SHORT COMMUNICATION

Knowledge of intravascular imaging in interventional cardiology practice

Results of a survey on Polish interventional cardiologists

Paweł Gąsior[1]*, Krzysztof Bryniarski[2]*, Magda Roleder[1], Wojciech Wojakowski[1], Jacek Legutko[2]

1   Department of Cardiology and Structural Heart Diseases, Medical University of Silesia, Katowice, Poland
2   Department of Interventional Cardiology, Institute of Cardiology, Jagiellonian University Medical College, John Paul II Hospital, Kraków, Poland

Correspondence to:
Jacek Legutko, MD, PhD,
Department of Interventional
Cardiology, Institute of Cardiology,
Jagiellonian University Medical
College, John Paul II Hospital,
ul. Prądnicka 80, 31-202 Kraków,
Poland, phone: +48 12 614 35 01,
email: jacek.legutko@uj.edu.pl

* PG and KB contributed equally to
  this work.

Introduction   A growing number of studies and practice guidelines support the use of intravascular ultrasound (IVUS) and optical coherence tomography (OCT) for optimizing procedural results and improving clinical outcomes of patients undergoing percutaneous coronary interventions (PCIs) as well as for assessment of stent failure.[1] However, the rate of using IVUS and OCT in everyday clinical practice in Poland remains low. In 2015, it did not exceed 1.5% of the total number of PCIs.[2] In the current European Society of Cardiology (ESC) guidelines, IVUS imaging is recommended for optimizing stent implantation in selected patients and for evaluating the severity of left main coronary artery lesions and optimizing their treatment. Furthermore, both IVUS and OCT are recommended for assessing the mechanism of stent failure.[3] The introduction of reimbursement for IVUS was associated with a 63% increase in the absolute number of IVUS procedures in 2017. However, the overall usage of this method remains low (annual number of IVUS procedures, 2529; coronary angiographies, 198 362; PCIs, 114 282). The lack of reimbursement for OCT resulted in a 40% decrease in the number of OCT procedures (n = 238) as compared with the year 2016. It has been shown that economical restriction may not be the main factor responsible for the low usage of intravascular imaging (IVI).[4] Therefore, we undertook a study with a self-written questionnaire evaluating theoretical and practical knowledge on the clinical use of IVI in interventional cardiology practice in Poland.

Methods   **Study design**   The questionnaire (Supplementary material) was distributed among 101 interventional cardiologists during 2 major Polish invasive cardiology workshops (19th Interventional Cardiology Workshops in Zabrze in 2018 and 22nd Warsaw Course on Cardiovascular Interventions in 2018). In the first section, we asked respondents about their experience as interventional cardiologists, the number of performed PCI and IVI procedures, as well as theoretical knowledge about IVI. The second section focused on the practical aspects of IVUS and OCT image interpretation.

Statistical analysis   Categorical variables were presented as counts and percentages. The normality of distribution of continuous variables was examined with the Kolmogorov–Smirnov test. The mean (SD) was reported for normally distributed data, and the median (interquartile range [IQR]) was reported for data without normal distribution. The Fisher exact test or χ^2 test was used for categorical variables, and the t test or Mann–Whitney test was applied to compare continuous variables. All tests were 2-sided, and a P value of less than 0.05 was considered significant. All analyses were performed using the SPSS version 25.0 (SPSS, Inc., Chicago, Illinois, United States).

Results and discussion   The average length of work experience was 9 years (median [IQR], 7 [3–13] years). Over two-thirds of the respondents identified themselves as independent operators (67%). The declared volume of PCIs performed during the preceding year was 118 on average (median, 100 [IQR, 30–200]). Intravascular imaging was used in clinical practice by 71% of the operators, with a mean of 18 IVI-guided

procedures (median, 10 [IQR, 0–30]) during the preceding year. The number of performed PCI procedures did not influence the survey results (FIGURE 1).

