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Infarct Combat Project

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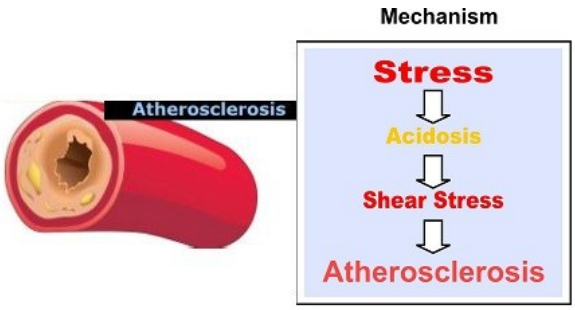
Stress induces acidosis and then atherosclerosis



The link between stress and atherosclerosis is well-known with many studies and postulations in this regard.

However, there is a general unawareness that stress can induce lactic acidosis, because this relationship has been little discussed in medical science.

The support for a direct participation of catecholamines in the development and/or maintenance of lactic acidosis includes: 1) the common association of stress and lactic acidosis; 2) the rise in plasma lactate concentration during adrenaline infusion; 3) the precipitation of lactic acidosis by adrenaline intoxication and phaeochromocytoma; and 4) the vasoconstrictor effects of catecholamines leading to tissue anoxia and lactic acid production

The heart is an organ of high metabolic activity— it cannot rest as can other body muscles. Chronic or acute elevated catecholamine release (adrenaline, noradrenaline) may accelerate myocardial glycolysis leading to a significant increase in lactate production. Lactic acidosis results from increased production of lactate, the final product in the pathway of glucose metabolism. Lactate and lactic acid are not synonymous. Lactic acid is a strong acid which, at physiological pH, is almost completely ionized to lactate.

Plasma lipid abnormalities and myocardial lactate production were significantly associated with subsequent arteriographic progression. The amount of lactate released by the myocardium has been shown to be related to the severity of coronary artery disease.

Studies also indicate a relationship of reduced pH and an increased oxidation of low-density lipoprotein (LDL). One of these has indicated that pH augments the oxidation LDL by releasing Fe and Cu radicals and decreasing anti-oxidant defense capacity. Other found that LDL oxidation occurs not within the interstitial fluid of atherosclerotic lesions but within lysosomes in macrophages in atherosclerotic

lesions. This same study also found that the oxidative modification was inhibited by the drug chloroquine, which increases the pH of lysosomes, as oxidation can be promoted by acidic pH

The influence of adrenaline on lactic acid production was first noticed by Carl Ferdinand Cory in 1925. Together with his wife Gerty Cory, received a Nobel Prize in 1947 for their discovery of how glycogen– a derivative of glucose – is broken down and resynthesized in the body.

John R. Williamson confirmed in 1964 the effects of adrenaline infusion on the increased production of lactate in isolated heart tissue, up to five times the normal production.

Important risk factors for atherosclerosis such as hypertension, diabetes and cigarette smoking have a significant elevation in blood lactate levels. Blood lactate is also associated with carotid atherosclerosis.

According to the acidity theory of atherosclerosis, developed in 2006 by the Brazilian researcher Carlos Monteiro, acidosis evoked by continuous stress leads to changes in shear stress, the final stage in the development of atherosclerotic lesions. The importance of mechanical forces such as those derived from changes in hemodynamic shear stress, as a decisive factor for atherosclerosis, was advocated by Meyer Texon since1957.

In a review article (1), published in Positive Health Online, a medical journal from England, Carlos Monteiro described the history about his findings. It tells about the launch of his book Acidity Theory of Atherosclerosis – New Evidences in early 2012 and on the speech about his theory at the IV International Conference of Advanced Cardiac Sciences - The King of Organs Conference, November 2012, in Saudi Arabia.

This current review presents around 25 risk factors for atherosclerosis, where the common denominator is the autonomic nervous system dysfunction (sympathetic dominance over the parasympathetic system) that leads to a raise in catecholamines. The list includes hypertension; diabetes; high carbohydrate diets; infection through bacteremia; air pollution; salt, vitamin D deficiency and cigarette smoking.

In his article Monteiro has also discussed about the reversion or lower progression of atherosclerosis through drugs with sympathoinhibitory effects, and by stress reduction management.

1) Carlos Monteiro, Acidity Theory of Atherosclerosis -- History, Pathophysiology, Therapeutics and Risk Factors – A Mini Review. Positive Health Online, Edition 226, November 2015. Free access at http://goo.gl/AejGAV