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The role of circulating lymphocytes on hypertensive heart disease

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Aims and background: Hypertension is a disease accompanied by moderate inflammation. Physical activity and pharmacological intervention protect the organisms against hypertension-dependent end-organ damage. They should therefore interfere with the mobilization of lymphocytes. Different subsets of lymphocytes should specifically interfere with vascular and cardiac remodeling. In this study we correlated the amount of circulating lymphocytes with the expression of vascular and cardiac specific genes in the aorta and left ventricle to identify the tissue-specific effects of these cells.

Methods: 50 female spontaneously hypertensive rats (SHR) and 6 female normotensive Wistar rats (Wis) were analyzed. They were grouped in 7 subgroups exposed to different treatment regimes (modification of activity, type of activity, aldosterone blockade, and a combination thereof). Indicator genes of mal-adaptive vascular and cardiac remodeling were quantified by qRT-PCR.

Results: SHRs had an increased number of circulating NK cells and monocytes, but lower numbers of T cells. T cells inversely correlated with the vascular expression of p22phox, a member of the NADPH oxidase complex. Thus, lower number of T-cells favors the vascular expression of p22phox and thereby oxidative stress. In the left ventricle, T cells are inversely correlated with the expression of arginase-1 and UCP-2 but positively correlated with Glut-4 expression. The lower number of T cells in SHR therefore favors the expression of proteins often associated with oxidative stress and glucose metabolism. Monocytes are positively correlated with key markers of left ventricular hypertrophy (such as ANP, collagen-1, and β-MHC). Thus, the increased number of monocytes in SHRs supports cardiac hypertrophy. NK cells are inversely correlated with the expression of anti-inflammatory cytokines in the aorta (IL-10, IL-15). Thus, high number of circulating NK cells seems to favor a pro-inflammatory phenotype in the vasculature.

Conclusion: In a standard model of essential hypertension the profile of circulating lymphocytes differs from that in normotensive rats. The different subsets of lymphocytes specifically interfere with specific processes in the ventricle and vessel. Collectively, the difference between hypertensive and normotensive rats (less T cells, more NK cells and monocytes) supports a mal-adaptive role under hypertensive conditions.