In the theoretical part, physicians' knowledge regarding IVUS and OCT was almost identical (64% [IQR, 60%–80%] vs 62% [IQR, 55%–73%], respectively; $P = 0.19$). Most of the operators (76%) were able to correctly sort the imaging modalities from those with the lowest to those with the highest resolution. The knowledge of OCT class recommendation in the 2014 ESC guidelines on myocardial revascularization to assess the mechanisms of stent failure was relatively high (76%). However, only 37% of the respondents were aware of OCT class recommendation for stent implantation optimization. The correct borderline thickness of thin-cap fibroatheroma (<65 μm) was indicated by 52% of the operators. Only 30% of the operators knew that the lipid plaque on OCT was associated with the highest attenuation. The knowledge of the best IVUS parameter used to assess significance of left main coronary artery stenosis (minimum lumen area) was high (87%). Also, 70% of the respondents were aware that IVUS overestimates the lumen area measurements when compared with OCT. Most respondents (75%) were aware that IVUS offered less accurate detection of thrombus when compared with OCT, and 41% thought that IVUS was a proper modality to assess the thrombus volume.

In the second part of the survey, we observed a difference in image interpretation skills between IVUS and OCT (80% [IQR, 60%–100%] vs 50% [IQR, 25%–75%], respectively; $P <0.001$). Only 33% of the respondents were able to correctly indicate calcifications and lipid pools on cross-sectional OCT images. Also, 37% of the physicians properly detected plaque rupture with the presence of white and red thrombus. Most of the operators (77%) identified strut malapposition, dissection, and tissue protrusion visible on OCT. Fibrotic plaque and calcifications visible on IVUS were detected by 59% of the operators. Stent struts on an IVUS image were correctly indicated by 83% of the operators, and 71% of them properly identified wire presence in the lumen of the artery. Vessel dissection on IVUS was detected by 66% of the operators.

A recent survey of the European Association of Percutaneous Cardiovascular Interventions (EAPCI) on the use of intracoronary imaging in interventional practice demonstrated a high rate of personal experience with IVI in a sample of predominantly experienced interventional cardiologists. The most commonly identified indications for IVI were optimization of stenting, procedural or strategy guidance, and guidance of left main coronary artery interventions. Practice patterns varied considerably according to geographic region and interventional experience.[5] The results of our survey demonstrated similar theoretical knowledge of both IVUS and OCT. However, in contrast to the theoretical part, we observed differences in image interpretation skills between IVUS and OCT. Our results may be partially explained by the greater availability of IVUS in Polish catheterization laboratories: OCT is still not reimbursed and is mainly used in university centers. Moreover, some of the low scores in the IVUS part of the questionnaire may be explained by a very low use of IVUS by the participants. Our survey showed that half of the participants using IVI modalities used them less than once per 5 weeks. The recent expert consensus of the EAPCI on the clinical use of intracoronary imaging stated that IVUS and OCT are equivalent (and superior to angiography) in guiding and optimizing most PCI procedures.[6] Both modalities can identify features of optimal stent implantation (expansion, apposition, and complications) and mechanisms of stent failure that cannot be detected using standard coronary angiography.[7]

