Regulation of oxidative stress and inflammation by microRNAs

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A primary event in atherogenesis is the infiltration of activated monocytes into the arterial wall. Activation of the inflammatory toll-like receptor/nuclear factor κB signaling in monocytes contributes to inflammation. This is associated with secretion of reactive oxygen species and oxidation of lipoproteins, and induction of foam cells and endothelial cell apoptosis, which in turn lead to plaque growth and rupture. Importantly, this vicious circle between oxidative stress and inflammation does also occur in adipose tissues during obesity. There, oxidative stress and inflammation impair adipocyte maturation resulting in defective insulin action and adipocytokine signaling. This observation raises question what molecules are likely common regulators of these pathogenic processes in adipose and vascular tissues. Candidates are small, non-coding, microRNAs which control gene expression by inducing mRNA degradation or blocking translation. For example, microRNA-181a, a possible regulator of the toll-like receptor/nuclear factor κB signaling, is decreased in obese monocytes and weight loss normalizes its expression. It is associated with a higher number of metabolic syndrome components and with CAD even after adjustment for traditional risk factors, obesity and the metabolic syndrome. MicroRNA-146b-5p is also decreased in monocytes during obesity and is a major mediator of the anti-inflammatory action of globular adiponectin. In addition, the activation of monocytes is associated with the release of microRNA-containing microvesicles which mediate the communication between different cell types within the same tissue. When they are secreted in the circulation they may also mediate the communication between different tissues, for example adipose and vascular tissues, possibly explaining the similarity and the simultaneity of molecular changes and interactions in those tissues.