Comparison of procedural and clinical outcomes between optical coherence tomography and intravascular ultrasound guided percutaneous coronary intervention for patients with acute coronary syndrome

（急性冠症候群患者における光干渉断層法と血管内超音波ガイド下経皮的冠動脈インターベンションの手技成績および臨床転帰についての比較）

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Abstract

Backgrounds: Intravascular ultrasound (IVUS) and optical coherence tomography (OCT) are a standard intravascular imaging modality available for percutaneous coronary intervention (PCI). However, the comparison of procedural and clinical outcomes between IVUS-guided and OCT-guided PCI for patients with the acute coronary syndrome (ACS) has not been fully evaluated. We aimed to investigate it retrospectively.

Methods: Consecutive ACS patients who underwent primary PCI within 48 hours from symptom onset were retrospectively enrolled (117 OCT-guided and 47 IVUS-guided PCI). Angiographical characteristics assessed by quantitative coronary angiography, procedural complications, and clinical outcomes were evaluated.

Results: The patients with IVUS-guided PCI were older, and had a higher proportion of Killip IV. The acute gain was similar and procedural complications of PCI did not differ between the two groups (1% in OCT versus 4% in IVUS, p=0.20). The cardiovascular death within 30 days was lower in the patients with OCT-guided PCI than in those with IVUS-guided PCI (1% versus 11%, $p<0.05$ by Log-rank test). However, multivariate analysis after adjusting for confounders did not show the difference.

Conclusions: In ACS patients, OCT-guided PCI can be performed as effectively and safely as IVUS-guided PCI in terms of procedural complications and clinical outcome.

Keywords:

Acute coronary syndrome, Percutaneous coronary intervention, Coronary imaging device, Optical coherence tomography, Intravascular ultrasound

Abbreviations

ACS; Acute coronary syndrome

BNP; B-type natriuretic peptide

CPK; Creatinine phosphokinase

CVD; Cardiovascular death

IVUS; Intravascular ultrasound

LMT; Left main trunk

OCT; Optical coherence tomography

PCI; Percutaneous coronary intervention

QCA; Quantitative coronary angiography

TIMI; Thrombolysis In Myocardial Infarction

TLF; Target lesion failure

Introduction

Currently, intravascular ultrasound (IVUS) is an established and standard intravascular imaging modality available for percutaneous coronary intervention (PCI) [1]. Intravascular imaging modality helps in creating a more appropriate treatment plan for each lesion. Several studies have evaluated the effectiveness of IVUS-guided PCI. Based on these studies, the IVUS-guided PCI with drug-eluting stent could achieve larger vessel diameters and better clinical outcomes, including target lesion revascularization and stent thrombosis compared with angiography-guided PCI [2-8]. Optical coherence tomography (OCT) is an intravascular imaging modality based on near-infrared and optical technology with a higher resolution (10–20 μm). Hence, more accurate identification of thrombus, lipid, calcification, fibrous cap thickness, dissections, plaque rupture, stent malapposition, and strut coverage could be obtained with OCT compared with IVUS [9].

As compared with angiography-guided PCI, better clinical outcomes were reported both with OCT-guided and IVUS-guided PCI [10-16]. However, OCT-guided PCI requires sufficient blood supply during contrast material injection. Due to the presence of a massive thrombus and severe stenosis in the lesion, it is difficult to replace blood in acute coronary syndrome (ACS) patients, leading to poor OCT imaging. Therefore, IVUS-guided PCI is often chosen for the treatment of ACS patients. Additionally, the

comparison between IVUS-guided and OCT-guided PCI for patients with ACS has not been evaluated. This study aimed to compare the procedural complications and clinical outcome between the OCT-guided and IVUS-guided PCI for ACS patients retrospectively.

Methods

Study population

This was a single-center retrospective observational study. A total of consecutive 226 ACS patients who were admitted to the Hirosaki University Hospital between April 2016 and December 2017 were reviewed in this study. Within 48 hours from symptom onset, all patients underwent primary PCI. The exclusion criteria for this study were as follows: 1) Patients with left main trunk (LMT) ostial (n=4) and RCA ostial (n=3) lesions, 2) patients with both IVUS and OCT imaging modalities (n=9), 3) patients who underwent PCI without stent (n=19), 4) patients without imaging modalities (n=8), 5) patients who underwent two or more non-contiguous PCI procedures (n=11), and 6) patients without baseline and procedural data (n=8). Finally, a total of 164 eligible patients were enrolled in the study. Of them, 117 (71%) patients underwent OCT-guided PCI and 47 (29%) underwent IVUS-guided PCI with second or third-generation drug-eluting stents (**Figure 1**). The demographic characteristics, medical background, technical

aspects of the PCI procedure, and procedure-associated complications were collected from equivalent medical records. This study was conducted as per the ethical guidelines for medical research on humans in the Helsinki Declaration. The research protocol was approved by the Institutional Review Board of Hirosaki University Hospital (IRB number: 2020-070).

