International Journal of Research in Medical Sciences
Sacoto VMA et al. Int J Res Med Sci. 2024 May;12(5):1681-1689
www.msjonline.org pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20241256

Systematic Review

A systematic review of clinical applications and diagnostic efficacy of intravascular optical coherence tomography in cardiology

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Received: 04 April 2024
Accepted: 19 April 2024

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ABSTRACT

Intravascular Optical Coherence Tomography (OCT) has emerged advanced imaging modality in cardiology, offering high-resolution visualization of coronary artery structures. Since its inception in the late 1990s, OCT has undergone significant advancements, transitioning from time-domain to frequency-domain systems, thereby enhancing its clinical viability and diagnostic efficacy. We aimed to comprehensively assess the clinical applications and diagnostic efficacy of intravascular OCT in cardiology, particularly in guiding percutaneous coronary interventions (PCI) and evaluating coronary artery diseases. In methodology, A systematic search was conducted in PubMed and Google Scholar databases for studies published between 2013 and 2023, comparing OCT with intravascular ultrasound (IVUS) and conventional angiography (C.A.) in guiding PCI procedures. Studies were selected based on predefined inclusion and exclusion criteria, focusing on major adverse cardiovascular events (MACE), cardiac death, and revascularizations as outcomes. In results we included 28 studies from databased and 3 manuals, highlighting OCT's superior resolution in identifying thin-capped fibroatheromas (TCFAs), optimizing stent placement, and assessing plaque composition. Comparative analyses revealed no significant differences in clinical efficacy between OCT and IVUS, with both modalities showing superiority over C.A. in reducing cardiovascular events. The OCTIVUS trial further confirmed the non-inferiority of OCT-guided PCI compared to IVUS-guided PCI, with lower procedural complications reported in the OCT group. In conclusion, Intravascular OCT has revolutionized the diagnostic and interventional landscape in cardiology, offering unparalleled insights into coronary artery pathology. Its high-resolution imaging capabilities facilitate accurate plaque characterization, stent optimization, and real-time intervention guidance, thereby improving clinical outcomes in PCI procedures. Future research should focus on expanding OCT's applications and further validating its efficacy in diverse clinical settings.

Keywords: Intravascular optical coherence tomography, Cardiology, Systematic review

INTRODUCTION

Intravascular optical coherence tomography (OCT) has evolved significantly since its inception in the late 1990s. OCT was first developed by professor Fujimoto at the Massachusetts Institute of Technology (MIT), and later, in 1998, the cardiac OCT group at Massachusetts General Hospital (MGH) including Brett Bouma and Guillermo Tearney from MIT, and cardiologist Ik-Kyung (I.K.) Jang aimed to validate OCT findings against histology, analyzing hundreds of human vessel specimens to characterize various plaque types accurately. Early development efforts focused on creating a clinically viable catheter-based OCT system thus, a prototype OCT console was developed at the Wellman laboratory of photomedicine at MGH. This prototype OCT was initially cumbersome and required manual adjustments after each image acquisition. Catheters were constructed by integrating optical fibers into commercial intravascular ultrasound (IVUS) catheters.[1]

The first-in-man procedure was conducted in 2000, enrolling patients undergoing “percutaneous coronary intervention (PCI)” also known as angioplasty with stent in Korea. PCI is a minimally invasive procedure to open blocked arteries. Despite the prototype machine's stability challenges, the procedure was performed without complications and this success marked significant milestone in advancing intracoronary OCT imaging. Subsequent developments were made and it was brought to use at commercial level by LightLab Imaging Inc., utilizing time-domain (T.D.) detection. The time domain TD-OCT system required proximal blood flow occlusion during image acquisition, limiting its efficiency. Regulatory approval was obtained in Europe, but the US Food and Drug Administration (FDA) did not initially approve it. In 2006, frequency-domain (FD)-OCT was introduced, revolutionizing intravascular imaging by enabling faster image acquisition without blood flow occlusion1. This advancement paved the way for broader clinical adoption and eventual FDA approval in 2010.

