Effect of Electrical Stimulation of the Aortic Depressor Nerve on Inflammatory Response after Experimental Myocardial Infarction in Rats

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Introduction: A marked or prolonged post-infarction inflammatory response leads to a pathologic remodeling, impairing the left ventricle function that is the most important predictor of heart failure development. Recent studies have investigated the modulation of inflammation by the autonomic system, mainly by electrical or drug vagal stimulation, making possible a new therapeutic approach for the modulation of the inflammation in the AMI.

Objective: To evaluate the effect of the electrical stimulation of the aortic depressor nerve (ADN) on autonomic modulation and the possible effect on inflammatory response post AMI. **Material and Methods:** The animals were divided into 3 groups: Sham Group (SHAM) - 5 animals not infarcted without treatment; Infarcted group (AMI) - 10 infarcted animals without treatment; Infarcted and stimulated group (AMI+EST) - 10 infarcted animals treated with electrical stimulation of the ADN. Five sessions of 30 min of ADN stimulation were performed between days 1 and 3 post AMI.

Results: The electric current was able to reduce the median arterial pressure during the stimulation period by more than 30 mmHg in all sessions. The LF/HF ratio, which reflects the global sympathetic-vagal balance, was elevated in the AMI group (0.36±0.066) when compared to SHAM (0.18±0.015) and AMI+EST (0.16±0.022). Thus, it was possible to observe that the HF and LF parameters, important indicators of autonomic function, were similar between the SHAM and AMI+EST groups, demonstrating the beneficial effect of ADN electrical stimulation on the maintenance of autonomic modulation. The baroreflex sensitivity (BPM/mmHg) was reduced in the IAM

group (ITR=1.44±0.20; IBR=-0.82±0.15) when compared to the SHAM group (TRI=2.79±0.58; BRI=1.10±0.43). The IAM+EST group presented higher induced baroreflex sensitivity (TRI=3.40±0.18; BRI=-3.32±0.43) and spontaneous compared to the AMI group, being similar or higher when compared to the SHAM group. Cardiac function assessed by echocardiography revealed a better systolic function in the AMI+EST group (Ejection Fraction %=53±3.8) when compared to the AMI group (Ejection Fraction %=43±2.0). Regarding collagen deposition in the lesion (% of collagen), the AMI group presented significantly higher values (14.24±1.75) when compared to SHAM (0.85±0.04) and AMI+EST (5.35±0, 46). Immunohistochemical analysis showed a higher concentration (cells per field) of M1 macrophages in the AMI group (131.13±11.75) in comparison to the AMI+EST group (95.46±16.27) and a higher number of M2 macrophages in the AMI+EST group (143.69±15.23) when compared to the AMI group (96.38±22.35). Oxidative stress markers indicated a higher carbonyl content of proteins (nmol/mg) in the AMI group (2.24±0.09) in comparison to the AMI+EST group (1.96±0.07). The IAM+EST group had a higher activity of the superoxide dismutase enzyme (USOD/mg) (5.55±0.04) when compared to the AMI group (5.16±0.06).

Conclusions: These findings suggest that the electrical stimulation of the ADN was able to modulate the inflammatory response post AMI, leading to a less pathological remodeling and improving the indexes of the cardiac function evaluated by echocardiography, presenting as a new therapeutic approach in the prevention of heart failure development after AMI.

Keywords: Electrical stimulation, aortic depressor nerve, Inflammation, rats, myocardial Infarction