

Treatment of Heart Failure with Physical Methods

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Device and producing company:

There is no device involved.

Introduction:

The efficacy of the application of physical methods as treatment for different diseases is widely underestimated because of a lack of knowledge of the mode of action on the molecular level. It is known, for example, that the application of shock waves as well as the application of electrical current has an influence on the collagen synthesis in bones. Furthermore, unloading of hearts with mechanical pumps leads to an improvement of heart function merely from the physical effect of mechanical unloading. We investigated the effect of electrical microcurrent on the extracellular matrix of rats in heart failure. We hypothesized that electrical microcurrent changes the collagen composition of the myocardium with favorable effects on the heart's function.

Methods:

Mircocurrent (MC) was applied over a period of up to 31 days after surgical implantation of two electrodes covering the right and left myocardium of five spontaneous hypertensive rats (SHR). Thereafter, the myocardium was analyzed and compared to the myocardium from five healthy wild type rats and five SHR without previous MC application. Gene expression (quantitative PCR) was measured for MMP 2, 3, 8, 9, 13, 14, 16; TIMP 1, 2, 3, 4; connexin 40, 43, 45 and collagen I and III.

Results:

Compared to the myocardium of the healthy rats, the myocardium of SHR without MC application showed a significantly higher level of MMP 3, significant lower level of MMP 8, 14, 16 and an unchanged level of MMP 2 and 13. The TIMPs and connexins were only marginally altered. Collagen I showed an upregulation of 40%. After MC application, MMP 2, 3, 9, 13, 14 and 16 were significantly up-regulated, MMP 8 remained unchanged, and most importantly, collagen I up-regulated by a factor of 2.5. All other analyzed parameters were not altered significantly by MC application.

Discussion:

Despite the fact that it is still unknown how the MC works, MC generates a potential difference which facilitates molecules and electrolytes to move along the potential gradient. Furthermore, MC influences the membrane potential with the effect of a modified exchange of molecules between the inner and outer space of cells.

Conclusion: MC application up-regulates MMPs as well as collagen I on the gene expression level and normalizes the extracellular matrix of hearts in a progressed state of failure. MC application initializes a process towards healing of the diseased myocardium.