SEMERN ON SMALL CORONARY ARTERY DISEASE: STRUCTURE AND FUNCTION OF SMALL CORONARY ARTERIES IN HEALTH AND DISEASE—1*

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Introduction

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Several years ago, the Netherlands Heart Foundation chose to support meetings under the joint aegis of the World Health Organization (WHO) and the International Society and Federation of Cardiology (ISFC) for the purpose of reviewing certain aspects of knowledge about the coronary arteries. The first of these (I) was on the subject of nomenclature of coronary arteries, especially in relation to coronary arteriography. The second (2) dealt with terminology and reporting for catheter and surgical interventions in coronary artery disease. This third and final report is on the subject of normal and abnormal small coronary arteries and their function. It was presented at the meeting of the WHO/ISFC Task Force in Geneva, Switzerland on June 12, 1989.

Just as it is appropriate that the series be concluded with a discussion of the terminal portion of the coronary artery system, it is fitting that the first presentation dealt with coronary anastomoses, among the most important of the small coronary arteries, although not often considered in that context. For that purpose, we were fortunate to have anastomoses discussed by the Schapers, who have gained international renown for their contributions on the subject of coronary anastomoses. As the group of vessels most responsible for regulating coronary flow, the small arteries are greatly influenced by activities of their intact endothelium and behave abnormally when their endothelium is diseased, as authoritatively reviewed by Lüscher, who included comments about endothelial function in large coronary arteries as well. In his presentation, James recounted the wide assortment of pathologic changes found in small arteries of the human heart, and logically speculated about the likely differing functional significance of these different types of disease.

Oleg Atkov, who had been a Soviet cosmonaut and spent a long period in orbit, discussed the effect of weightlessness on the microcirculation as observed in experimental animals, finding remarkable abnormalities shortly after return from space orbit but relatively rapid resolution toward normal on earth. Strauer, a pioneer in the subject of coronary reserve measurements and their clinical significance, reviewed the experience of his laboratory and that of others, thus placing in current context this clinical evaluation method for normal and abnormal function of small coronary arteries. Bruschke and colleagues assessed both the value and limitations of coronary arteriography in relation to the smallest coronary branches, defining current as well as prospective approaches to the subject. Tomanek demonstrated what happens in the experimental animal to the small arteries and capillaries during myocardial hypertrophy, a subject to which Strauer and others also contributed discussion.

Further directions for research. At this small meeting, there was neither the intent nor the opportunity for an exhaustive examination of the subject, but there was ample time for discussion from a reasonable number of vantage points and the postulation of important further directions for research. These include the following:

1. Enhancement of our growing knowledge about coronary anastomoses will improve our chances for favorably influencing the development and successful function of these life-saving small coronary arteries, utilizing either pharmacologic or surgical methods or some combination of two.

2. The whole field of studies dealing with endothelial function is in a fascinating and explosive growth period. Cells of the endothelium not only act as regulators of transmural transport of vasoactive substances, but also are...
the source of such substances themselves, and each of these is now the subject of intensive and highly promising research leading to potential clinical applications of great value.

3. For optimal understanding of the functional significance of small coronary artery disease, it is essential to know that there are many different forms, some affecting primarily the endothelium, others causing myointimal or purely medial hypertrophy that markedly narrows the lumen, and various forms of destructive arteriopathy rendering the vessel unresponsive to usual vasoactive influences.

4. Coronary flow (or resistance) reserve and the principles underlying its clinical utility have become a rapidly growing area of clinical investigation of diseases as commonplace as hypertension and as unusual as the cardiomyopathy of scleroderma or Friedreich's ataxia. As Strauer and other discussants emphasized, both normal and test values must be determined carefully or else become subject to disbelief.

5. What weightlessness does to small coronary arteries, or indeed to all small vessels in all organs of the body, is more than an arcane subject for scientific investigation and has considerable clinical and basic value. It is a subject of more obvious importance in the fuller understanding of the adaptation of human beings to space travel and inhabitation, a destiny as inescapable as it is mesmerizing for the public in all the world's nations.

6. Visualization of small arteries by coronary arteriography is limited by the physical properties of radiographic systems. It is unlikely that in the near future a better radiographic definition of the coronary anatomy can be achieved with current methods. However, arteriographic methods to obtain functional information about the microcirculation by digital techniques have become operational and may prove to be of value in the assessment of small vessel disease. Although the potential of other imaging modalities (such as nuclear magnetic resonance spectroscopy and positron emission tomography) was not the subject of formal discussion, it is recognized that these methods may provide significant information relative to the functional and metabolic consequences of small artery disease.

7. Finally, both the development and the regression of small coronary artery changes in association with myocardial hypertrophy were the subjects of encouraging discussion, particularly as to the prospects of "cure" for some of the consequences of hypertension when blood pressure is successfully controlled.

Much remains to be learned about the structure and function of small coronary arteries in health and disease, and the participants had their appetites whetted by hearing and copiously discussing vantage points that were often much different from their own field of endeavor. We are grateful to The Netherlands Heart Foundation for its generous support of all three meetings, and to the World Health Organization (Dr. Ivan Gyarfas) and the International Society and Federation of Cardiology (Marianne de Figueiredo) for their superb staff support.

References