PCI procedure

All patients underwent emergent PCI via the radial or femoral artery and were administered unfractionated heparin 100 IU/kg before the procedure. The decision to use OCT (Dragonfly, St. Jude Medical) or IVUS (Eagle Eye Platinum ST, Philips, OptiCross, Boston Scientific) was left to the operator's discretion. Moreover, factors like the balloon or stent size, and whether balloon dilation was needed at pre- and post-stenting, were also left to the operator's discretion. To stop blood flow, a low molecular weight dextran was used in all OCT cases.

Angiographical analyses

Coronary angiograms before PCI, post PCI, and during the chronic phase were assessed by quantitative coronary angiography (QCA). QCA analysis was performed using a validated edge-detection system (QAngio XA 7.3, Medis Medical Imaging Systems BV, Leiden, Netherlands). During primary PCI, the reference diameter,

minimum lumen diameter, percentage of diameter stenosis, lesion length, and acute lumen gain were measured. Late lumen loss was additionally evaluated in cases with follow-up coronary angiography. Thrombolysis In Myocardial Infarction (TIMI) flow was evaluated after PCI.

Procedural complications and clinical outcome

The PCI procedural complications and the clinical outcome were evaluated within 30 days after the PCI procedure. The procedural complications included coronary perforation, acute occlusion, and coronary dissection (dissection defined as unintentional intimal disruption using the National Heart, Lung, and Blood Institute classification system for intimal tears) [17]. Moreover, the target lesion failure (TLF) was evaluated by follow-up angiography during the chronic phase of PCI. Additionally, cardiovascular death (CVD) was evaluated as a clinical outcome among patients with OCT-guided and IVUS-guided PCI.

Statistical analysis

As per data distribution, baseline continuous variables were presented as mean ± standard deviation or median and interquartile range. Categorical variables were presented as percentages. An unpaired t-test or chi-square test was used to compare the differences between the two groups, whereas Mann-Whitney's U test was used for

nonparametric variables. The Kaplan-Meier method was used to estimate clinical outcomes. The Log-rank test was used to compare the two groups. Using the Cox proportional hazards regression, we performed multivariate analyses for the determinants of CVD. The variables including age and male (sex) for Model 1, and age, male (sex), diabetes, B-type natriuretic peptide (BNP) for Model 2, were used for analysis. The 95% confidence intervals (CIs) and hazard ratios (HRs) were calculated. The level of significance was set at $P < 0.05$. All the statistical analyses were performed using the JMP software (JMP Pro 16 for Windows, SAS Institute, Cary, NC, USA).

Results

Patient characteristics

The baseline clinical characteristics of the study patients are shown in **Table 1**. Patients with IVUS-guided PCI were older than those with OCT-guided PCI (71 ± 16 versus 66 ± 13 years, $p<0.05$). Regarding coronary risk factors, diabetes was more prevalent in patients with IVUS-guided PCI compared with OCT-guided PCI (40% versus 24%, $p<0.05$). Patients with OCT-guided PCI had a higher proportion of ST-segment elevation myocardial infarction compared with those with IVUS-guided PCI (94% versus 79%, $p<0.05$). In the laboratory data, patients with IVUS-guided PCI had lower

hemoglobin, worse renal function, and higher level of b-type natriuretic peptide as compared to those with OCT-guided PCI. There were no differences in max creatinine phosphokinase (CPK) and max CPK-MB levels between the two groups. Killip classification IV was seen more frequently and mechanical support devices were needed more in patients with IVUS-guided PCI than in those with OCT-guided PCI.

PCI procedural characteristics

The PCI procedural characteristics are summarized in **Table 2**. The proportion of the patients with radial artery approach was significantly higher in patients with OCT-guided PCI compared with those with IVUS-guided PCI (92% versus 57%, $p<0.05$). All patients having an LMT lesion underwent IVUS-guided PCI. Total stent length, maximum stent diameter, the rate of post-dilatation after stent implantation, and maximum balloon diameter were similar in both groups. No difference was noted in the contrast volume. However, fluoroscopy time and radiation dose were lower in patients with OCT-guided PCI compared with IVUS-guided PCI (19.4 [15.3–24.4] versus 32.0 [24.2–36.3] min, $p<0.05$, and 1.2 [0.9–1.8] versus 1.6 [1.1–2.0] Gy, $p<0.05$, respectively).

