissections at the stent edges and inside the stents with a higher resolution (3). Accordingly, recent guidelines recommend using OCT to detect stent-related mechanical problems leading to restenosis, optimizing stent implantation and using IVUS (4,5). The clinical utility and outcomes of routine OCT guidance compared to those of IVUS-guided PCI are not well established in patients with ACS. Therefore, we studied the three-year clinical outcomes in ACS patients who underwent OCT- or IVUS-guided PCI, through propensity score matching analysis.

2. Materials and Methods

2.1. Study design and population:

A total of 638 patients with ACS (unstable angina, non-ST-elevation MI, or ST-elevation MI) who underwent PCI using intravascular imaging were enrolled in a single-center cohort. The exclusion criteria were left-main (LM) disease, multi-lesion PCI, loss to follow-up, and poor OCT or IVUS imaging due to heavy calcification or artifacts. Among the 638 consecutive patients, nine with LM, 65 with multi-lesion PCI, 15 lost to follow-up, and 17 with poor intravascular imaging were excluded (Figure 1).

2.2. Procedure and angiographic measurements:

The PCI procedure was performed using a standard technique without restriction of the catheters, wires, balloons, and stents. Lesion preparation using a balloon catheter, rotator, or other device was left to the discretion of the operators. The selection of a specific type of contemporary drug-eluting stent (DES) was at the discretion of treating physician (6). Stent size and length were selected using a predefined common algorithm for OCT or IVUS based on expert consensus (7), which was recommended for PCI optimization criteria. If intravascular imaging criteria for optimal stent deployment were not met, additional procedures with a high-pressure balloon or additional balloon and/or stenting were performed at the discretion of the operators. Procedural

anticoagulation was achieved with unfractionated heparin according to the local site protocols. After PCI, all patients were prescribed lifelong aspirin at a daily dose of 100–200 mg. A platelet P2Y₁₂ receptor inhibitor (clopidogrel, prasugrel, or ticagrelor) was prescribed for at least 12 months after the procedure at the physician's discretion according to the clinical indication and procedural complexity. All coronary angiograms were analyzed using standard definitions and quantitative coronary angiography (QCA).

2.3. Imaging modality and imaging-guided stent optimization:

In each group, either OCT or IVUS was performed before, during, and immediately after PCI. If the imaging catheter did not cross the lesion prior to stenting, or if the flush was insufficient to clear blood from the lumen (in OCT cases), balloon predilation was used to facilitate image acquisition. In the IVUS group, IVUS was performed using the participating center's available devices with a motorized catheter pullback. After intracoronary injection of nitroglycerin or isosorbide dinitrate, the IVUS catheter was advanced > 5 mm beyond the target lesion over the guidewire and then withdrawn to the aorto-ostial junction at a motorized pullback speed of 0.5 mm/s or 1.0 mm/s. During PCI, the obtained IVUS images were evaluated with independent core lab in accordance with the criteria of the American College of Cardiology clinical expert consensus document on IVUS (8).

In the OCT group, the operator selected the distal fiducial site as the starting point for the analysis. A bolus intracoronary injection of nitroglycerin or isosorbide dinitrate was administered prior to OCT

imaging. A frequency-domain OCT system (C7-XR and OPTIS, Abbott, Santa Clara, CA, USA) was integrated in the catheterization laboratory. Under angiographic guidance, an OCT catheter (Dragonfly Imaging Catheter, Abbott, Santa Clara, CA) was advanced more than 5 mm distal to the target segment. To remove the blood from the field of view, contrast medium was infused into the coronary artery from the guide catheter using an injector pump. Images were acquired at a motorized pullback speed of 20 mm/s for a length of 54 mm (C7-XR, 100 frames/s), 18 mm/s for 54 mm, and 36 mm/s for 75 mm (OPTIS, 180 frames/s). During PCI, the acquired OCT images were evaluated online in real-time in accordance with the criteria reported by the International Working Group for Intravascular OCT Standardization and Validation (9).

2.4. Study definitions and endpoints:

The primary endpoint was a three-year rate of target vessel failure. Target vessel failure was defined as the composite endpoint of cardiac death, target vessel myocardial infarction, and target vessel revascularization (TVR). Cardiac death was defined as any death due to a proximate cardiac cause, unwitnessed death and death of unknown cause, and all procedure-related deaths, including those related to concomitant treatment. The diagnosis of recurrent myocardial infarction was made according to the third universal definition of myocardial infarction (10). TVR was defined as repeat percutaneous intervention of the target lesion or bypass surgery of the target vessel performed for restenosis or other complications of the target lesion. The secondary

endpoints included death (cardiac or non-cardiac), MI (any or target vessel), repeat revascularization, and definite or probable stent thrombosis, according to the Academic Research Consortium definition (11).

