RELEVANCE OF METALS IN THE INITIATION OF CARDIOVASCULAR DISEASES

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Abstract: The impact of environmental factors on the initiation and progression of cardiovascular diseases (CVDs) is still hardly investigated. This is particularly true for pathophysiological processes linking environmental pollutants with CVDs. To gain insight into this interrelation we have in the past focused on two major topics: a) the impact of smoking on, and b) the relevance of metals as environmental pollutants in the initiation of CVDs. To reveal changes in the physiological state of the cardiovascular system that favour CVD initiation we have set up cell and organ culture systems allowing us to expose and study the effects of cigarette smoke constituents and metal ions on the vascular wall. Further we have performed in vivo studies on animals, and conducted studies on human subjects to link elevated levels of environmental pollutants with initial stages of CVDs. Smoking is long known to constitute a risk factor for CVDs, but until recently the chemicals in cigarette smoke as well as the processes via which smoking causes CVDs were not known. In our studies we could reveal that metals in cigarette smoke constitute a central principal via which smoking contributes to CVD initiation. Based on this finding we have then focused on the activity of Cadmium and Lead (environmental pollutants which also occur in cigarette smoke) on CVD initiation, and found that Cadmium exerts its atherogenic activity mainly by causing vascular endothelial damage, and that Lead stimulates the proliferation of vascular smooth muscle cells, which leads to a thickening of the vessel wall and to a consequent narrowing of the vessel lumen. We could show that metals as environmental pollutants play an important role in the initiation of CVDs by causing endothelial damage, which contributes to thromboses, and an altered transfer of compounds and cells between the blood stream and the vessel wall. Further we observed effects that may lead to vessel stenosis and as a potential consequence to myocardial infarction, stroke, and peripheral arterial diseases. In addition to pathophysiological findings we could support our data by revealing independent correlations between increased serum levels of Cadmium or Lead and increased vessel wall thickness, and early indicator of atherosclerosis.