QCA analyses

Angiographic characteristics evaluated by QCA are summarized in **Table 3**. There were no differences in reference lesion diameter stenosis, area stenosis, and lesion length

at baseline between the two groups. However, the minimum lumen diameter was smaller in patients with IVUS-guided PCI compared with OCT-guided PCI (0.6 [0.4–0.7] versus 0.7 [0.5–1.0] mm, $p<0.05$). No significant differences between the two groups were observed in the QCA data after performing PCI. However, a tendency of the smaller minimum lumen diameter was observed in patients with IVUS-guided PCI compared with OCT-guided PCI (2.4 [2.1–2.7] versus 2.6 [2.2–3.0] mm, $p=0.06$). The acute gain was similar in both groups. However, the proportion of the patients with TIMI 3 flow after PCI was higher in patients with OCT-guided PCI as compared to those with IVUS-guided PCI (96% versus 79%, $p<0.05$).

Follow-up coronary angiography was performed in 102 patients (62%) with a median interval period of 287 (278–299) days. QCA data at the chronic phase revealed no differences in reference lesion diameter, minimum lumen diameter, and diameter stenosis between the two groups. The late lumen loss was very small and did not differ in both groups. TLF was seen in three (4%) patients with OCT-guided PCI and two (10%) in patients with IVUS-guided PCI, although no significant difference was found between the two groups ($p=0.28$).

Procedural complications and clinical outcome within 30 days after PCI

Procedural complications and clinical outcomes are summarized in **Table 4**. A case of coronary perforation due to a perforated wire was seen in IVUS-guided PCI, whereas a case with residual coronary dissection was seen without the restriction of coronary flow in each group. The complication rates were extremely low and did not differ between the two groups (1% in OCT versus 4% in IVUS, p=0.20). CVD within 30 days was lower in the patients with OCT-guided PCI than in those with IVUS-guided PCI (1% versus 11%, p<0.05 by Log-rank test) (**Figure 2**).

Cox multivariate regression analysis for CVD within 30 days after adjusting for baseline characteristics (age and sex) showed that OCT-guided PCI was an independent predictor for CVD (HR: 0.11; 95% CI: 0.01 to 0.99; p=0.049) (Model 1) (**Table 5**). However, after adding diabetes and BNP, OCT-guided PCI was not an independent predictor (HR: 0.11, 95% CI: 0.01-1.12, p=0.06) (Model 2).

Discussion

This study revealed that OCT-guided PCI seems to be as effective and safe as IVUS-guided PCI in terms of procedural complications and clinical outcome. Further, the fluoroscopy time and radiation dose were lower in the patients with OCT-guided PCI as compared to those with IVUS-guided PCI. Based on our knowledge, this is the

first report to compare the efficacy and safety between OCT-guided PCI and IVUS-guided PCI in ACS patients.

In OCT, the elimination of blood flow is required for obtaining good images. However, some cases with poor OCT imaging are seen due to the following reasons: First, it is difficult to eliminate the blood flow in ostial lesions, lesions with large vessel diameters, and lesions with massive thrombi. Second, contrast loading or volume loading could be avoided in cases with renal failure, low cardiac function, or congestive heart failure. Moreover, some techniques and practices are necessary to obtain good OCT images. It depends on the operator if OCT-guided PCI or IVUS-guided PCI should be performed. Under such emergent circumstances, IVUS-guided PCI is often chosen in ACS patients because OCT procedure is complicated. These conditions may make it difficult to perform a prospective study for comparison between OCT-guided and IVUS-guided PCI in ACS patients. Furthermore, the efficacy and safety of OCT-guided PCI in ACS patients have not been studied adequately. The ILUMIEN III study revealed no statistically significant difference in minimum stent area among the IVUS-guided, OCT-guided, and angiography-guided PCI [12]. The present study was consistent with the ILUMIEN III study as no significant differences between OCT-guided and IVUS-guided PCI were seen in terms of minimum stent diameter or acute gain immediately after PCI

[12]. Moreover, only a few procedural complications occurred, and the rate of late lumen loss at the chronic phase was very small and comparable between OCT-guided and IVUS-guided PCI.