2.5. Statistical analysis:

The main study compared OCT-guided and IVUS-guided PCI. Categorical outcomes were compared using the chi-square test unless the expected number of values in any cell of the 2×2 contingency table was < 5 , in which case the Fisher exact test was used. Continuous variables are presented as mean \pm SD and were compared using t-test. The cumulative incidence rates of primary and secondary clinical outcomes were estimated using the Kaplan-Meier method and tested using the log-rank statistic.

Cox proportional hazard models were used to compare the clinical events associated with OCT- and IVUS-guided PCI. All variables with a p-value < 0.1 in the univariate analysis in Tables 1 and 2 were entered into a multivariate Cox regression model. Independent predictors of TVF were entered into a multivariable logistic regression analysis, including pre- and post-QCA parameters. To compensate for the nonrandomized design of observational studies and reduce the effect of potential confounding factors, a propensity score method was used. Baseline characteristics with clinical relevance were selected as potential risk adjusting variables. Variables with a p-value ≤ 0.1 in univariate analyses were included in the multivariable Cox regression model. The final models for each endpoint were determined using backward stepwise

elimination procedures, in which the least significant variable was removed one at a time from the full model. Propensity score analysis was performed to control for potential confounders and to minimize selection bias. Propensity scores were estimated without regard to outcomes, using multiple logistic regression analysis for each patient. Statistical significance was set at two-sided p-value of < 0.05 . Analyses were performed using the R software version 3.1.2.

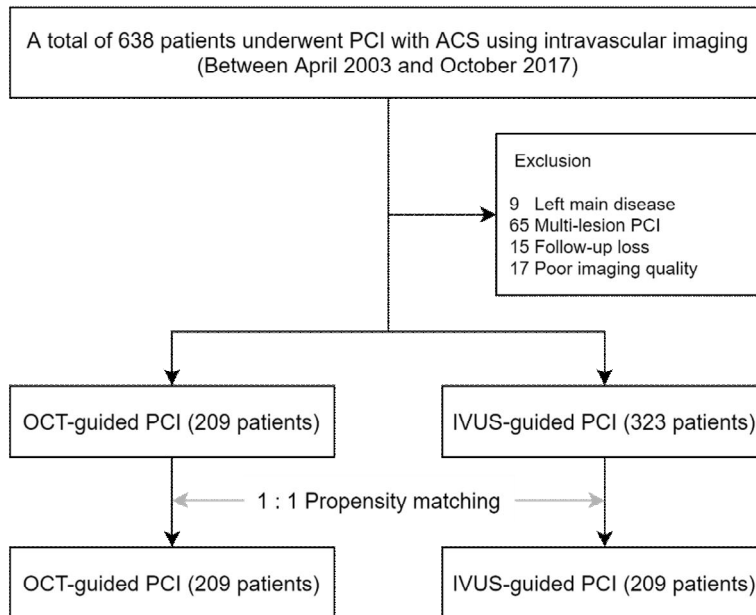


Figure 1. Flow chart. PCI: percutaneous coronary intervention; ACS: acute coronary syndrome; OCT: optical coherence tomography; IVUS: intravascular ultrasound.

3. Results

3.1. Baseline characteristics:

We enrolled 532 patients, of which, 209 underwent OCT-guided PCI and 323 underwent IVUS-guided PCI. The patient characteristics are listed in Table 1. There was no statistical difference between the two groups in terms of baseline clinical characteristics. Procedural characteristics are listed in Table 2. Proximal reference vessel diameter (OCT versus IVUS; 3.3 ± 0.5 mm versus 3.4 ± 0.4 mm, $p < 0.05$), percent diameter stenosis ($83.8 \pm 10.6\%$ versus $86.1 \pm 11.3\%$, $p < 0.05$) were higher in the IVUS-guided, and the lesion length (21.2 ± 9.0 mm versus 25.2 ± 12.7 mm, $p < 0.001$) was longer in the IVUS-guided group. After PS matching, there were 209 matched pairs of patients between the OCT- and IVUS-guided groups, and there were no significant differences between the groups for any of the clinical and procedural covariates (Table 1 and 2).

