Introduction to the Sixth International Workshop on Structure and Function of the Vascular System

Harry A. Struijker-Boudier, Bernard I. Levy, Michel E. Safar

From February 1 through February 3, 2007, the Sixth International Workshop on Structure and Function of Arteries was held in Paris. As with preceding workshops in this series, the presentations and discussions were of outstanding quality. The organizers were particularly happy with the manuscripts that were submitted for publication in this issue of Hypertension. As with the preceding workshops, the proceedings are published in this journal after a thorough review process and editorial decisions by the Editor and Associate Editors of Hypertension. The impact of these workshops and their proceedings is evident. No less than 4 of the 50 most highly cited papers from Hypertension were published as part of the proceedings of previous workshops.

The Sixth Workshop differed in one important aspect from the previous workshops. The focus this time was not only on large arteries. It also included small arteries and the microcirculation. There were several good reasons to expand the scope in this direction. First of all, the microcirculation is the major location of peripheral vascular resistance. Because increased resistance is the major hemodynamic change in most forms of hypertension, the microcirculation is the logical site of vascular research in hypertension. It has become evident that the structure of the microcirculation determines the distribution of peripheral resistance. A combination of inward eutrophic remodeling of small arteries and rarefaction of arterioles and capillaries is now believed to maintain the increased vascular resistance in hypertension. The second reason to include small arteries and the microcirculation is the contribution of these segments of the vascular tree to the function of large arteries. Small arteries and the microcirculation are important sites of arterial wave reflections. Thereby, they influence the contour of the pressure wave and the height of pulse pressure in large arteries. It is now evident that pulse pressure is not a constant value throughout the arterial tree. Its value is influenced by the pattern of ventricular ejection, the buffering capacities of large arteries, and the timing and intensity of wave reflections. Pulse pressure is an independent risk factor for cardiovascular morbidity and mortality. A full understanding of the factors that contribute to elevated pulse pressure is essential for a proper appreciation of this risk factor. Moreover, we believe that the distinction between large elastic or muscular arteries and resistance arteries must be reconsidered. This anatomic classification is certainly important in terms of teaching and of research strategies; however, it is impossible to really understand the physiology and pathophysiology of any of these elements without deep knowledge of both upstream and downstream elements. We now must consider the vascular system as a continuum. This workshop aimed to develop this concept.

The scientific program of this workshop was opened with a session on premature vascular senescence. Edward Lakatta discussed the role of angiotensin II and matrix metalloproteinases in human aortic walls with aging. He argued that some of the changes in extracellular matrix components can be exclusively attributed to the aging process, independent of hypertension, atherosclerosis, or other vascular diseases. Next, Karl-Heinz Krause and Gaetan Gavazzi reviewed the role of various NOX enzymes in the vascular system. The session closed with an overview by Vicente Andrés on telomeres and cardiovascular disease.

The second session was dedicated to Edward Frohlich, who made important contributions to all previous workshops, particularly with respect to the publication of the proceedings. This session was devoted to the macro- and microcirculation in clinical hypertension. Coen Stehouwer provided an insightful review on microcirculatory dysfunction as a link between obesity, hypertension, and insulin resistance. These three conditions share certain abnormalities in the microcirculation, such as capillary rarefaction. Because obesity, hypertension, and insulin resistance often coincide in humans, there are good arguments to propose a common microcirculatory dysfunction as the underlying mechanism. Eoin O’Brien and Eamon Dolan reviewed how data from the Anglo-Scandinavian Cardiac Outcomes Trial (ASCOT) study has influenced cardiovascular risk management and suggested new strategies for future clinical trials. The next two presentations were by Jacques Blacher and Gary Mitchell. Jacques Blacher presented interesting data on the impact of large artery properties on cardiovascular survival in the very old. Gary Mitchell discussed on the basis of data from the Framingham Heart Study how abnormal aortic stiffness and...
increased pressure pulsatility are associated with blunted microvascular reactivity to ischemic stress. In addition, he showed that pulse pressure is an important risk factor for incident atrial fibrillation in a community-based sample.