Since then, the MGH-OCT registry was established, collecting data from multiple sites globally. The registry encompasses a diverse patient population, including those with acute coronary syndromes (ACS), chronic coronary syndromes, and previously implanted stents. With time, overall developments and modifications were made which has significantly enhanced our understanding of coronary artery pathology and aided in optimizing percutaneous coronary interventions. Through ongoing research and training initiatives, intravascular OCT continues has revolutionized cardiovascular medicine.[1]

Intravascular OCT advancements and superior resolution

Intravascular OCT is a medical imaging technique used in cardiology to visualize the inside of blood vessels. Catheter is used with an OCT probe which is inserted into the blood vessel. Intravascular OCT uses near-infrared light to create high-resolution cross-sectional images of the vessel wall while simple OCT, on the other hand, refers to the use of OCT in non-invasive imaging applications, where external OCT device placed close to the body's surface which is used for other purposes such as imaging the retina or skin.[2] In cardiology, intravascular OCT provides higher resolution blood vessel wall images, allowing for detailed visualization of plaque buildup, stent placement, and other structural features.[2] Intravascular OCT is considered superior to other imaging modalities in cardiology, such as IVUS, in several aspects such as thin-capped fibroatheromas (TCFAs) identification which may not be visible with other imaging modalities. OCT can provide real-time imaging during interventions, allowing immediate stent placement and higher optimization assessment.[2]

METHODS

We conducted research by systematically reviewing relevant literature literature published between 2013 and 2023 on PubMed and Google Scholar databases. We searched databases for studies comparing IVUS, OCT, and conventional angiography (CA) in guiding PCI procedures. Studies with a sample size of at least 200 patients and reporting on major adverse cardiovascular events (MACE), cardiac death, and revascularizations were included. Data on study design, patient population, interventions, outcomes, and conclusions were extracted and analyzed. Statistical analysis was performed to compare the efficacy of IVUS, OCT, and CA in guiding PCI and their impact on clinical outcomes.

Inclusion criteria

Only those studies that discuss intravascular, OCT, and studies published between 2013 and 2023 were selected. Studies comparing IVUS, OCT, and CA in PCI procedures. Studies reporting on MACE, cardiac death, and revascularizations as outcomes. We included studies involving patients undergoing PCI for CAD or other cardiovascular conditions and those studies utilizing IVUS and OCT for intravascular imaging. Studies, including a sample size of at least 200 patients, randomized controlled trials (RCTs), systematic reviews, meta-analyses, and observational studies or even literature reviews were also considered.

Exclusion criteria

Studies that included intravascular OCT or just discussed simple OCT were excluded. Studies with a sample size below 200 patients were excluded. Case reports, editorials, letters, grey literature, unpublished papers, and conference abstracts are excluded. Studies focusing solely on technical aspects of IVUS or OCT without clinical outcomes are excluded.