3.2. Impact of clinical outcomes according to imaging modality:

The median follow-up was 36.5 months (interquartile range 35.2 to 38.2 months) in the overall patients. During three years of follow-up, the observed (unadjusted) clinical outcomes according to the imaging modality are presented in Table 3. During follow-up, five patients died (1.0%) and 10 patients had myocardial infarction (2.0%). TVR was performed in 29 (5.5%) patients. The incidence of any repeated

revascularization was higher in the IVUS-guided group, but the difference was not statistically significant (5.9% versus 10.6%, $p > 0.05$).

After PS matching, 418 matched pairs of patients were created. In PS matching methods, there was no significant difference in the three-year rates of death and a composite of TVF (cardiac death, target vessel MI, or TVR) between the two groups (Table 3 and Figure 2). In addition, the three-year rate of any repeated revascularization was consistently higher in the IVUS-guided group than in the OCT-guided group, but without statistical significance (5.9% versus 10.2%, $p > 0.05$).

3.3. Predictor of clinical outcomes in patients with acute coronary syndrome:

The results of the univariate and multivariate Cox proportional hazards analyses to identify the risk factors for the occurrence of a three-year TVF are summarized in Table 4. In the overall cohort, the number of stents, diabetes mellitus, lesion length, and total stent length were predictors of the three-year TVF event rate in the univariate analysis. OCT was not a predictor of the primary endpoint. Lesion length was an independent predictor of the three-year TVF rate (hazard ratio, HR: 1.04; 95% confidence interval, CI: 1.02–1.07; $p < 0.01$).

Table 1A. Baseline Demographic and Clinical Characteristics of Patients

Characteristics	Before PS matching			After PS matching		
	OCT	IVUS	p-value	OCT	IVUS	p-value
	(n = 209)	(n = 323)		(n = 209)	(n = 209)	
Age (years)	60.9 ± 10.8	60.0 ± 10.3	> 0.05	60.9 ± 10.8	60.5 ± 10.4	> 0.05
Men	156 (74.6%)	251 (77.7%)	> 0.05	156 (74.6%)	159 (76.1%)	> 0.05
Hypertension	79 (37.8%)	150 (46.4%)	> 0.05	79 (37.8%)	78 (37.3%)	> 0.05
Diabetes mellitus	43 (20.6%)	65 (20.1%)	> 0.05	43 (20.6%)	41 (19.6%)	> 0.05
Hyperlipidemia	50 (23.9%)	87 (26.9%)	> 0.05	50 (23.9%)	50 (23.9%)	> 0.05
Current smoker	134 (64.1%)	180 (55.7%)	> 0.05	134 (64.1%)	127 (60.8%)	> 0.05
Renal failure	5 (2.4%)	4 (1.2%)	> 0.05	5 (2.4%)	3 (1.4%)	> 0.05
Previous MI	8 (3.8%)	8 (2.5%)	> 0.05	8 (3.8%)	5 (2.4%)	> 0.05
Previous PCI	7 (3.3%)	13 (4.0%)	> 0.05	7 (3.3%)	6 (2.9%)	> 0.05
Previous CABG	1 (0.5%)	2 (0.6%)	> 0.05	1 (0.5%)	0 (0.0%)	> 0.05
Ejection fraction (%)	53.5 ± 10.3	53.8 ± 10.4	> 0.05	53.5 ± 10.3	53.7 ± 10.2	> 0.05
LDL-C (mg/dl)	114.8 ± 35.9	118.2 ± 33.2	> 0.05	114.8 ± 35.9	114.1 ± 32.0	> 0.05
High-sensitive CRP	0.7 ± 2.1	1.3 ± 6.0	> 0.05	0.7 ± 2.1	0.6 ± 1.6	> 0.05
Clinical diagnosis	< 0.001			> 0.05		
Unstable angina	36 (17.2%)	80 (24.8%)		36 (17.2%)	42 (20.1%)	
NSTEMI	110 (52.6%)	94 (29.1%)		110 (52.6%)	92 (44.0%)	
STEMI	63 (30.1%)	149 (46.1%)		63 (30.1%)	75 (35.9%)	

Table 1B. Baseline Demographic and Clinical Characteristics of Patients
(continued).

