

Intravascular imaging and coronary intervention: Is the bond getting stronger?

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Related article

by Januszek et al.

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Intravascular imaging (IVI) plays a vital role during percutaneous coronary intervention (PCI), especially in a subset of coronary lesions. It gives the operator an intravascular view and hence allows for a much better understanding of vessel anatomy and plaque morphology, which aids in optimal lesion preparation and stent/balloon-sizing [1]. The European Society of Cardiology (ESC) guidelines have given class IIa indication for the use of IVI to optimize stent implantation, especially for unprotected left-main lesions [2]. However, since the last published guidelines in 2018, there have been more trials that have shown the superiority of IVI-guided PCI over conventional angiography-guided intervention. In the recently published ULTIMATE trial, there was a reduced incidence of target vessel failure (TVF) in the IVI arm as compared to the angiography-alone group during 3-year follow-up (6.6% vs. 10.7%, hazard ratio [HR], 0.60; 95% confidence interval [CI], 0.42–0.87; $P = 0.01$) [3]. In addition, the IVI group had a lower incidence of stent thrombosis. Similar findings were noted in IVUS-XPL, where the 5-year outcomes showed reduced major adverse cardiovascular event (MACE) rates in the IVI arm as compared to angiography-guided PCI (5.6% vs. 10.7%; $P = 0.001$) [4]. Due to that evidence and guidelines, IVI use in PCI can be strongly recommended, especially in certain anatomical circumstances such as left main stem, long-lesions, in-stent restenosis, calcified lesions, and chronic total occlusion (CTO). Notwithstanding, global use of IVI is generally low, even as it is consistently increasing. In New York's PCI registry, the use of IVI had increased from 13% in 2014 to

17% in 2018 [5]. The British data published in 2022 is even more convincing, IVI use in 2014 was around 8% and increased to 18% by 2020 [6]. In the recently published study from the Polish national database from 2014 to 2021, the authors quite convincingly demonstrated a significant increase in the use of IVI from 0.67% in 2014 to 4.42% in 2021 [7]. This increase is almost 7-fold and has been attributed to changes in the reimbursement policy in Poland. Currently, imaging catheters are reimbursed, which is excellent news reflected in the data. In addition, there is a constant desire amongst operators to use IVI and make Polish cardiologists aware of it. Free courses on IVI and practical teaching from proctors have further encouraged its use. The investigators have also demonstrated that MACE rates were significantly lower in the IVI group as compared to the angiography guidance alone as seen in the ULTIMATE and IVUS-XPL randomized control trials [3, 4].

Although light penetrates tissue better compared to ultrasonic waves, the uptake of optical coherence tomography (OCT) is generally lower than in the case of intravascular ultrasound (IVUS), and this was noted in the Polish registry (OCT, 0.43% vs. IVUS, 4.42% in 2021) [7]. This may be because OCT is a relatively new tool as compared to IVUS, and historically interventionalists are more familiar with images obtained from IVUS than OCT. In addition, OCT is not preferred in patients with kidney impairment due to the need for contrast, in aorto-ostial lesions where the blood clearance is poor, and in tortuous coronary anatomy, which may hamper OCT pullback. Nevertheless, both modalities are better than

angiography-based PCI, and with more emerging data from OCT, its use will grow.

The advent of new technologies, such as intravascular lithotripsy and orbital atherectomy, have helped us tackle more complex coronary lesions such as CTO, calcified lesions, and complex left main bifurcations. One of the main rules when dealing with such complex lesions is the upfront use of IVI, which aids in choosing the modality to adequately prepare the lesion [8]. In the past, IVI was mainly used to optimize stents, which may be too late especially if lesion preparation was inadequate or sub-optimal. The current consensus is the upfront use of IVI and repeating it after every modality to assess lesion preparation before considering stents. In the study by Januszek et al., IVI use remained low in complex lesions (<2% for CTOs, left main stem (LMS) 5.3%, and in multi-vessel PCI <1%). Interestingly, the use of IVI in bifurcation was almost as in LMS (around 5%).

With all the data and guidelines favoring image-guided PCI, should we be expecting almost exclusive use of IVI in all coronary lesions? The answer is probably no, as the use of IVI in simple lesions may not be needed given the low event rates with current-generation drug-eluting stent (DES) and novel antiplatelet agents [9, 10]. Despite the benefits; procedure times, radiation, and contrast use are higher with IVI, and this was noted in the Polish registry too, and these factors influence low IVI uptake globally. Hence reimbursement of imaging catheters, as in Poland, will remove one of the barriers to IVI uptake. Unfortunately, in countries that have not introduced IVU reimbursement, the uptake will remain low. Similarly, time pressure can discourage operators from using IVI, but as operators do more imaging, they will become proficient in both technical aspects of the procedure and image interpretation. Challenges in image interpretation can be overcome by courses and proctoring. This has been demonstrated by the study of Januszek et al. where such measures have given rise to the number of IVI procedures. Proper use of angiogram and IVI-guided PCI is important – non-complex lesions can be treated by angiographic guidance alone. However, in complex lesions, operators should readily use IVI to obtain optimal results. Imaging should almost be a standard in such lesions as CTO and in heavily calcified lesions to avoid suboptimal outcomes, especially considering the time and resources spent on treating such lesions.

In conclusion, it is a positive sign to see the increased IVI use in Poland as a result of introducing the judicious reimbursement policy. We can be sure that in the coming years, Poland will continue to see a further increase in the number of imaging-guided PCIs. Finally, the authors

have to be commended for collecting impactful data and the excellent article, which I am sure will encourage more operators not only in Poland but globally to use IVI.

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