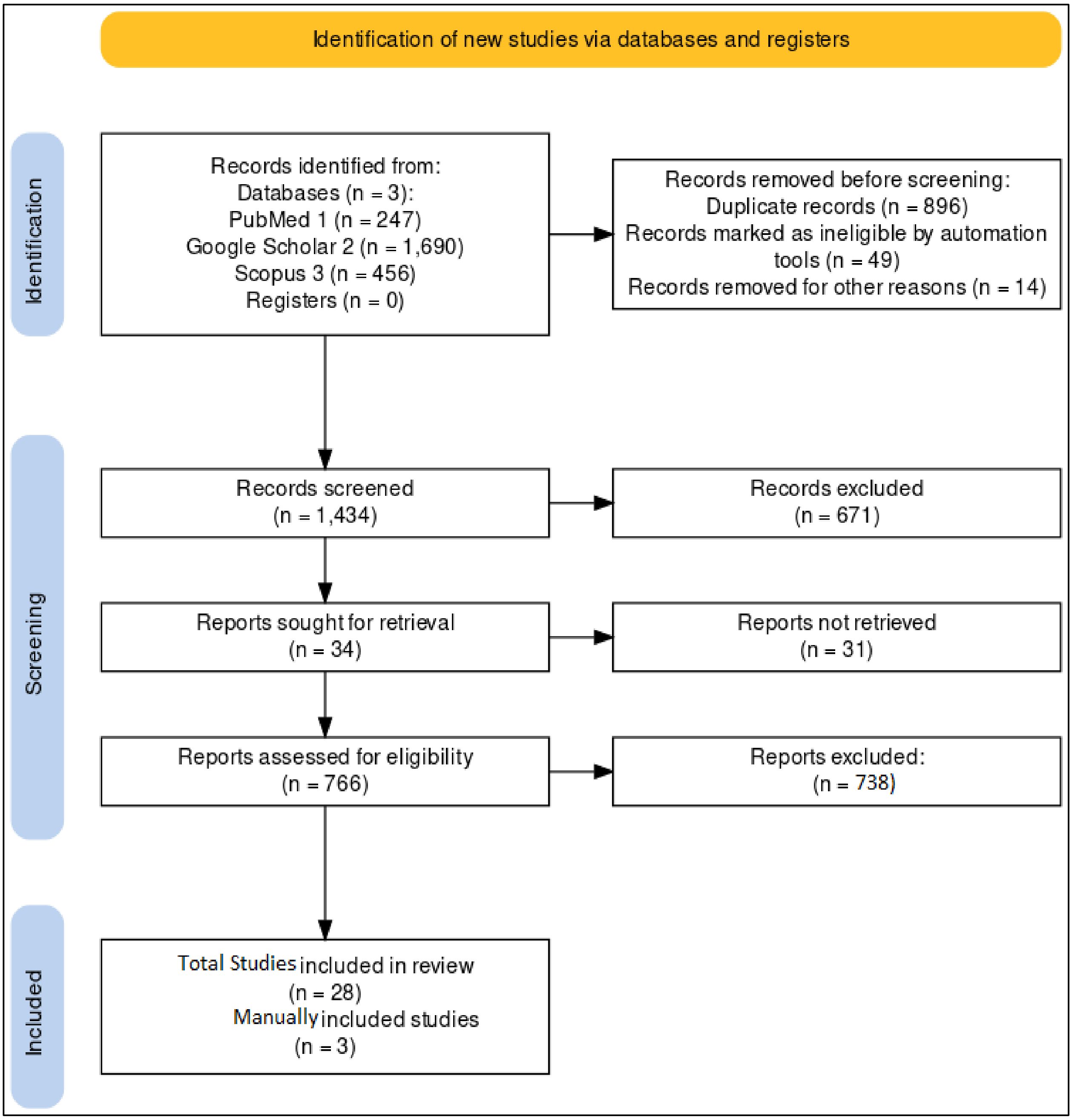

Figure 1: Identification of new studies via databases and registers.

Designed key terms: our key terms for MesH were IVUS, OCT, angiography, digital subtraction (DSA), PCI, CAD, CVD, meta-analysis (or review), and review literature.

Boolean search strategy

The search strategy included keywords like ("intravascular ultrasound" OR "IVUS") AND ("percutaneous coronary intervention" OR "PCI"); ("intravascular ultrasound" OR "IVUS") AND ("intravascular OCT" OR "OCT") AND ("percutaneous coronary intervention" OR "PCI") AND ("meta-analysis" OR "review"); ("optical coherence tomography" OR "OCT") AND ("intravascular OCT" OR "OCT") AND ("percutaneous coronary intervention" OR "PCI") AND ("meta-analysis" OR "review"); ("coronary artery disease" OR "CAD") AND ("intravascular OCT" OR "OCT") AND ("percutaneous coronary intervention" OR "PCI") AND ("meta-analysis" OR "review"); ("cardiovascular diseases" OR "CVD") AND ("intravascular OCT" OR "OCT") AND ("percutaneous coronary intervention" OR "PCI") AND ("meta-analysis" OR "review").

