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Review

# The role of optical coherence tomography in the setting of acute myocardial infarction

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ABSTRACT

In recent years, intravascular imaging-guided percutaneous coronary intervention (PCI) has been increasing in patients with acute myocardial infarction (AMI). However, the role of optical coherence tomography (OCT) has not been established in the setting of AMI despite OCT providing superior resolution (10 μm axial resolution) and facilitating assessment of baseline lesion characteristics and post-intervention evaluation of the acute result of stent implantation, including visualization of procedural dissections, malapposition, tissue prolapse, and thrombus. We provide an overview of the potential benefits of OCT-guidance in various situations of AMI.



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## Introduction

Coronary angiography is the most commonly utilized imaging modality for assessment of coronary artery disease (CAD) and facilitates percutaneous coronary intervention (PCI). However, a 2-dimensional (2-D) lumenogram of the 3-dimensional structure of the coronary artery, provided by coronary angiography, has fundamental limitations in the accurate evaluation of plaque characteristics, vessel wall, and lumen dimensions [1]. The limitations of 2-D, angiography-guided PCI for complex lesion subsets, such as bifurcation or left main disease, are reflected by procedural success rates and long-term clinical outcomes [2,3]. Intravascular ultrasound (IVUS) has been a useful tool for providing information in terms of pre-intervention lesion characteristics, including plaque morphology and vessel dimensions with improved resolution (100–200 μm axial resolution)

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compared with angiography [4]. As a result, IVUS-guided stent implantation has facilitated better clinical outcomes when compared with angiography-guided intervention in randomized studies [5,6].

Optical coherence tomography (OCT) provides superior resolution (10 μm) for assessment of the coronary vasculature and detailed post-intervention information, including visualization of edge dissections and strut apposition [7–9]. Although both IVUS and OCT provide images of the coronary artery by intra-coronary imaging catheter, there are different characteristics offered by both modalities. OCT has greater accuracy in detecting post-procedural dissections, malapposition, and tissue prolapse compared with IVUS, providing assessment of pathology of coronary vessel wall and post-intervention intraluminal components [10,11]. Moreover, OCT measurement demonstrates greater accuracy regarding lumen diameter and area, both in vivo and ex vivo, compared with IVUS and angiography [12,13]. However, OCT has a limited depth of penetration in comparison to IVUS hampering visualization of the vessel border and plaque burden.

The role of OCT has not been established in patients with acute myocardial infarction (AMI), although the application of OCT has been increasing in clinical practice. In this review article, we focus on the potential role of OCT in the setting of AMI and its clinical benefits.

## Current status of OCT-guided PCI in patients with AMI: from the Korea Acute Myocardial Infarction Registry

The Korea Acute Myocardial Infarction Registry (KAMIR), launched in November 2005, is the first nationwide, prospective, observational registry reflecting 'real-world' clinical practice in Korean patients presenting with AMI. Data relating to the use of OCT have been collected since 2012 [14]. Between January 2012 and April 2017, a total of 17,800 consecutively listed patients were enrolled in the KAMIR, and 3843 AMI patients underwent intravascular imaging-guided PCI. The utilization of intravascular imaging guidance has increased gradually from 17.5% in 2012 to 28.7% in 2017 ($p$ for trend <0.001). A gradual increase in OCT utilization was observed from 1.0% in 2012 to 2.2% in 2016, but more than doubled to 4.7% in 2017 ($p$ for trend <0.001). Conversely, IVUS utilization has increased from 16.5% in 2012 to 25.9% in 2016 with a decrease to 24.1% observed in 2017 ($p$ for trend <0.001) (Fig. 1).

Intravascular imaging-guided PCI in patients with AMI is progressively increasing and OCT-guided PCI has been growing in recent years.

## The role of OCT in the setting of AMI

### *Assessment for ambiguous angiographic findings in patients with AMI*

Spontaneous coronary artery dissection (SCAD) is defined as a spontaneous separation of the coronary wall associated with intramural hematoma [15]. Even though SCAD was reported as a rare disease in the studies based on coronary angiography, studies using OCT to aid diagnosis have demonstrated a greater prevalence of SCAD [16–18]. An angiographic classification has been developed by Saw et al., with evidence of the pathognomonic 'double lumen' with contrast staining in the vessel wall and a radiolucent flap defined as type 1. Type 2 SCAD is characterized by a long and diffuse stenosis, with either an abrupt onset and recrudescence of normal caliber vessel (type 2a) or caliber reduction to the distal coronary bed (type 2b). Type 3 SCAD is difficult to distinguish from native CAD [19]. In cases of type 2b/3 SCAD angiographic diagnosis can be challenging and a role for diagnosis confirmation by use of intra-coronary imaging, particularly the high resolution (10 μm) provided by OCT, may be considered to confirm intima tear, intramural hematoma, and false lumen [20].

Although suboptimal blood clearance has potential limitations with OCT in the setting of SCAD, we reported equivalent medial area in lesion and normal segment supported the diagnosis of intramural compression, particularly when observed in association with luminal folding, which was difficult to evaluate by IVUS [21]. In particular, SCAD type 3, which mimics atherosclerosis, is the most challenging to differentiate from atherosclerosis and may be misdiagnosed if intravascular imaging is not performed. However, intravascular imaging must be undertaken with caution, as propagation of SCAD is possible through inadvertent wiring of the false lumen or extension by contrast injection [22]. Where possible, a conservative approach to the treatment of SCAD should be considered, as there are numerous reports of vessels healing spontaneously [20].

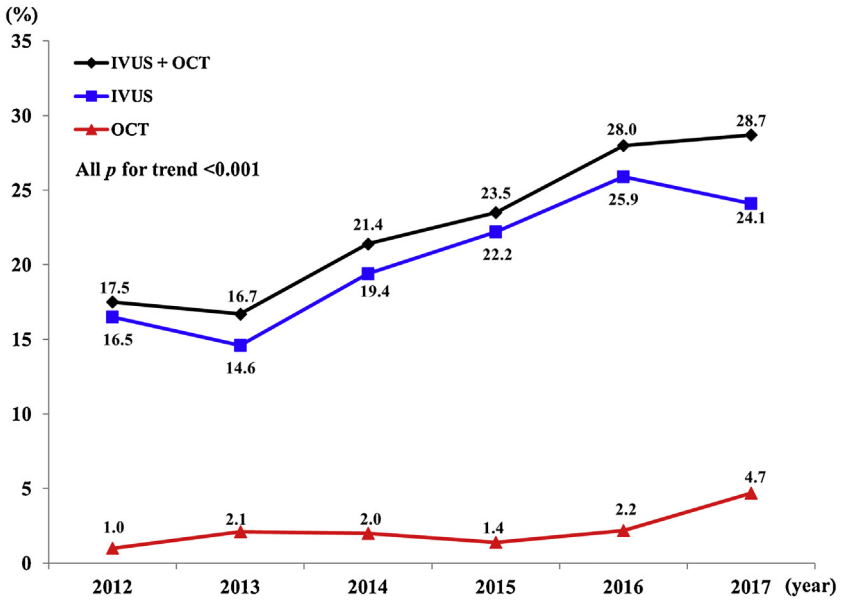


**Fig. 1.** Annual trends of intravascular imaging guided percutaneous coronary intervention in patients with acute myocardial infarction from KAMIR. IVUS, intravascular ultrasound; OCT, optical coherence tomography.

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