After PCI, the minimum stent area is the most important determinant of early and late adverse events [2-8, 18]. A randomized comparison between OCT-guided and IVUS-guided stenting reported less acute lumen enlargement in patients with OCT-guided PCI compared to those with IVUS-guided PCI [18]. In the present study, no difference between OCT-guided and IVUS-guided PCI was observed in terms of minimum stent diameter and acute lumen gain after PCI. The probable reasons for these results were as follows: First, about 60% of ACS patients have a lipid-rich ruptured plaque in the lesions [19], resulting in the no-reflow phenomenon and the distal embolism after balloon dilation or stenting. Generally, operators are likely to use smaller stents with lower pressure dilation in ACS patients with primary PCI than in stable patients with elective PCI to prevent the no-reflow phenomenon or distal embolism. Second, higher diabetic complications were seen in the IVUS-guided PCI group. Hence, the IVUS-guided group might have more diffuse lesions compared with the OCT-guided group. Diffuse lesions might have resulted in the selection of smaller stents because of not having suitable landing points on the stent edge where the vessel was almost normal. Third, this was a retrospective study and stent

size was selected at the operator's discretion. In the OCT-guided PCI, the stent size was determined generally based on lumen diameter in several prior studies. In recent times, adventitial diameter is being used in determining the stent size. In the present study, many operators had generally used OCT in elective PCI and were familiar with OCT-guided PCI. Therefore, stent size could be determined by adventitial diameter in some cases.

Late lumen loss was very small and there was no difference in TLF between the two groups, suggesting that the clinical efficacy of OCT-guided PCI for ACS patients may be acceptable. Moreover, there were few procedural complications in both groups, which indicated that OCT-guided PCI could be performed as safely as IVUS-guided PCI. The rate of CVD within 30 days was 1% in the patients with OCT-guided PCI which was less than that in the patients with IVUS-guided PCI (11%). In the patients with IVUS-guided PCI, a worse CVD rate might be derived from the severity of the baseline characteristics with higher Killip classification, worse renal function, and congestive heart failure compared with the patients with OCT-guided PCI. Indeed, multivariate analyses after adjusting confounders, OCT-guided PCI was not an independent predictor for CVD within 30 days.

Contrast volume used in PCI was not different between the two groups, whereas fluoroscopy time and radiation dose were lower in the patients with OCT-guided PCI. In

OCT, the elimination of blood flow is needed because of the characteristic of near-infrared light which does not penetrate blood [9]. Additionally, contrast agents are often used during imaging. However, all patients in the present study were treated with low molecular weight dextran to eliminate blood flow. Hence, the contrast volume might not increase in patients with OCT-guided PCI. Fluoroscopy time and radiation dose might be influenced by the higher pull-back speed of OCT compared with that of IVUS [9]. An increase in the fluoroscopy time and radiation dose in patients with IVUS-guided PCI might have occurred because of the presence of a higher proportion of the patients with baseline clinical as well as severe angiographical characteristics.

OCT is superior to IVUS in depicting the fine structures of the coronary artery surface. It has the advantage of evaluating plaque characteristics in more detail [9], like histological characteristics and lesion type, including plaque rupture, erosion, and thin cap fibroatheroma in ACS patients. Detailed information about the lesion, like plaque morphologies and characteristics, obtained by OCT could lead to further research on the optimization of primary PCI for ACS patients. The OCT images are useful for lipid management and the strategy without stenting in ACS patients. However, its utility for secondary prevention in ACS patients was not fully elucidated in this study and further research needs to be done in this direction.

This study has some limitations. First, this was a single-center study with a relatively small number of patients. Second, this was a retrospective study. Hence, recommendations for the optimization of stent placement were not defined. Additionally, operator bias was seen in terms of deciding if the patient should have undergone OCT or IVUS imaging. Third, more severe patients were included in the IVUS-guided PCI group, which may have affected the results in the present study. Although multivariate analyses did not show the significant difference between OCT-guided and IVUS-guided PCI, these analyses may have a limited accuracy due to the small number of clinical events in this study. Therefore, larger-scale and prospective observational studies should be done in the future. Finally, this study excluded severe cases with poor outcomes, like LMT ostial and RCA ostial lesions because it was difficult to obtain good OCT imaging in these lesions. Accordingly, clinical outcome in ACS patients with these lesions was not fully evaluated in the present study.