RESULTS

Above PRISMA flow diagram illustrates the systematic review process, we collected total of 2,393 records from three databases (PubMed, Google Scholar, Scopus). After removing duplicates using a tool, excluding records deemed ineligible by automation tools, 1,434 records underwent screening of their title, leading to the exclusion of 671 based on title. Thirty-four reports were sought for retrieval, but only three were retrieved. Following full-text assessment of 766 reports, we excluded those which were not discuss intravascular, or were irrelevant and did not fit in our inclusion criteria, we resulted in the inclusion of 28 studies while 3 other studies are included in paper which were selected manually.

Table 1: Summarization of previous literature: clinical outcomes, efficacy and OCT comparison with other modalities.

Author	Study design	Sample size	Patient pop	Intervention	Key findings	Conclusion
Park et al[2]	Systematic review and meta-analysis	12,895	PCI patients	IVUS vs. OCT vs. CA	IVUS reduces MACE, cardiac death, and revascularizations compared to C.A.; IVUS and OCT have similar efficacy	IVUS is preferable for PCI, comparable to OCT, and superior to C.A.
Roland et al[3]	Review	-	CAD patients	OCT-guided PCI vs. C.A./IVUS-guided PCI	Intravascular OCT provides superior visualization, aids diagnosis and treatment, and improves outcomes.	OCT is valuable in interventional cardiology; more research is needed
Kume et al[4]	Review	-	-	OCT vs. IVUS-guided PCI	Intravascular OCT and IVUS have equivalent outcomes; OCT offers high-resolution.	OCT is viable for guiding PCI with high-resolution imaging
Vignali et al[5]	Review	-	Invasive cardiology patients	Intravascular OCT vs. IVUS vs. NIRS	Intravascular OCT is superior in detecting TCFA and plaque vulnerability; it guides PCI by assessing the luminal area and thrombus types.	Intravascular OCT is valuable for research and clinical applications in invasive cardiology.
Kang et al[6]	RCT	2008	PCI patients with significant lesions	Intravascular OCT vs. IVUS-guided PCI	Intravascular OCT non-inferior to IVUS for primary composite endpoint at one year; lower incidence of major procedural complications	Intravascular OCT non-inferior to IVUS for guiding PCI, both safe and effective
Wang et al[7]	Review	-	CHD patients undergoing PCI	Intravascular OCT in CAD	Intravascular OCT accurately assesses plaque composition, guides treatment, and influences interventional strategies.	Intravascular OCT is valuable for diagnosing and treating CHD and optimizing interventional treatment efficacy.
Jorge et al[8]	Systematic review	-	P.H. patients	OCT imaging of pulmonary arteries	Intravascular OCT is useful for visualizing intravascular thrombi in CTEPH and measuring vessel wall thickness in P.H.	Intravascular OCT potential tool for in vivo study of vascular changes in pulmonary arteries
Oosterveer et al[9]	Review	-	CAD patients	OCT in PCI	OCT influences pre-stenting decisions and optimizes stents post-stenting; similar clinical outcomes to IVUS	Intravascular OCT is valuable in PCI for CAD, influencing decisions and improving outcomes.
DiVito et al[15]	Review	-	-	Intravascular OCT in clinical practice	Intravascular OCT provides detailed information on vascular biology and	Intravascular OCT high-resolution imaging modality is valuable for guiding and optimizing

Continued.

