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Heart morphology in Zucker-obese rat

Seyed Khosrow Tayebati [1] - Daniele Tomassoni [2] - Ilenia Martinelli [1] - Francesco Amenta [1]

[1] Scuola di Scienze del Farmaco e Prodotti della Salute, Università di Camerino, Camerino, Italia - [2] Scuola di Bioscienze e Medicina Veterinaria, Università di Camerino, Camerino, Italia

Obesity represents the central and causal component of the metabolic syndrome (MetS), which is a growing medical challenge in western countries as a result of changes in lifestyle. Obesity is also associated with an increased incidence of arterial hypertension and of cardiovascular disease burden. In animal models of diet-induced obesity, endothelial inflammatory activation, demonstrated by changes in adhesion molecule expression, is one of the earliest manifestation of vascular and cardiac damage. The intercellular adhesion molecule-1 (ICAM-1) is a member of the immunoglobulin (Ig) superfamily present on the surface of several other cell types, including endothelial cells. Adhesion molecules [e.g., ICAM-1, vascular cell adhesion molecule 1 (VCAM-1) and platelet-endothelial cell adhesion molecule-1 (PECAM-1)] if in contact with an activated endothelium could represent attractive targets for delivery of drugs and imaging probes to vascular pathological sites. The present study was designed to investigate, with morphological, immunochemical and immunohistochemical techniques, changes of heart and coronary arteries in Obese Zucker rats (OZR) compared to the lean Zucker rats (LZRs). The OZRs, with a mutation in leptin receptors, is a model of Type II diabetes mellitus, characterized by the presence of obesity, hyperglycemia, hyperinsulinemia, hyperlipidemia and moderate hypertension similar to MetS. The heart of OZRs of 12, 16 and 20 weeks was processed for microanatomical analysis and ICAM-1, VCAM-1 and PECAM-1 and pro-inflammatory cytokines (IL-1β, IL-6 and TNF-α) immunohistochemistry. OZRs at the different age, developed ventricular hypertrophy, characterized by increase size of cardiomyocytes but not fibrosis compared to LZRs. This phenomenon was more evident in 20-weeks-old OZRs. VCAM-1 was more expressed in the coronary arteries compared to other adhesion molecules, and increased in the OZRs of 20-weeks of age. In the same age, IL-6 expression was significantly increased. These results suggest that the obesity leads to heart tissue changes and coronary inflammation. Myocardial vascular inflammation, induced by metabolic comorbidities, could contribute to the development of heart failure. Protective strategies in obesity may be focussed versus body weight loss and countering of metabolic alterations induced by obesity.

Keywords

Obesity; heart morphology; inflammation; obese Zucker rats.

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