In conclusion, OCT-guided PCI in patients with ACS could be performed as effectively and safely as IVUS-guided PCI in terms of procedural complications and clinical outcome.

Conflicts of interest

All authors have no conflicts of interest directly relevant to the content of this article.

Acknowledgements

None.

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Figure legends

Figure 1. Study flow chart.

Abbreviations; ACS; acute coronary syndrome, IVUS; intravascular ultrasound, LMT; left main trunk, OCT; optical coherence tomography, PCI; percutaneous coronary intervention, RCA; right coronary artery.

Figure 2. Comparison of the Kaplan-Meier curves for cardiovascular death between OCT-guided and IVUS-guided PCI in patients with acute coronary syndromes.

Abbreviations; IVUS; intravascular ultrasound, OCT; optical coherence tomography, PCI; percutaneous coronary intervention.

Table 1. Baseline characteristics of the study patients.

	OCT-guided PCI (n=117)	**IVUS-guided PCI (n=47)**	**p value**
Age	66±13	71±16	<0.05
Male gender, n (%)	92 (79)	39 (83)	0.53
BMI, kg/m^2	23.8±3.3	23.3±3.6	0.32
Coronary risk factors			
Hypertension, n (%)	89 (76)	35 (74)	0.83
Dyslipidemia, n (%)	63 (54)	21 (45)	0.29
Diabetes, n (%)	28 (24)	19 (40)	<0.05
Smoker, n (%)	82 (70)	27 (57)	0.12
Previous PCI, n (%)	4 (3)	3 (6)	0.41
Previous CABG, n (%)	1 (1)	0 (0)	NS
Dialysis, n (%)	0 (0)	2 (4)	0.08
STEMI, n (%)	110 (94)	37 (79)	<0.05
Laboratory data			
Hemoglobin, g/dL	14.0±2.1	12.7±2.2	<0.05
Serum creatinine, mg/dL	0.80±0.28	1.42±1.38	<0.05
HbA1c, %	6.0±0.9	6.4±1.5	0.24
LDL-cholesterol, mg/dL	126±38	117±35	0.08
Max CPK, IU/L	2,723 (1,014-4,858)	2,094 (898-5,725)	0.95
Max CPK-MB, IU/L	280 (118-465)	212 (61-612)	0.78
BNP, pg/mL	45 (15-83)	151 (46-673)	<0.05
Killip classification, n (%)			<0.05
I	107 (91)	24 (51)	
II	4 (3)	7 (15)	
III	1 (1)	8 (17)	
IV	5 (4)	8 (17)	
Mechanical support device			
IABP	2 (2)	12 (26)	<0.05
PCPS	1 (1)	1 (2)	0.49
Medication at discharge			
Aspirin	117 (100)	47 (100)	NS
ADP receptor antagonist	117 (100)	47 (100)	NS
β-blocker	103 (88)	38 (81)	0.23
ACEI or ARB	107 (91)	33 (70)	<0.05

Statins	114 (97)	43 (91)	0.10
DOAC	4 (3)	7 (15)	<0.05
Warfarin	3 (3)	2 (4)	0.63

Data are presented as mean ± standard deviation values, n (%), or median values and interquartile ranges.

Abbreviations; ACEI; angiotensin-converting enzyme inhibitor, ADP; adenosine-diphosphate, ARB; angiotensin receptor blocker, BMI; body mass index, BNP; b-type natriuretic peptide, CABG; coronary artery bypass grafting, CPK; creatinine phosphokinase, CPK-MB; creatine phosphokinase MB isoenzyme, DOAC; direct oral anticoagulants, IABP; intra-aortic balloon pump, IVUS; intravascular ultrasound, LDL; low density lipoprotein, OCT; optical coherence tomography, PCI; percutaneous coronary intervention, PCPS; percutaneous cardiopulmonary support, STEMI; ST-segment elevation myocardial infarction.

Table 2. PCI procedural characteristics.

