Intravascular β-Radiation May Acutely Increase Coronary Collateral Blood Flow in Patients With Coronary Artery Disease

To the Editor:

Intravascular irradiation effectively reduces neointimal proliferation after coronary interventions. Scheinert et al\(^1\) showed that vasoconstriction is a frequent reaction of coronary arteries after high-dose intracoronary β-radiation, necessitating repetitive administration of vasodilators. Unfortunately, these authors did not study the effects of β-radiation on the microcirculation and small resistance vessels.

To examine the acute effects of intravascular β-radiation on the coronary collateral blood flow, we studied 7 patients with stable angina, 4 with in-stent restenosis, and 3 with de novo lesions while they were undergoing angioplasty and intracoronary β-radiation. Eight control patients, 2 with in-stent restenosis and 6 with de novo lesions, underwent balloon angioplasty without intracoronary β-radiation. All patients underwent a minimum of 3 balloon inflations (BIs) of 120 s duration with a 5-minute time interval. Between the second and third BIs in the irradiated group, intracoronary β-radiation was performed. The JetMed wave wire was used for the estimation of the coronary wedge pressure during the 3 BIs.\(^2\) Statistical analysis was performed using ANOVA with repeated measurements.

In the irradiated group, coronary wedge pressure was 26±11 mm Hg during the first BI, 27±12 mm Hg during the second BI, and 35±12 during the third BI (P<0.05 versus the first BI), whereas in the control group, the respective values were 28±8, 30±6, and 30±7 mm Hg (F=2.78, P=0.08). In the irradiated group, coronary wedge/mean arterial pressure was 0.23±0.08 during the first BI, 0.24±0.09 during the second BI, and 0.31±0.09 during the third BI (P<0.05 versus first BI), whereas in the control group, the respective values were 0.26±0.08, 0.28±0.08, and 0.29±0.09 (F=2.42, P=0.10).

This may be the first time that the effect of β-radiation on the collateral blood flow has been studied. An explanation of the above results would be a possible vasoconstriction of the resistance arteries in the nonischemic region, whereas in the ischemic area, the possible vasoconstriction is counterbalanced by the local ischemia. The result would be vasoconstriction of the resistance arteries in the nonischemic area, thus promoting collateral blood flow to the ischemic region.

Zenon S. Kyriakides, MD
Ioannis Rassias, MD
Dimitrios T. Kremastinos, MD
B Department of Cardiology
Onassis Cardiac Surgery Center
Athens, Greece
zskyr@otenet.gr

Response

The letter by Dr Kyriakides and colleagues reports an increase of coronary wedge pressure in a group of patients treated with repetitive balloon dilatation and intracoronary β-radiation as compared with a group treated with repetitive balloon dilatation only. This finding is explained by an increase in collateral blood flow to the ischemic region distal to the target lesion, and the authors speculate that this could be facilitated by a radiation-induced vasoconstriction of the resistance arteries in the adjacent nonischemic region.

The occurrence of acute radiation-induced coronary artery spasm after high-dose intracoronary β-radiation was described in our original article; however, this phenomenon was a local reaction of the irradiated vessel segment.\(^1\) Furthermore, in vitro studies could show that this effect of acute radiation-induced endothelial dysfunction is dose-dependent and requires application of a relatively high cumulative radiation dose.\(^2\) Unfortunately, no data are provided by Dr Kyriakides et al concerning the radiation dose applied, coronary arteries treated, additional use of nitroglycerine, or whether spasm was seen in any of the irradiated epicardial coronaries. In addition, the reported wedge pressure changes observed in the irradiated coronaries were only borderline significant, and the number of patients studied was small. Furthermore, given the limited penetration of β-radiation through the vessel wall, it seems unlikely that the adjacent resistance arteries of the nonischemic area could be effected by a relevant radiation dose resulting in vasoconstriction of these arteries.

D. Scheinert, MD
R. Burckhard, MD
S. Ropers, MD
W.G. Daniel, MD
J. Ludwig, MD
Department of Cardiology
University of Erlangen-Nuremberg
Germany
V. Strnad, MD
R. Sauer, MD
Department of Radiooncology
University of Erlangen-Nuremburg
Germany
R. Müller, MD
Department of Medical Physics
University of Erlangen-Nuremberg
Germany
R. Bonan, MD
Montreal Heart Institute
Montreal, Canada

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