Characteristics	Before PS matching			After PS matching		
	OCT	IVUS	p-value	OCT	IVUS	p-value
	(N = 209)	(N = 323)		(N = 209)	(N = 209)	
Discharge medication						
Aspirin	206 (98.6%)	322 (99.8%)	> 0.05	206 (98.6%)	208 (99.5%)	> 0.05
P2Y12 inhibitor	206 (98.6%)	319 (98.7%)	> 0.05	206 (98.6%)	206 (98.6%)	> 0.05
Beta-blocker	166 (79.4%)	276 (85.4%)	> 0.05	166 (79.4%)	172 (82.2%)	> 0.05
Calcium channel blocker	15 (7.2%)	24 (7.4%)	> 0.05	15 (7.2%)	16 (7.7%)	> 0.05
ACE inhibitor or ARB	142 (67.9%)	197 (60.9%)	> 0.05	142 (67.9%)	132 (63.1%)	> 0.05
Statin	184 (88.0%)	267 (82.6%)	> 0.05	184 (88.0%)	179 (85.6%)	> 0.05

Data are shown as mean (SD) for continuous variables and absolute numbers (percentage) for dichotomous variables. PS: propensity score; N: number; OCT: optical coherence tomography; IVUS: intravascular ultrasound; LDL-C: low-density lipoprotein cholesterol; NSTEMI: non-ST-elevation myocardial infarction; STEMI: ST-elevation myocardial infarction; ACE: angiotensin-converting enzyme; ARB: angiotensin receptor blockers; CABG: coronary artery bypass grafting; MI: myocardial infarction; PCI: percutaneous coronary intervention; CRP: C-reactive protein.

Table 2. Baseline Lesion and Procedural Characteristics

Characteristics	Before PS matching			After PS matching		
	OCT (N = 209)	IVUS (N = 323)	p-value	OCT (N = 209)	IVUS (N = 209)	p-value
Treated lesion			> 0.05			> 0.05
LAD	133 (63.6%)	200 (61.9%)		133 (63.6%)	138 (66.0%)	
LCX	22 (10.5%)	40 (12.4%)		22 (10.5%)	20 (9.6%)	
RCA	54 (25.8%)	83 (25.7%)		54 (25.8%)	51 (24.4%)	
Pre-procedural QCA						
Proximal RVD (mm)	3.3 ± 0.5	3.4 ± 0.4	< 0.05	3.3 ± 0.5	3.3 ± 0.4	> 0.05
Distal RVD (mm)	3.0 ± 0.5	3.1 ± 0.4	> 0.05	3.0 ± 0.5	3.1 ± 0.4	> 0.05
MLD (mm)	0.5 ± 0.3	0.6 ± 3.8	> 0.05	0.5 ± 0.3	0.5 ± 0.4	> 0.05
Diameter stenosis (%)	83.8 ± 10.6	86.1 ± 11.3	< 0.05	83.8 ± 10.6	84.9 ± 11.3	> 0.05
Lesion length (mm)	21.2 ± 9.0	25.2 ± 12.7	< 0.001	21.2 ± 9.0	21.0 ± 7.7	> 0.05
Procedural data						
Number of stents	1.04 ± 0.3	1.18 ± 0.3	< 0.05	53.2 ± 9.9	53.4 ± 10.5	> 0.05
Mean stent diameter (mm)	3.2 ± 0.4	3.2 ± 0.4	> 0.05	3.2 ± 0.4	3.2 ± 0.4	> 0.05
Total stent length (mm)	23.8 ± 9.0	28.6 ± 14.5	<0.001	23.8 ± 9.0	23.7 ± 7.7	> 0.05
Post-procedural QCA						
MLD (mm)	2.7 ± 0.8	2.7 ± 0.8	> 0.05	2.7 ± 0.8	2.7 ± 0.7	> 0.05
Diameter stenosis (%)	16.1 ± 15.0	17.5 ± 21.2	> 0.05	16.1 ± 15.0	15.5 ± 18.4	> 0.05

Data are shown as mean (SD) for continuous variables and absolute numbers (percentage) for dichotomous variables. PS: propensity score; N: number; OCT:

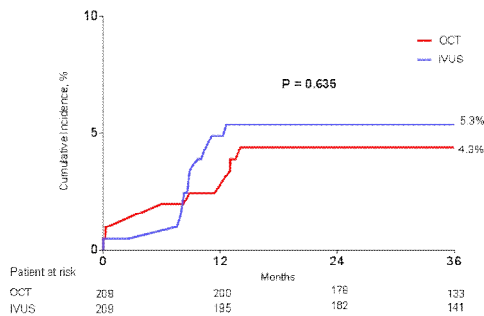
optical coherence tomography; IVUS: intravascular ultrasound; LAD: left anterior descending artery; LCX: left circumflex artery; RCA: and right coronary artery; QCA: quantitative coronary angiography; RVD: reference vessel diameter; MLD: minimal lumen diameter.