Author	Study design	Sample size	Patient pop	Intervention	Key findings	Conclusion
					atherosclerosis and is sensitive in detecting incomplete stent apposition.	interventional procedures.
Okamoto et al[10]	Comparison study	280 patients participated	Patients with acute coronary syndrome (ACS)	Primary PCI guided by OCT or IVUS	Primary PCI guided by OCT or IVUS	OCT-guided PCI provides comparable clinical outcomes to IVUS-guided PCI in patients with ACS, with the added benefits of shorter fluoroscopy and procedure times, potentially reducing patient radiation exposure and improving hospital workflow.
Kang et al[6]	Randomized, open-label pragmatic trial	2,008 patients	Patients aged 19 years or older undergoing PCI for significant coronary artery lesions	OCT-guided or IVUS-guided PCI	OCT-guided PCI was non-inferior to IVUS-guided PCI for the composite endpoint of death from cardiac causes, target vessel myocardial infarction, or ischemia-driven target vessel revascularization at one year (2.5% vs. 3.1%, p<0.001 for noninferiority). The incidence of contrast-induced nephropathy in the OCT and IVUS groups is similar (1.4% vs. 1.5%). There was a lower incidence of major procedural complications in the OCT group than in the IVUS group (2.2% vs. 3.7%, p=0.048). A higher total amount of contrast was used in the OCT group compared to the IVUS group (238.3 vs. 199.8 mL, p<0.001). Shorter total PCI time in the OCT group was compared to the IVUS group (mean 46.1 vs. 48.9 minutes, p<0.001).	The OCTIVUS trial confirms that OCT-guided PCI is as effective as IVUS-guided PCI in reducing major cardiovascular events in one year. It also shows lower procedural complications with OCT and demonstrates its safety and efficacy in clinical practice.

DISCUSSION

OCT specifications and advantages

OCT is a cutting-edge intravascular imaging technique that utilizes near-infrared light (1,300 nm) to provide high-resolution images of in vivo plaques. It offers an axial resolution of up to 10 µm and a lateral resolution of up to 20 µm, which is approximately ten times higher than that of IVUS.[13] OCT Superior resolution aids to monitor plaque microstructures below the endothelial surface providing exceptional clarity. OCT imaging is used by physicians to distinguish various plaque compositions, such as fibrous, lipid-rich, and fibrocalcific plaques, based on their unique backscattering and signal characteristics.[14] Its effectiveness is exceptional in visualizing thin fibrous caps, macrophage accumulation, microchannels, and cholesterol crystals, all these components are critical in plaque vulnerability assessment.

OCT is good at identification of thin-cap fibroatheroma (TCFA) and in-stent neoatherosclerosis, where it helps in plaque progression and stent-related complications.[15] But there exist some limitations such as poor tissue penetration and sensitivity to interference from blood. Its penetration depth is limited to 1 to 3 mm which restricts its ability to image the entire extent of plaques in larger arteries. The need for contrast medium infusion during OCT imaging also poses challenges for patients when examining renal functions.[16]

How intravascular OCT works in cardiology

Intravascular OCT in cardiology begins with the preparation of the patient and the insertion of a conventional 0.014 angioplasty guide wire to access the coronary artery lesion. An occlusion balloon is then passed along the guide wire beyond the lesion for Time-domain OCT (TD-OCT), while for frequency-domain OCT (FD-OCT), the occlusion balloon may not be necessary. The guide wire is exchanged for an OCT imaging wire or catheter, which is advanced distally into the coronary artery. To obtain clear images, blood is cleared from the imaging area by dilating the occlusion balloon and flushing with lactated Ringer's solution or normal saline for TD-OCT or by flushing with a viscous contrast medium through the guide catheter for FD-OCT. The OCT imaging wire or catheter is then pulled back to capture high-resolution coronary artery images, which are analyzed to assess plaque composition, stent apposition, and other features relevant to the patient's condition. Once imaging is complete, the OCT or catheter and guide wire are removed.[17]