	OCT-guided PCI (n=117)	**IVUS-guided PCI (n=47)**	**p value**
Access site, n (%)			<0.05
Radial artery	108 (92)	27 (57)	
Femoral artery	9 (8)	20 (43)	
Culprit vessel, n (%)			<0.05
RCA	32 (27)	12 (25)	
LMT	0 (0)	4 (9)	
LAD	72 (62)	25 (53)	
LCX	13 (11)	6 (13)	
ACC/AHA lesion classification			0.44
A	2 (2)	2 (4)	
B	107 (91)	40 (85)	
C	8 (7)	5 (11)	
Total stent length, mm	23 (18-28)	23 (18-33)	0.50
Maximum stent diameter, mm	3.0 (2.5-3.5)	3.0 (2.5-3.5)	0.87
Post-dilatation after stenting, n (%)	71 (61)	28 (60)	0.90
Maximum balloon diameter, mm	3.3 (2.8-4.0)	3.4 (3.0-3.9)	0.64
Contrast volume, ml	190 (164-210)	187 (155-221)	0.95
Fluoroscopy time, min	19.4 (15.3-24.4)	32.0 (24.2-36.3)	<0.05
Radiation dose, Gy	1.2 (0.9-1.8)	1.6 (1.1-2.0)	<0.05

Data are presented as n (%), or median values and interquartile ranges.

Abbreviations; ACC; American College of Cardiology, AHA; American Heart Association, IVUS; intravascular ultrasound, LAD; left anterior descending, LCX; left circumflex, LMT; left main trunk, OCT; optical coherence tomography, RCA; right coronary artery.

Table 3. Angiographical characteristics evaluated by quantitative coronary angiography.

	OCT-guided PCI (n=117)	**IVUS-guided PCI (n=47)**	**p value**
Before PCI			
Reference lesion diameter, mm	2.5 (1.9-3.0)	2.3 (2.0-2.6)	0.12
Minimum lumen diameter, mm	0.7 (0.5-1.0)	0.6 (0.4-0.7)	<0.05
Diameter stenosis, %	69.1 (61.5-78.8)	71.7 (65.9.0-80.9)	0.13
Area stenosis, %	90.4 (84.9-95.4)	92.0 (88.4-96.3)	0.13
Lesion length, mm	10.6 (8.2-14.4)	12.5 (9.2-17.6)	0.07
After PCI			
Reference lesion diameter, mm	2.9 (2.6-3.4)	2.8 (2.4-3.1)	0.09
Minimum lumen diameter, mm	2.6 (2.2-3.0)	2.4 (2.1-2.7)	0.06
Diameter stenosis, %	12.6 (8.4-16.0)	12.3 (8.3-19.4)	0.46
Area stenosis, %	23.6 (16.2-29.5)	23.1 (15.9-35.1)	0.46
Acute luminal gain, mm	1.8 (1.5-2.1)	1.7 (1.5-2.1)	0.68
TIMI 3 flow, n (%)	112 (96)	37 (79)	<0.05
Follow-up CAG	**(n=81)**	**(n=21)**	
Time to follow up, days	286 (278-297)	287 (280-355)	0.37
Reference lesion diameter, mm	2.7 (2.4-3.3)	2.6 (2.3-3.1)	0.28
Minimum lumen diameter, mm	2.5 (2.1-2.9)	2.2 (2.0-2.7)	0.13
Diameter stenosis, %	11.2 (8.7-16.8)	12.7 (8.7-17.7)	0.87
Area stenosis, %	21.1 (16.6-30.7)	23.8 (17.8-32.1)	0.74
Late lumen loss, mm	0.06 (-0.09-0.33)	0.01 (-0.21-0.20)	0.37
Target lesion failure, n (%)	3 (4)	2 (10)	0.28

Data are presented as n (%), or median values and interquartile ranges.

Abbreviations; CAG; coronary angiography, IVUS; intravascular ultrasound, OCT; optical coherence tomography, PCI; percutaneous coronary intervention, TIMI; Thrombolysis In Myocardial Infarction.

Table 4. Procedural complications and clinical outcome within 30 days after PCI.

	OCT-guided PCI (n=117)	**IVUS-guided PCI (n=47)**	**p value**
Procedural complications, n (%)	1 (1)	2 (4)	0.20
Coronary perforation	0 (0)	1 (2)	0.29
Coronary dissection	1 (1)	1 (2)	0.49
Acute occlusion	0 (0)	0 (0)	NS
Clinical outcome, n (%)			<0.05
Cardiovascular death	1 (1)	5 (11)	

Abbreviations; IVUS; intravascular ultrasound, OCT; optical coherence tomography, PCI; percutaneous coronary intervention.

Table 5. Adjusted hazard ratios for cardiovascular death within 30 days after PCI.