Table 3. Three-year Clinical Outcome According to Type of Intravascular Imaging after PS Matching

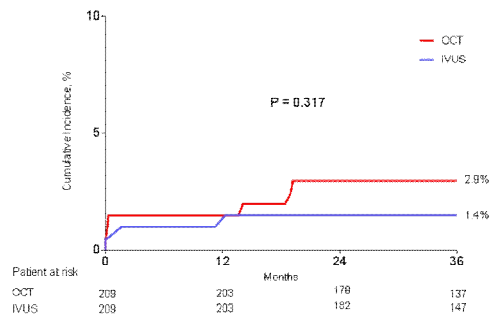
Characteristics	Event rate (%)			Event rate (%)			Hazard Ratio* (95% CI)	p-value
	before PS matching		p-value	after PS matching				
	OCT (N = 209)	IVUS (N = 323)		OCT (N = 209)	IVUS (N = 209)			
Target vessel failure	9 (4.4)	21 (6.8)	> 0.05	9 (4.4)	11 (5.4)	0.81 (0.33-1.95)	> 0.05	
Target lesion failure	9 (4.4)	19 (6.2)	> 0.05	9 (4.4)	9 (4.5)	0.98 (0.39-2.47)	> 0.05	
Death from any cause	3 (1.5)	2 (0.6)	> 0.05	3 (1.5)	0 (0.0)	-	-	
Cardiac death	0 (0.0)	1 (0.3)	> 0.05	0 (0.0)	0 (0.0)	-	-	
Non-cardiac death	3 (1.5)	1 (0.3)	> 0.05	3 (1.5)	0 (0.0)	-	-	
Myocardial infarction	3 (1.5)	7 (2.3)	> 0.05	3 (1.5)	3 (1.4)	1.00 (0.20-4.95)	> 0.05	
Target vessel MI	3 (1.5)	3 (1.1)	> 0.05	3 (1.5)	1 (0.5)	3.00 (0.31-28.8)	> 0.05	
Repeat revascularization	12 (5.9)	33 (10.6)	> 0.05	12 (5.9)	21 (10.2)	0.56 (0.28-1.14)	> 0.05	
Target vessel	9 (4.4)	20 (6.5)	> 0.05	9 (4.4)	11 (5.4)	0.82 (0.34-1.97)	> 0.05	
Target lesion	9 (4.4)	18 (5.8)	> 0.05	9 (4.4)	9 (4.4)	1.01 (0.40-2.53)	> 0.05	
Non-target vessel	3 (1.5)	13 (4.1)	> 0.05	3 (1.5)	10 (4.9)	0.30 (0.08-1.08)	> 0.05	
Definite Stent thrombosis	2 (1.0)	2 (0.8)	> 0.05	2 (1.0)	1 (0.5)	2.05 (0.19-22.5)	> 0.05	

* Cumulative rates of events based on Kaplan-Meier estimates. PS: propensity score; N: number; OCT: optical coherence tomography; IVUS: intravascular ultrasound; CI: confidence interval; MI, myocardial infarction.

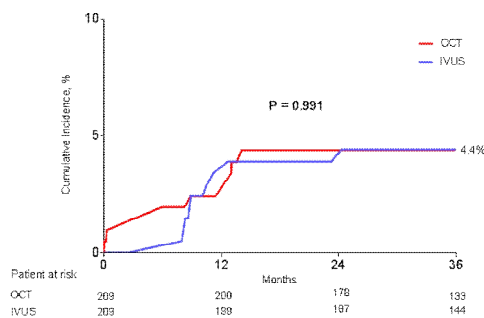
(A) Target-vessel failure



(B) All cause death or MI



(C) Target-lesion revascularization



(D) Stent thrombosis

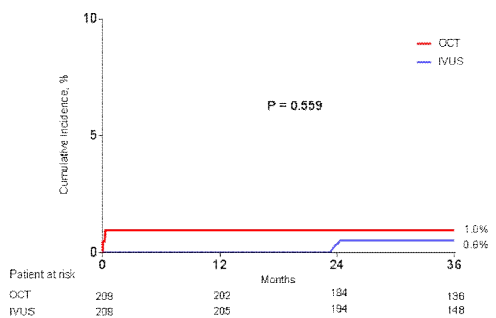


Figure 2. Three-year cumulative incidence of clinical outcomes according to type of intravascular imaging after propensity score matching. MI: myocardial infarction; OCT: optical coherence tomography; IVUS: intravascular ultrasound.