This study has several limitations. First, our results may not reflect the actual knowledge of all Polish interventional cardiologists due to the small number of participants. Second, we cannot exclude selection bias towards respondents positively predisposed to the use of IVI, because physicians with a greater interest and personal involvement in these modalities may be more likely to participate in interventional cardiology meetings. We did not collect data regarding the availability of IVI in catheterization
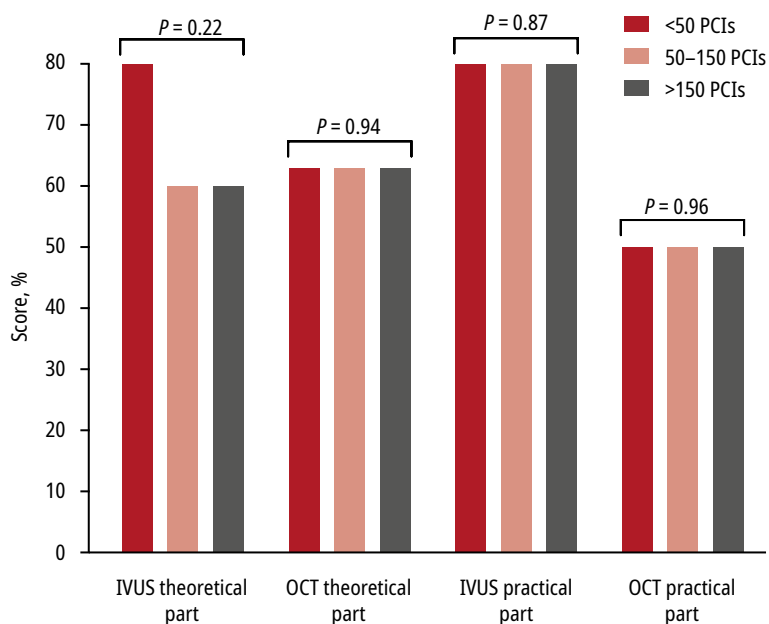

FIGURE 1 Median scores for the theoretical and practical part of the questionnaire depending on the number of percutaneous coronary intervention procedures per year

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

laboratories, so some respondents might not have the means to use OCT in clinical practice. The survey was conducted before the introduction of new guidelines on myocardial revascularization and the change in the class of recommendation for using OCT for stent optimization. Finally, the survey provides only a snapshot of practical and theoretical knowledge regarding IVI.

In conclusion, the use of IVI among Polish interventional cardiologists remains very low. There is still a strong need for further education and promotion of IVI not only among younger and less experienced colleagues, but also among cardiologists who in their own opinion are experienced operators. Our study indicates that the evaluation of interventional cardiologists regarding their IVI knowledge is also needed in other countries.

SUPPLEMENTARY MATERIAL

Supplementary material is available at www.mp.pl/kardiologiapolska.

ARTICLE INFORMATION

REFERENCES

1   Witzenbichler B, Maehara A, Weisz G, et al. Relationship between intravascular ultrasound guidance and clinical outcomes after drug-eluting stents: the assessment of dual antiplatelet therapy with drug-eluting stents (ADAPT-DES) study. Circulation. 2014; 129: 463-470.

2   Legutko J, Siudak Z, Parma R, et al. Poland: coronary and structural heart interventions from 2010 to 2015. EuroIntervention. 2017; 13: Z51-Z54.

3   Neumann FJ, Sousa-Uva M, Ahlsson A, et al. 2018 ESC/EACTS Guidelines on myocardial revascularization. Eur Heart J. 2019; 40: 87-165.

4   Dudek D, Siudak Z, Legutko J, et al. Percutaneous interventions in cardiology in Poland in the year 2017. Summary report of the Association of Cardiovascular Interventions of the Polish Cardiac Society AISN PTK and Jagiellonian University Medical College. Postepy Kardiol Interwencyjnej. 2018; 14: 422-424.

5   Koskinas KC, Nakamura M, Räber L, et al. Current use of intracoronary imaging in interventional practice - Results of a European Association of Percutaneous Cardiovascular Interventions (EAPCI) and Japanese Association of Cardiovascular Interventions and Therapeutics (CVIT) Clinical Practice Survey. EuroIntervention. 2018; 14: e475-e484.

6   Räber L, Mintz GS, Koskinas KC, et al. Clinical use of intracoronary imaging. Part 1: guidance and optimization of coronary interventions. An expert consensus document of the European Association of Percutaneous Cardiovascular Interventions. EuroIntervention. 2018; 14: 656-677.

7   Basavarajaiah S, Naganuma T, Watkin R. Bioresorbable vascular scaffolds for a long diffuse coronary lesion: insights from optical coherence tomography at 25-month follow-up. Kardiol Pol. 2018; 76: 928.