Coronary Aneurysm After Endovascular Brachytherapy: True or False?

To the Editor:

We read with great interest the article about the mechanism of action of endovascular brachytherapy after balloon angioplasty published by Sabaté et al.1 Intravascular ultrasound (IVUS) imaging provides an extremely effective means of examining vessel changes after interventions and it seems to be critical in the objective evaluation of radiation therapy for restenosis.2 Angiographic follow-up of patients in several trials revealed a few cases of coronary or peripheral aneurysms.3 Ewing et al. have previously reported that endovascular radiation might prevent or delay the early resolution of coronary dissection.5 It would be of great interest to know whether the aneurysm development was linked to an early dissection and if it was a true or false aneurysm on the basis of IVUS findings. Finally, the benefits of 3D reconstruction are significant after a therapy like radiation that seeks to inhibit the proliferation of neointimal cells. However, when assessing localized phenomena, such as the flow-limiting site in a restenotic lesion, or the site of malformation, such as an aneurysmal dilatation or dissection, the 2D approach has significant advantages. In this situation, in which all these features are of such interest, a combined 2D and 3D analysis would be invaluable for a better understanding of this novel therapy.

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Response

Intravascular ultrasound (IVUS) is a unique technique that allows investigators to visualize the coronary vessel wall. This particular feature is of the utmost importance when assessing the safety and efficacy of a new therapy, such as intracoronary radiation. Indeed, 2D IVUS images provide detailed information about local phenomena (ie, plaque characteristics, presence of dissection, stent malapposition), which may be useful in guiding the procedure. Therefore, the use of 2D IVUS may solve most clinical situations in daily practice. However, this approach is limited for the study of the effects of a novel and still not fully understood percutaneous technique. In this regard, 2D IVUS has several drawbacks that are germane to the use of a conventional motorized non-ECG gated pullback as opposed to the ECG-gated pullback.1 First, the systolic-diastolic vessel compression artifact that occurs during the cardiac cycle may lead to an underestimation or overestimation of the vessel dimensions. Further, slice independence cannot be obtained from a conventional continuous pullback in which IVUS images are continually being acquired during the pullback. In this instance, the axial movement of the catheter during different phases of the cardiac cycle may induce the recording of the same IVUS image in 2 different time frames.

The methodology proposed in our study2 requires an analysis of the 2D images before the longitudinal reconstruction and volumetric computation are performed. Thus, an interaction is always present between the 2D and 3D approach. In this regard, we can calculate the doses of radiation actually received by an area (for instance, the adventitia volume) from the 2D cross-sectional images and relate these data to the volumetric outcome.3 The case mentioned by Dr. Bertrand and colleagues, which was depicted in Figure 3 of our original report,2 demonstrated 2 potential undesirable outcomes at 6-month follow-up after brachytherapy: aneurysm formation and restenosis. On angiography, a type B dissection that involved both the region of the restenosis and that of the aneurysm dilatation was identified after the procedure. At follow-up, vessel dilatation was defined as a true aneurysm because all normal vessel wall layers were intact. Indeed, the presence of the dissection may be linked to the development of this excessive vessel dilatation, because aneurysms may occur in nonirradiated coronary segments.4 However, the dissection was probably not the sole mechanism of the aneurysm because it also involved the restenotic region. To investigate this apparently contradictory phenomenon, we retrospectively calculated the dose received by the adventitia volume in these 2 different regions, as calculated from geometric data obtained from the IVUS. Interestingly, the dose varied considerably between these 2 contiguous subsegments. The dose received by 90% of the adventitial volume of the region which became restenotic was 4.6 Gy; it was 8.6 Gy in the region which became aneurysmatic. Thus, dose inhomogeneity, probably derived from the use of a noncentered delivery system, could also have contributed to the different response to injury observed in our patient.

We strongly believe that in the early phase of the development of intracoronary radiation therapy, the use of the most refined and accurate technique currently available should be advocated to gain further insight into the pathophysiology of the new therapy.

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