Table 4. Univariate and Multivariate Cox Proportional Hazard Analyses for Three-year Target Lesion Failure in Overall Patients

Target Lesion Failure				
Variables	Univariate		Multivariate	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Number of stents	2.39 (1.09-5.25)	< 0.05	–	–
Diabetes mellitus	1.98 (0.92-5.25)	< 0.1	–	–
Lesion length (mm)	1.04 (1.02-1.06)	< 0.01	1.04 (1.02-1.07)	< 0.01
Total stent length (mm)	1.03 (1.01-1.04)	< 0.01	–	–
OCT use	0.65 (0.30-1.42)	> 0.05	–	–

Lesion length was an independent predictor of clinical outcomes in ACS patients with imaging-guided PCI. CI: confidence interval; HR: hazard ratio.

4. Discussion

The main findings of the present study are as follows: (1) imaging-guided PCI showed favorable outcomes in ACS patients, (2) there were no significant differences in three-year clinical outcomes between OCT-guided PCI and IVUS-guided PCI, and (3) lesion length was an independent predictor of clinical outcomes in ACS patients with imaging-guided PCI.

4.1. Imaging-guided versus angiography-guided percutaneous coronary intervention:

With the establishment of intracoronary imaging, previous studies have evaluated the clinical benefits of imaging-guided PCI compared to angiography-guided PCI (12-16). A recent network meta-analysis including 17,882 patients who underwent angiography-, IVUS-, or OCT-guided PCI in 17 randomized controlled trials and 14 observational studies demonstrated that IVUS or OCT guidance was associated with significant reductions in major adverse cardiac events (MACE) and cardiovascular mortality compared to angiographic guidance, without efficacy differences between IVUS and OCT (12). OCT-guided PCI was associated with greater procedural success rates and reduced in-hospital MACE rates compared with angiography-guided PCI (0.8% versus 2.0%; $p = 0.01$) in a large British observational study (13). In a multicenter retrospective study, Centro per la Lotta Contro L'Infarto-Optimization of Percutaneous Coronary Intervention (CLI-OPCI) also revealed an event

rate reduction in patients who underwent OCT-guided interventions (14). DOCTORS (Does Optical Coherence Tomography Optimize Results of Stenting) trial compared OCT-guided with angiography-guided PCI in ACS using the post-PCI fractional flow reserve (FFR) value (15). Post-PCI FFR and the prevalence of post-PCI FFR > 0.9 were significantly higher in the OCT-guided group than in the angiography-guided group. In the IVUS-XPL study, a randomized, multicenter trial of patients (n = 1400) with long coronary lesions, the use of IVUS-guided stent implantation was associated with a significant 2.9% absolute reduction and 48% relative reduction in the risk of MACE at 1 year compared with angiography-guided stent implantation (16) and reduced the rate of target vessel revascularization significantly with five-year follow-up observation (HR: 0.50; 95% CI: 0.34-0.75; p < 0.01) (17). The current study showed favorable outcomes in patients with ACS who underwent imaging-guided PCI. The rates of cardiac death in the matched OCT- and IVUS-guided groups were favorable, and the rates of target vessel MI were 1.5% and 0.5% (p > 0.05), respectively. The present study noted that lesion length was an independent predictor with respect to predictors of the three-year TVF event rate. Eventually, intravascular imaging allows physicians to design appropriate stent implantation, especially in long lesions, regardless of modality.

4.2. Imaging-guided percutaneous coronary intervention in patients with acute coronary syndrome:

Although there is accumulating evidence for the usefulness of imaging-guided PCI (12, 18-21), most of the existing clinical trial data relate