	Adjusted HR (95% CI)	**p value**
Model 1		
Age	1.05 (0.99-1.15)	0.14
Male	1.66 (0.19-14.8)	0.65
OCT	0.11 (0.01-0.99)	0.049
Model 2		
Age	1.05 (0.99-1.14)	0.17
Male	1.71 (0.18-16.0)	0.64
Diabetes	0.23 (0.02-2.77)	0.24
BNP	1.00 (0.99-1.00)	0.24
OCT	0.11 (0.01-1.12)	0.06

Abbreviations; BNP; B-type natriuretic peptide, CI: confidence interval, HR: hazard ratio; OCT; optical coherence tomography.

Figure 1.

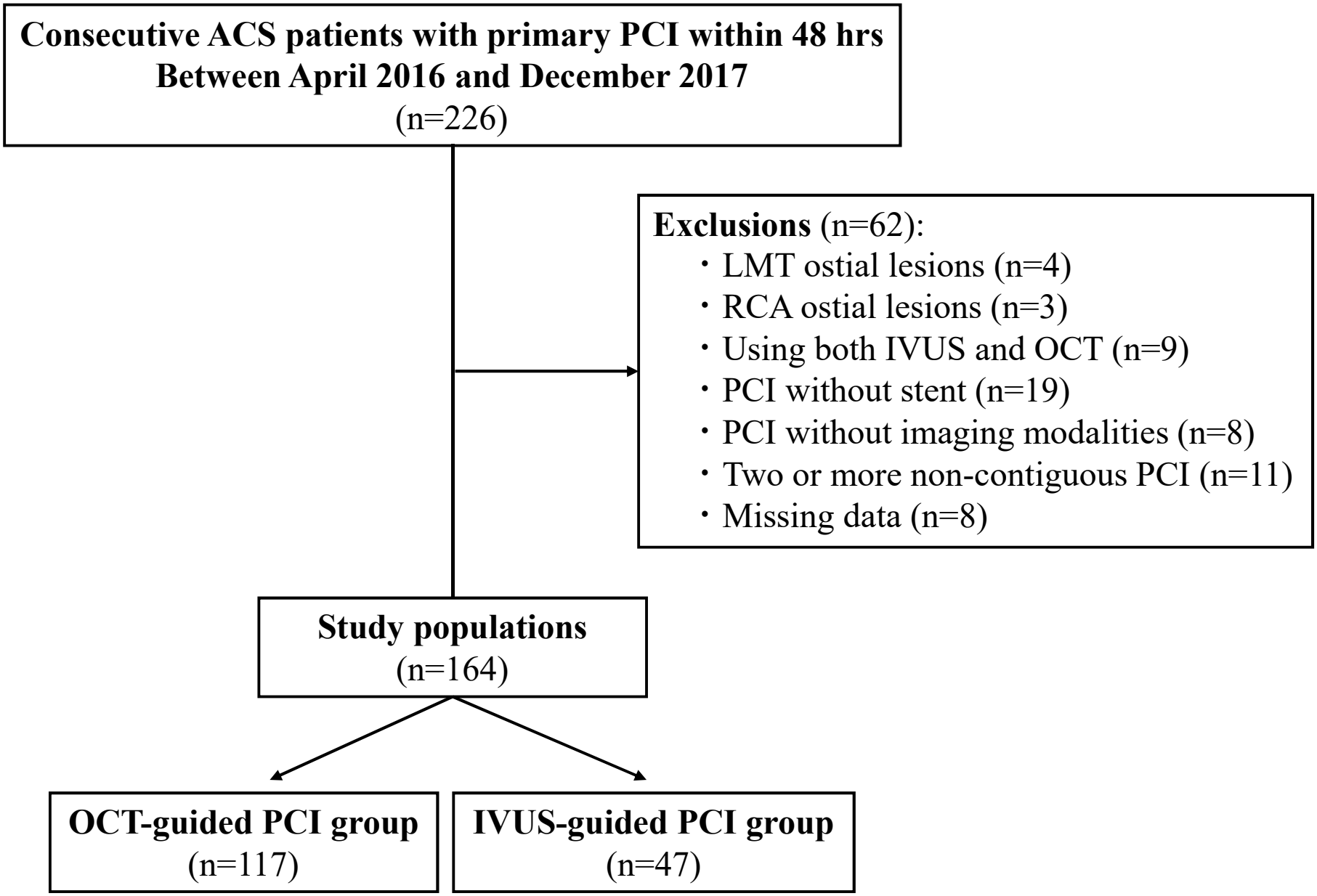
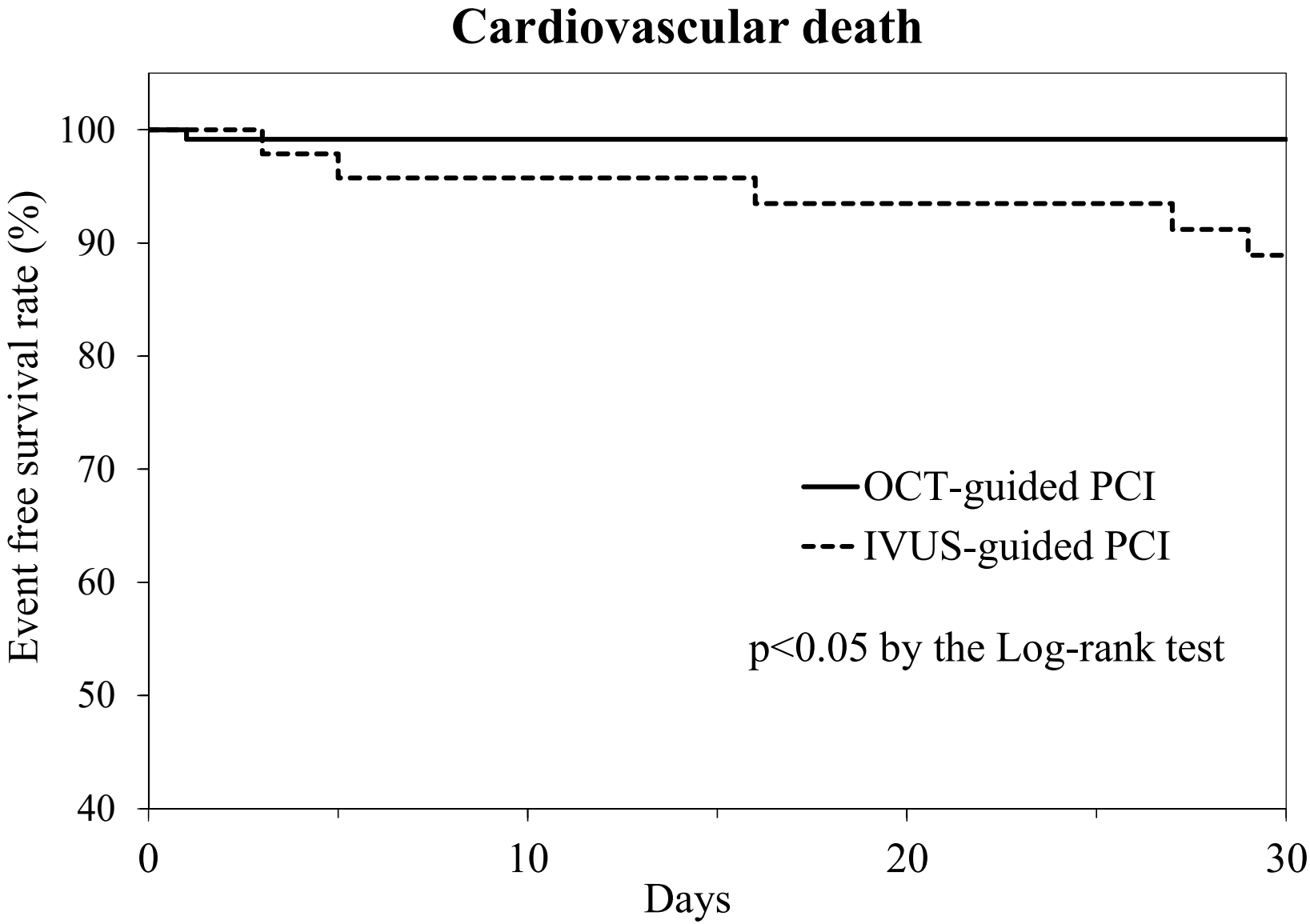

Consecutive ACS patients with primary PCI within 48 hrs
Between April 2016 and December 2017
(n=226)
Exclusions (n=62):
・LMT ostial lesions (n=4)
・RCA ostial lesions (n=3)
・Using both IVUS and OCT (n=9)
・PCI without stent (n=19)
・PCI without imaging modalities (n=8)
・Two or more non-contiguous PCI (n=11)
・Missing data (n=8)
Study populations
(n=164)
OCT-guided PCI group
(n=117)
IVUS-guided PCI group
(n=47)

Figure 2.


Cardiovascular death
Event free survival rate (%)
100
90
80
70
60
50
40
0
10
20
30
Days
OCT-guided PCI
IVUS-guided PCI
p<0.05 by the Log-rank test