I prefer to remain humble and to know that direct stenting is safe and advantageous when I think it is necessary and feasible.

A. COLOMBO
Columbus Hospital and San Raffaele Hospital, Milan, Italy

References


The stent is here to stay: a note on stenting, ultrasound imaging, and the prevention of restenosis

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Following percutaneous coronary interventions, a considerable number of patients develop restenosis despite an acute success with initially large lumen dimensions. This serious clinical problem causes hospitalization and recatheterization and represents a substantial economic burden for society. Various novel devices with different modes of operation have been suggested and applied, but most of
them were dropped or their use was restricted to a certain niche.

Formation of restenosis after balloon angioplasty and other non-stent procedures was previously thought to be the result of plaque growth only, stimulated by the injury that was caused by the therapeutic device. Various concepts of adjunctive pharmacological therapies, aiming at a reduction of plaque growth, were tested and failed to prove a benefit in the clinical setting\[^1\]. During the last decade of the past century intravascular ultrasound imaging became available, providing a high-quality transmural cross-sectional visualization of the coronary artery in vivo. This approach is ideal not only for the assessment of the lumen, but also for the vascular dimensions at the lesion site and in the reference segments\[^2\]. Intravascular ultrasound demonstrated that the aforementioned concept of restenosis was incorrect. In fact, restenosis after balloon angioplasty and alternative non-stent interventional techniques turned out to be, to a great extent, the result of unfavourable constrictive remodelling of the vessel wall while plaque growth played a secondary role\[^3,4\].

At the time when intravascular ultrasound became available, another therapeutic interventional approach was more or less failing: coronary stenting was about to be dropped, as many of the stents implanted developed a subacute stent thrombosis. Intravascular ultrasound visualizes the echoreflective metallic struts of the stent and provides comprehensive insight into vessel and stent geometry by the assessment of stent apposition and stent expansion and of reference and stent dimensions. At that time, ultrasound demonstrated malapposition and under-expansion of many coronary stents, which was the key to the development of optimal stent deployment by high-pressure inflations and slightly oversized balloons catheters\[^5\].

Meanwhile, coronary stenting has been shown to be safe and effective and has become the standard approach for the percutaneous transluminal therapy of significant coronary lesions\[^6,7\]. The significantly reduced rate of restenosis after successful coronary stenting, compared with balloon or other angioplasty techniques, results from the large lumen dimensions that can be achieved and from the prevention of late unfavourable constrictive remodelling. Nevertheless, a significant portion of the patients treated by coronary stents develop restenosis, which still represents a serious clinical problem.

We have learned from intravascular ultrasound that late lumen narrowing and restenosis at follow-up result from neointima formation inside the stent only. The extent and distribution of in-stent neointima can be thoroughly examined by ultrasound\[^8,9\]. The mechanism of development of in-stent restenosis is markedly different from that following balloon dilatation or other angioplasty techniques. The stent-specific mechanism may be triggered by the strut-induced vascular injury, the prolonged radial strain applied by the stent, and the permanent presence of foreign material in the human body. The likelihood of developing in-stent restenosis has been shown to increase with the number and length of stents implanted, the extent of residual post-procedural stenosis measured, and a history of restenosis or total occlusion in the coronary segment treated. Balloon angioplasty inside the stented segment still represents the standard conventional percutaneous treatment, as alternative techniques such as high-speed rotational atherectomy and laser ablation failed to demonstrate advantages.

Recently, intracoronary catheter-based irradiation following successful balloon angioplasty for the treatment of in-stent restenosis has been shown to inhibit recurrence of in-stent restenosis. The effect has been shown for both, beta- and gamma-emitting sources. While almost no restenosis can be found in the centre of the irradiated segment and the overall restenosis rate is significantly lower, restenosis is not completely abolished and can result from luminal obstruction at the edges of the irradiated segment\[^10\]. Data of meticulous angiographic and intravascular ultrasound analyses have shown that radiation has to be performed in a segment that is significantly larger than the segment of coronary injury in order to minimize the risk of these edge-effects resulting from so-called ‘geographic miss’\[^10\].

Even better than successful restenosis treatment may be its prevention. The results of the European Dose-Finding Study\[^11\] have shown an impressive effect of beta-irradiation on restenosis following balloon angioplasty in de-novo coronary lesions. Our own initial intravascular ultrasound experience suggests that lumen dimensions may even tend to increase over time\[^12\].

In this issue, the intravascular ultrasound observations of Kozuma and colleagues\[^13\] following percutaneous interventions with beta-irradiation teach us another interesting lesson that cannot yet be found in the current textbooks of interventional cardiology and vascular biology. Following both balloon angioplasty and coronary stenting, they found that the total vessel dimensions were enlarged. Accordingly, beta-irradiation induced vascular enlargement after both types of catheter-based coronary interventions and accommodated tissue growth. Compared to a non-irradiated control group, irradiated stent-covered segments showed a similar overall tissue growth (plaque plus neointima). However, non-irradiated stents showed mainly neointimal
proliferation, while irradiated stents revealed mainly plaque growth outside the stents. Kozuma and co-workers conclude that in this setting with adjunctive beta-irradiation, stenting may no longer play an important role in the prevention of late constrictive remodelling.\[13\]

In their subtitle, Kozuma and colleagues raise the question whether stenting is still necessary in the setting of catheter-based radiotherapy.\[13\] We feel that it is definitely premature to question the role of the stent, as there is so much evidence of its benefit. Procedural safety, for instance, has been increased by the use of coronary stents. It may deteriorate, if stenting is avoided whenever possible. Moreover, the breathtaking reduction in the restenosis rate by using Sirolimus-coated stents in the double-blind randomized RAVEL Study.\[14\] has demonstrated that another powerful player is entering the clinical arena. In the light of the aforementioned arguments we are confident that the stent is here to stay.

C. VON BIRGELEN  
R. ERBEL  
University Essen, Department of Cardiology,  
Essen, Germany

References


Substantial variations in clinical outcome following hospitalization for heart failure

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In patients with chronic heart failure, a number of trials have shown a significant improvement in survival and a reduction in hospitalization. Based on these encouraging data, different guidelines\[1,2\] concerning the treatment of patients with chronic heart failure have been published in recent years. Nevertheless the study published by Stewart et al.\[3\] in this issue shows there still exists important differences in

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