During the procedure, intravascular OCT in cardiology utilizes near-infrared light with a wavelength of approximately 1,300 nm, which is absorbed at relatively low levels by red blood cells, water, lipids, and proteins. The system consists of a rotating glass fiber-optic probe that directs coherent infrared light into the coronary artery tissue. As the light is reflected from the tissue layers, it creates detailed cross-sectional tomographic images with a 10-20 µm resolution, about ten times higher than IVUS.[13] 1300 nm wavelength is enough to distinguish atherosclerotic plaques due to the tissue components' differential absorption and scattering properties.[19-21] OCT excels in visualizing fibrotic plaques as areas of high backscattering and uniform appearance, while fibrocalcific plaques appear as well-delineated, signal-poor regions due to calcium's high light attenuation. Lipid-rich plaques, characterized by their low backscattering and poorly delineated borders, are identified by the rapid signal drop-off and minimal light reflection, indicative of the light's interaction with the lipid content. Furthermore, OCT is instrumental in identifying vulnerable plaques, which pose a higher risk of rupture. It does so by revealing thin fibrous caps, usually defined as less than 65 µm in thickness, overlying large lipid cores, providing critical information that aids in assessing the plaque's stability and the patient's risk of acute coronary events. Through these specific interactions between light and tissue, OCT offers an unparalleled view into the composition and stability of atherosclerotic plaques.[22]

The introduction of FD-OCT technology has simplified the imaging process. FD-OCT uses a fixed reference mirror and a tunable laser light source, allowing faster image acquisition rates and pullback speeds. This technology enables a simpler, non-occlusive OCT imaging approach, where blood is removed from the artery by flushing with a viscous contrast medium through the guide catheter during the automated intravascular OCT pullback.[23]

Modification of plaque based on morphology identified by OCT

Lipid-rich plaque

Lesions mainly composed of a necrotic lipid core with a fibrous cap are called fibroatheromas. The risk of rupture is determined by the thickness of the overlying cap, with a thickness of <65 µm (thin cap fibroatheroma or TCFA) being particularly prone to rupture. Significant stenoses due to predominantly Lipid-rich plaque (LRP)s and TCFAs can be treated with direct stenting without dilatation.[24]

Fibrotic plaque

These plaques are typically rich in collagen or smooth muscle cells and have a homogeneous signal-rich backscatter on OCT. Fibrotic lesions causing significant obstructive disease can be addressed using cutting balloons or non-compliant balloons for adequate bed preparation prior to stent deployment to optimize stent expansion. Fibrofatty lesions with predominantly fatty composition require compliant balloons for bed preparation.[24]

Vulnerable plaques

These plaques can be recognized on OCT as having a large lipid core (lipid in ≥2 quadrants in any image) and a thin fibrous cap (<65 µm). Stenosis caused by TCFAs with evidence of active inflammation, such as macrophage infiltration, is seen as multiple punctate signal-rich regions near the fibrous cap, indicating increased vulnerability.[24]

Calcified lesion

Calcified lesions causing significant stenosis commonly cause under-expanded stents (UESs), leading to acute and chronic stent failure. OCT has a distinct advantage over IVUS for calcified lesion characterization and quantification. Calcium deposition in a lesion is classified into superficial, deep, and nodular calcium. An OCT-based calcium score helps determine the probability of stent under-expansion in calcified lesions.[24]

Assessment of stenosis severity using OCT

OCT provides precise measurements of lumen dimensions, aiding in assessing the severity of coronary artery stenosis. This detailed visualization helps determine the extent of narrowing within the coronary artery, aiding in the decision-making process for appropriate interventions. The ability to accurately quantify stenosis severity is crucial for planning PCI and ensuring optimal treatment outcomes.[24]

OCT is used in guiding stenting procedures, known as PCI because it illustrates coronary artery anatomy, plaque characteristics, and stent deployment.[24]

OCT-guided PCI

As previously described, OCT identifies plaque types and distribution, aiding in selecting interventional strategies and devices, ensuring accurate stent sizing, and detecting rupture-prone TCFAs.[24] During PCI, OCT helps choose the right stent size and determine the optimal landing zones for stent deployment based on pre-assessment. It ensures that the stent covers the lesion adequately without extending into healthy segments of the artery. After stent deployment, OCT is used to evaluate stent expansion and apposition. It can detect under-expansion or malposition areas, critical for ensuring optimal stent deployment. Proper stent expansion and apposition are essential for reducing the risk of restenosis and stent thrombosis.[25]

