In this issue of *Circulation: Cardiovascular Interventions*, Im et al. are assessing the fate and clinical significance of optical coherence tomography (OCT)–detected incomplete stent apposition (ISA) in drug-eluting stents (DESs). This work is addressing an important clinical question because interventional cardiologists are obsessed with achieving optimal stent expansion since the early days of coronary stent implantation, and this is still today considered the best way to prevent acute and long-term sequelae such as stent thrombosis. Indeed, intravascular ultrasound (IVUS) studies unveiled the prominent role of stent underexpansion in the pathogenesis of stent thrombosis in the past. Therefore, optimal stent expansion allowing to achieve a high acute lumen gain is of concern ever since. This knowledge triggered the development of improved stent design and high-pressure balloons, as well as the use of invasive imaging technologies, such as IVUS, to diagnose stent underexpansion. Back then, complete apposition of the stent struts against the vessel wall was an implicit prerequisite for optimal stent expansion. ISA, defined as the absence of contact of ≥1 stent strut with the vessel wall, became an entity in its own right in the late 1990s with the introduction of intracoronary brachytherapy and the IVUS observation of late-acquired ISA. This interest extended later, in the beginning of the millennium, to the first-generation DES. Late-acquired ISA was interpreted as a symptom of vascular toxicity, caused by either radiation or cytotoxic drugs and suspected to be associated with adverse outcomes. Nevertheless, an adverse effect of either acute ISA or late-acquired ISA on clinical outcome was not demonstrated in prospective studies at that time.

With these advantages for in vivo imaging available, the first small-scale pilot OCT studies were published. These studies demonstrated that incomplete apposition of ≥1 individual strut within a stent is rather frequent with an incidence of ≈65% of stents, much higher than what was estimated from IVUS studies in the past. Hand in hand with these early observations arose questions about scale and the clinical relevance of OCT-detected ISA, especially in the light of case series focusing on patients with stent thrombosis that showed an incidence of ISA on a stent-level basis at the time of the event as high as 78%.

In this issue of the journal, Im et al. add to the current knowledge. They present their findings on OCT-detected ISA in a large cohort of 351 patients undergoing serial OCT imaging after single DES implantation. They confirmed a relatively high incidence of acute ISA on a stent-level basis with 60%. However, it is important to realize that the incidence of acute ISA might be even higher in real-life practice because patients with complex lesions, such as left main disease and overlapping stents, were excluded.

Acute ISA tends to resolve in the majority of cases (70%) within 6 months. Predictors for ISA persistence were a high ISA volume and ISA location near the stent edges, which is in accordance with findings of previous smaller scale studies. Late-acquired ISA was less common, with an incidence of 15%. Predictors for late-acquired ISA were the presence of thrombus or tissue prolapse at the index procedure. This might support the concept of thrombus degradation over time as a dominant pathomechanism of late-acquired ISA rather than inflammation. Interestingly, there was no association between the patient’s clinical presentation as acute coronary syndrome at baseline and late-acquired ISA at follow-up. This is somewhat surprising because acute coronary syndrome lesions are characterized by the presence of thrombi. Likewise, the role of tissue prolapse after stenting needs further clarification. Predilatation was performed systematically in all patients, and there is the hypothesis that predilatation is causing dissections that then in turn can result in tissue prolapse. Thus, tissue prolapse might rather reflect periprocedural vessel trauma than being a pathogen in itself.

What is the clinical relevance of the reported finding? Im et al. show a lack of association between ISA and clinical outcome. Although these findings may seem reassuring, the reported extremely low overall event rate (cardiovascular death or myocardial infarction 0.6%) and the absence of stent thrombosis events at a mean follow-up period of 29 months must be interpreted with caution. The study is clearly not powered for clinical outcome as end point, whereas the included...
patients represent a highly selected low-risk population with expected low event rates. Moreover, the follow-up duration of Im’s study might be too short to draw final conclusions on the effect of late-acquired ISA on late adverse events. In a recent substudy of the Sirolimus-Eluting Versus Paclitaxel-Eluting Stents for Coronary Revascularization (SIRTAx) trial, the presence of ISA at 8-month follow-up IVUS examination of first-generation DESs was associated with an increased rate of myocardial infarction and stent thrombosis through the following 5 years, with the effect becoming obvious beyond a 2-year follow-up period.8 Despite such limitations for generalizability, the authors are to be commended for performing one of the largest longitudinal OCT registries to date to investigate the vascular healing response after DES implantation.

What lessons can we learn for the daily practice in the cath lab? Perhaps, the most important message that the study by Im et al18 conveys is that the OCT finding of isolated ISA, when of small extent, in the absence of impaired flow conditions, and in noncomplex lesions, should not dictate the use of aggressive postdilatation because ISA tends to heal over time in the majority of the cases and is not associated with adverse midterm prognosis. The potential benefit of postdilatation for ISA near the stent edges should be weighed against the risk of iatrogenic edge dissection.

It remains for future studies to assess the role of ISA in more complex lesion subsets and also with more extended follow-up. Future studies with systematic assessment of the role of stent expansion, vascular trauma,19 and residual atherothrombotic burden20 will define the role of OCT in guidance of coronary interventions.

Disclosures
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References


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Standing on Solid Ground?: Reassessing the Role of Incomplete Strut Apposition in Drug-Eluting Stents
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