Intracoronary Imaging for In-Stent Restenosis – Ready for Clinical Routine?

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Since the first human coronary stent implantation in 1986, the number of coronary stenting procedures rapidly increased and many different types of coronary stents have been introduced in the market of cardiovascular products [1]. Despite the introduction of new generation stents with superior quality (drug eluting or bioabsorbable stents) and despite the increasing experience in performing stenting procedures, the restenosis within the implanted stent, known as in-stent restenosis (ISR), continues to represent a major healthcare problem. ISR was noted in approximately 30% of cases following implantation of bare metal stents, however its incidence significantly decreased after introduction of new drug eluting stents (DES) in the recent years.

In-stent restenosis has been traditionally associated with neointimal hyperplasia. However, recent studies have suggested that an underlying progression of the atherosclerotic process, different from intimal proliferation, could be present in these cases. The term of "neoatherosclerosis" has been recently introduced to characterize the development of new atheromatous process within the implanted stent, which could be extended beyond the traditional interval of several months associated with neointimal hyperplasia [2]. The extent in which this neoatherosclerosis is an unstable condition is not clear in present, however it has been reported that approximately one-third of patients with bare metal stents restenosis present with acute coronary syndromes. Furthermore, several studies reported typical histologic morphologies in the atheromatous samples retrieved from restenotic stents, that resembled vulnerable plaques in native coronary arteries [2-3].

The pattern of the restenotic tissue in DES is slightly different from the one encountered in bare metal stents (BMS). While the DES restenosis is usually characterized by neointimal hyperplasia with a large content of vascular smooth muscle cells, BMS restenosis typically contains a small amount of vascular smooth muscle cells and a proteoglycan-reach core [1].

According to published data, development of ISR could be the result of the interaction between systemic and local factors and different studies tried to identify the risk factors associated with a higher incidence of ISR [1]. It has been proved that smaller vessel sizes, a longer lesion length, the history of bypass surgery, the complexity of the lesion and the presence of diabetes mellitus are independent predictors of ISR, while the use of new generation drug eluting stents was an independent predictor of a lower restenosis rate [1].

A study published in this number by Blendea et al [45] showed that the most significant predictor of ISR development of was the control of the cholesterol values following the intervention. This underlines the importance of an appropriate follow-up of the patients carrying an intracoronary stent and indicates that beyond the well-known importance of dual antiplatelet therapy following stenting, the control of the lipidic metabolism plays also a significant role in the follow-up of these patients.

However, this study did not follow other traditional factors known as being associated with ISR, such as the stent apposition to the vessel wall, or the pattern of the restenotic tissue. All these factors are easy to be evaluated using new intracoronary imaging technologies or the non-invasive Cardiac Computed Tomographic Angiography (CCTA) [5]. At the same time, the study does not analyze separately the cases who developed ISR as a result of neointimal hyperplasia from those who developed ISR as a result of neoatherosclerosis, in cases who presented with the clinical picture of an acute coronary syndrome.

Acute Coronary Syndromes are traditionally associated with the presence of vulnerable plaques and three imagistic methods are most common used in present to assess the markers associated with vulnerable plaques: CCTA, Intravascular ultrasound with virtual histology (VH-IVUS), and Optical Coherence Tomography (OCT). While the utility of all these techniques is generally accepted for characterization of vulnerable plaques, in case of ISR CCTA is considered less able to provide reliable quantification of plaque components, mainly due to reverberations of the metallic stents which precludes a good quality visualization of the plaque inside the stent and a high accuracy assessment of its density. This significantly limits the possibility to assess the degree of restenosis and the vulnerability of the restenotic tissue in a non-invasive way.

Therefore an intracoronary imaging procedure could add relevant information in patients with ISR and the role of imaging in the cardiac catheterization laboratory should not be forgotten. Especially in the complex cases of ISR, intracoronary imaging techniques serve for the correct assessment of the restenosis type, the severity of the restenosis and the vulnerability of the lesions and should be used on a routine basis in any suspicion of ISR.

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