OCT-in-stent restenosis

OCT is paramount in analyzing arterial healing post-stenting, highlighting its efficiency. In-stent restenosis (ISR) stands as the predominant reason for stent failure, persisting as a substantial challenge even with the diminished rates brought by the advent of drug-eluting stents (DES). Through OCT, the causative factors of ISR, including under-expansion, malposition, or strut fracture, can be pinpointed, alongside differentiating ISR types into neointimal hyperplasia (NIH) or no atherosclerosis. It is noted that NIH linked to bare metal stents (BMS) displays homogeneity, whereas NIH from DES exhibits more variability. The accumulation of lipids and calcium distinguishes neoatherosclerotic hyperplasia, leading to ISR, necrotic core, and macrophage infiltration. Currently, the preferred treatment for ISR involves the utilization of DES, especially the everolimus-eluting DES, which boasts superiority over drug-eluting balloons (DEB) concerning both short-term and long-term outcomes.[26]

Understanding stent thrombosis through OCT

Stent thrombosis emerges as a grave complication, potentially diminishing life expectancy and precipitating myocardial infarction. The feasibility of OCT in acute/subacute stent thrombosis scenarios has been established, allowing for the identification of crucial morphological attributes like uncovered and malapposed struts, the under-expansion of stented coronary segments, and disturbed blood flow along malapposed stent struts.[26]

OCT's in bifurcation lesions

Bifurcation lesions are notably complex, accounting for 1520% of all PCI procedures. OCT plays a critical role in provisional bifurcation angioplasty by assessing plaque distribution relative to the side branch (SB) mostium, measuring the carina tip (CT) angle, and determining the distance from CT to the bifurcation point (BP). Additionally, for native coronary artery stenosis, the complete scaffold resorption by bioresorbable vascular scaffolds (BVS) is hypothesized to enhance clinical outcomes.[26]

Diagnostic efficacy and clinical outcomes of OCT

OCT offers high-resolution imaging (10-120 μm axial resolution), allowing for detailed visualization of coronary artery structures and stent struts. OCT is confirmed promising tool in guiding PCI, offering high-resolution imaging of coronary arteries. In RCTs directly comparing OCT-guided and angiography-guided PCI are scarce, several observational and registry studies discussed its efficacy and impact on clinical outcomes and success.[27] The CLI-OPCI study by Prati et al in an observational study, they compared OCT-guided PCI with angiography-guided PCI and revealed compelling findings. Patients undergoing OCT-guided PCI had a significantly lower 1-year risk of cardiac death (1.2% vs. 4.5%, p=0.010) and major adverse cardiovascular events (MACE) (9.6% vs. 14.8%, p=0.044) compared to those undergoing angiography-guided PCI. This suggested that OCT guidance may lead to improved clinical outcomes and can have potential clinical utility.[26] Prati et al in another study, the CLI-OPCI II emphasized the importance of optimal stent deployment, showing that suboptimal stent deployment based on specific OCT criteria was associated with a substantially increased risk of MACE (hazard ratio [HR]: 3.53; 95% confidence interval [CI]: 2.2-5.8; p<0.001). This finding emphasized while using OCT, physicians must ensure proper stent placement and subsequent clinical outcomes.[29]

Registry studies, Chandra et al suggested that patients with ST-segment elevation myocardial infarction (STEMI) have supported the advantages of OCT-guided PCI. These studies have shown that OCT-guided PCI is associated with reduced stent usage and larger in-stent minimal lumen diameter, indicating improved procedural precision and potentially better long-term outcomes than angiography-guided PCI.[30] ILUMIEN-I study compelled OCT's impact on PCI strategy, revealing that pre-stent OCT imaging influenced the operator's decision-making in 57% of cases, compared to 27% post-PCI imaging.