The third session was devoted entirely to microvascular structure and function. Axel Pries introduced this session by reviewing how mechanical factors in the microcirculation cause structural vascular adaptation. Both the geometry of individual vessels and the architecture of microvascular beds are under a tight control of local mechanical factors. One of these factors is shear stress. Shear stress–induced remodeling of small arteries was the topic of a presentation by Daniel Henrion. He showed in a rat model of the metabolic syndrome that exaggerated inactivation of NO by reactive oxygen species abolishes endothelium-mediated dilation of small arteries. Tony Heagerty focused on the role of wall stress on small artery remodeling and hypertrophy. Ernesto Schiffrin concluded this session with a review on how inflammatory mediators influence the process of small artery remodeling.

In the next session, Lowell Langille followed up on mechanical influences on arterial remodeling. His talk focused on cellular aspects of remodeling, in particular the role of vascular cell polarity. Ferdinand le Noble gave a presentation on arterial-venous differentiation. He described the molecular and cellular basis of the branching morphogenesis of the embryonic microvasculature. John Cockroft and Carmel McEniery provided convincing evidence that endothelial function contributes significantly to increased arterial stiffness in patients with isolated systolic hypertension and with age.

The fifth session concerned the contribution of the kidney in hemodynamic control of the circulation. Laurent Juillard presented state-of-the-art imaging methods to study renal microvascular function in ischemic nephropathy. Albert Mimran discussed the influence of pulse pressure on kidney function in hypertensive patients. Edward Frohlich concluded the renal session with a talk on the cardiovascular effects of salt loading in rats. He hypothesized that structural and functional alterations induced by chronic salt-loading are mediated through stimulation of local renin-angiotensin systems in heart, aorta, and kidney.

The session on mechanotransduction mechanisms was opened with a fascinating lecture by Peter Davies on spatio-temporal mechanosensitivity of the endothelium. This lecture focused on genomic analyses of the molecular basis of vascular mechanosensitivity. Stephanie Lehoux followed up on this theme by reviewing beneficial and adverse signal transduction cascades in the vasculature, in particular the protective role of matrix metalloproteinases in early hypertensive remodeling. Hans Vink presented an original contribution on the role of the glyocalix of the smallest blood vessels in mechanotransduction. Brad Berk closed the session with an update on the influence of oxidative stress on arterial mechanotransduction.

The final session of the workshop concerned new strategies of antihypertensive drug therapy, in particular in relation to central versus brachial blood pressure measurement. Ji-Guan Wang reviewed recent blood pressure lowering trials with respect to their outcome on stroke and coronary prevention. Bryan Williams presented data from the recent Conduit Artery Function Evaluation (CAFE) trial on the importance of central blood pressure measurements. Mary Roman further underlined the better correlation of central versus brachial pressure in vascular disease. Michael O’Rourke discussed pressure pulse waveform analysis as a better predictor of treatment-induced regression of left ventricular hypertrophy than casual brachial blood pressure measurement. The concluding lecture of the workshop was given by Giuseppe Mancia. He reviewed the significance of subclinical target organ damage in the latest guidelines on hypertension and its treatment.

The overall impression of this workshop was very positive. Large artery properties and pulse pressure were only studied in a few centers until the mid 1990s. Now, these topics attract major attention in the literature and at hypertension congresses. These Paris workshops played a vital role in guiding the clinical and scientific community to these important topics. A new dimension was added in this workshop by focusing also on the role of small arteries and the microcirculation. In this issue of *Hypertension* you can read a selection of the papers that were presented during the workshop. Finally, we are most grateful to Servier for their unrestricted educational support for the workshop and the publication of its proceedings.
Introduction to the Sixth International Workshop on Structure and Function of the Vascular System
Harry A. Struijker-Boudier, Bernard I. Levy and Michel E. Safar

Hypertension. 2007;50:152-153
doi: 10.1161/HYPERTENSIONAHA.107.111222
Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2007 American Heart Association, Inc. All rights reserved.
Print ISSN: 0194-911X. Online ISSN: 1524-4563

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://hyper.ahajournals.org/content/50/1/152