to the use of IVUS guidance during PCI (16,19,22), and there are few studies evaluating the impact of these modalities during PCI procedures in patients with ACS (23,24). Although intravascular OCT is theoretically an ideal imaging technology to differentiate thrombus from other tissue types, previous ILUMIEN II and III randomized studies have not proven whether intravascular OCT guidance improves the clinical outcome in patients with AMI (25,26). However, several large retrospective registries have demonstrated the clinical impact of imaging-guided PCI in ACS. According to a Japanese 1-year follow-up cohort study of 6,025 patients with ACS, the imaging-guided group showed lower rates of total cardiac events (2.1% versus 3.7%; $p = 0.001$) and non-fatal MI (0.5% versus 1.5%; $p = 0.005$) than the angiography-guided group (23). In addition, the Korea AMI registry (KAMIR) (24) showed that the patient-oriented composite endpoint (5.9% versus 7.7%; HR: 0.74; 95% CI: 0.60-0.92; $p < 0.01$) and device-oriented composite endpoint (5.0% versus 6.8%; HR: 0.72; 95% CI: 0.57 - 0.90; $p < 0.01$) were significantly lower with intravascular modality guidance than with angiography guidance in patients presenting myocardial infarction. These favorable clinical outcomes in ACS are consistent with those of the present study.

4.3. Optical coherence tomography-guided versus intravenous ultrasound-guided percutaneous coronary intervention:

While the limited penetration depth of OCT prevents visualization of vessel size, the ILUMIEN II study showed that the degree of stent expansion was not significantly different between OCT and IVUS guidance (25), which suggested that OCT- and IVUS-guided PCI are similarly

feasible with securing the minimal lumen area (MLA). Two randomized controlled trials directly compared OCT- and IVUS-guided PCI with clinical endpoints (26,27). In the OPINION study, target vessel failure within 12 months post-PCI did not differ between groups (5.2% versus 4.9%, P for non-inferiority < 0.05) (27). The ILUMIEN III study showed the safety of OCT-guided PCI, with a similar minimum stent area to that of IVUS-guided PCI (26). Untreated major dissections (OCT 14% versus IVUS 26% versus angiography 19%, p -value [OCT versus IVUS] < 0.01 , p -value [OCT versus angiography] > 0.05) and major malapposition (11% versus 21% versus 31%, respectively; p -value [OCT versus IVUS] < 0.05 , p -value [OCT versus angiography] < 0.001) were less frequent in the OCT group than in the IVUS and angiography groups (26). The recent OCTIVUS trial, a randomized controlled trial, demonstrated that OCT-guided PCI was noninferior to IVUS-guided PCI among patients undergoing coronary revascularization, with a primary outcome composed of cardiovascular death, target vessel myocardial infarction, or ischemia-driven target vessel revascularization occurring in 2.5% of the OCT group versus 3.1% of the IVUS group (p for non-inferiority < 0.001) (28).

In patients with ACS, our study showed no significant difference in the three-year event rate of TVF in both groups. (OCT- versus IVUS-guided PCI, 4.3% vs. 5.3%; HR: 0.81; 95% CI: 0.33 - 1.95; p -value > 0.05). According to the consensus opinion of the expert group that IVUS and OCT are equivalent (and superior to angiography) in guiding and optimizing most PCI procedures, OCT can be an alternative strategy of IVUS for managing ACS patients on the basis of the benefits and limitations of each modality.

4.4. Limitation:

Our study has several limitations. First, it had a retrospective design. Although selection bias cannot be avoided, baseline characteristics were similar between the two groups, and propensity score matching was performed to compensate for bias and minimize the difference between the two groups. Second, this study had a small sample size and a relatively short observational period to confirm the results. There might be a difference in the results with a larger sample size or a longer observational period. Third, the exclusion criteria included multi-lesion diseases, left main disease, and poor OCT or IVUS images due to heavy calcification and artifacts. The current study evaluated lesions caused by a single vessel and found a low event rate. Especially in the case of multi-lesion, the use of OCT was limited, resulting in a small sample size; thus, multi-lesion cases were not included. Among the factors that could influence the choice between IVUS and OCT modalities, there is a potential for worsening renal function due to the use of contrast agents, but this aspect was not assessed. The morphological or histopathological mechanisms were not analyzed, which might have produced discrepancies in the real world. Notwithstanding, our study finding supports an important hypothesis that the three-year clinical outcome was favorable for ACS patients regardless of intravascular imaging type.

5. Summary

The aim of the current study was to evaluate the clinical outcomes of optical coherence tomography (OCT)- versus intravascular ultrasound (IVUS)-guided percutaneous coronary intervention (PCI) in patients with acute coronary syndrome (ACS).