While this did not translate into differences in post-PCI fractional flow reserve (FFR) values between the two groups, it highlights OCT's role in guiding procedural strategies and optimizing PCI outcomes.[12,31]

Park et al conducted a systematic review, network meta-analysis, and meta-regression involving 12,895 patients undergoing PCI. The study found that IVUS, compared to CA alone, was associated with a significantly reduced risk of MACE, cardiac death, target lesion revascularization, and target vessel revascularization. Interestingly, no significant differences in clinical efficacy were observed between IVUS and OCT, indicating that OCT offers comparable outcomes to IVUS and is superior to conventional angiography in reducing cardiovascular events. This finding underscores the diagnostic precision and potential for PCI optimization provided by intravascular OCT.[2]

Further exploration into the utility of OCT is provided by Robert Roland, MD, and Josef Veselka, MD, PhD who reviewed the latest data on the clinical use of OCT across various coronary artery disease settings. Their analysis reveals that OCT's superior high-resolution visualization capabilities aid in accurately diagnosing coronary artery disease and enhance the treatment process, particularly in OCT-guided PCI. OCT's ability to offer detailed images of intramural and transmural coronary structures facilitates a deeper understanding of atherosclerosis, acute coronary syndrome, stent failure, and the performance of new devices. The author emphasized need for more randomized clinical trials to determine OCT's superiority over conventional angiography-guided PCI conclusively.[3] Kume et al directly compare OCT-guided PCI and IVUS-guided PCI, highlighting equivalent clinical and angiographic outcomes between the two methodologies. OCT's unique capability to identify high-risk lesions and provide detailed imaging for PCI guidance underscores its value as a viable alternative to IVUS. However, their conclusion echoes the need for further large-scale studies to affirm OCT's superiority.[4] In cardiology, optimal stent deployment based on OCT criteria is crucial, while innovative contrast-sparing methods like LMWD help protect renal function.[26] Luigi et al provide insights into OCT's superior capabilities in detecting thin-cap fibroatheroma (TCFA) and plaque vulnerability compared to IVUS and near-infrared spectroscopy (NIRS). The precision in luminal area assessment, thrombus identification, and stent apposition evaluation that OCT offers is invaluable in detecting post-stent implantation complications and guiding PCI interventions.[5]

A landmark study, the OCTIVUS trial by Do-Yoon et al prospectively compared OCT-guided PCI with IVUS-guided PCI in 2008 patients. The findings confirmed the noninferiority of OCT-guided PCI in terms of the incidence of a composite of death from cardiac causes, target vessel-related myocardial infarction, or ischemia-driven target-vessel revascularization at one year.[6]

OCT provides detailed imaging for PCI guidance and has shown promising results in reducing major adverse cardiovascular events (MACE), improving clinical outcomes compared to angiography-guided PCI. Studies also suggest that OCT-guided PCI is associated with reduced stent usage and larger in-stent minimal lumen diameter, indicating improved procedural precision. OCT offers comparable outcomes to IVUS and is superior to conventional angiography in reducing cardiovascular events which emphasizes diagnostic precision and potential for PCI optimization.

CONCLUSION

From all the above study, we conclude that intravascular OCT has revolutionized cardiology by providing high-resolution imaging of coronary arteries, enhancing the diagnosis and management of coronary artery diseases. It is clear that OCT is superior in guiding PCI, identifying thin-capped fibroatheromas (TCFAs), and optimizing stent deployment compared to conventional angiography and is more efficient compared to IVUS. All the previous trial and other studies confirm OCT's safety and effectiveness in PCI, with the potential for improved clinical outcomes and reduced procedural complications. Despite limitations like sensitivity to blood interference and limited tissue penetration depth, ongoing advancements are expanding OCT's utility. In conclusion, OCT is a valuable tool in interventional cardiology and it offers imperative insights into coronary artery pathology and enhances the precision of PCI.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Sacoto VMA, Mite APC, Pilatasig WJM, Mosquera-Ceprian RA, Cunduri EVM, Castillo AMB, et al. A systematic review of clinical applications and diagnostic efficacy of intravascular optical coherence tomography in cardiology. Int J Res Med Sci 2024;12:1681-9.