A total of 638 patients who underwent PCI for ACS using intravascular imaging were retrospectively enrolled in the study. After excluding left main disease and multi-lesion disease, each group was divided into OCT- and IVUS-guided PCI, and based on the characteristics of the people in each group, propensity score (PS) was calculated and matched with 1:1. The clinical outcomes were assessed using the three-year rate of target vessel failure (TVF: a composite of target lesion failure, cardiac death, target vessel myocardial infarction, target lesion revascularization, or stent thrombosis).

After PS matching, 209 patients in the OCT- and IVUS-guided PCI groups were included in the current analysis. There were no significant differences in the baseline characteristics between the groups. In addition, the post-procedural angiographic minimal lumen diameter and percent diameter stenosis did not differ significantly between the two groups. The 3-year event rate of TVF was not significantly different between the groups ($P = 0.635$) after PS score matching.

In patients with ACS, there was no difference in the 3-year clinical outcomes between OCT- and IVUS-guided PCI. Our study showed that OCT-guided PCI has comparable results to IVUS in 3-year outcomes, suggesting that OCT can be an alternative tool for stent optimization in patients with ACS.

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Three-year Clinical Outcome Comparison of Imaging-guided Percutaneous Coronary Intervention in Acute Coronary Syndrome

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(Abstract)

The aim of the current study was to evaluate the clinical outcome of optical coherence tomography (OCT)- versus intravascular ultrasound (IVUS)-guided percutaneous coronary intervention (PCI) in patients with acute coronary syndrome (ACS).

A total of 638 patients who underwent PCI for ACS intravascular imaging were retrospectively enrolled in the study. After excluding left main disease and multi-lesion disease, each group was divided into OCT- and IVUS-guided PCI, and based on the characteristics of the people in each group, propensity score (PS) was calculated and matched with 1:1. The clinical outcomes were assessed using the three-year rate of target vessel failure (TVF: a composite of target lesion failure,

cardiac death, target vessel myocardial infarction, target lesion revascularization, or stent thrombosis).

After PS matching, 209 patients in the OCT- and IVUS-guided PCI groups were included in the current analysis. There were no significant differences in the baseline characteristics between the groups. In addition, the post-procedural angiographic minimal lumen diameter and percent diameter stenosis did not differ significantly between the two groups. The three-year event rate of TVF was not significantly different between the groups after PS matching.

In patients with ACS, there was no difference in the three-year clinical outcomes between OCT- and IVUS-guided PCI. Our study showed that OCT-guided PCI has comparable results to IVUS in three-year outcomes, suggesting that OCT can be an alternative imaging tool during PCI in patients with ACS.

급성 관상동맥 증후군에서 영상 유도 경피적 관상동맥 중재술간의 3년 임상 결과 비교

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(초록)

본 연구의 목적은 급성 관상동맥 증후군(ACS) 환자에서 광간섭단층촬영(OCT)와 혈관내초음파(IVUS)를 이용한 관상동맥중재술(PCI) 간의 임상 결과를 비교하는 것이다.

총 638명의 ACS 환자들이 혈관내 영상을 이용한 PCI를 시행 후 후향적으로 본 연구에 등록되었다. 이후 좌주간부 질환과 다병변질환 환자들은 제외되었고, 각 군은 OCT 유도군과 IVUS 유도 PCI 군으로 분류된 후 성향점수(PS)를 계산 후 1:1 로 매칭하였다. 3년 이내 대상혈관부전의 발생률을 통해 임상 결과를 평가하였으며, 대상혈관부전(target vessel failure)은 대상병변부전(target lesion failure), 심장사(cardiac death), 대상혈관 심근경색(target vessel myocardial infarction), 대상병변 재관류술(target lesion revascularization), 또는 스텐트 혈전증의 발생으로 정의하였다.

PS 매칭 후 각 209명의 환자들이 OCT 유도, IVUS 유도 PCI 군으로 분

류되었다. 두 군 간 기본특성에서 유의한 차이는 보이지 않았다. 또한 술후 최소내강직경과 퍼센트직경협착에서도 두 군 간 유의한 차이를 보이지 않았다. PS 매칭 후 비교한 두 군 간 3년 이내 대상혈관부전에서 유의한 차이를 보이지 않았다.

ACS 환자에서 OCT 유도 그리고 IVUS 유도 PCI를 시행한 후 3년간 비교한 임상 결과에서 유의한 차이를 보이지 않았다. 이번 연구에서는 OCT 유도 PCI가 IVUS와 비슷한 결과를 보여주어 ACS 환자에서 PCI를 시행할 때 영상 획득 도구로 대안이 될 수 있음을 시사한다.