

Reversible Pulmonary Trunk Banding. VIII. Glucose-6-Phosphate Dehydrogenase Activity of Adult Goat Myocardium Submitted to Ventricular Retraining

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Objective: Traditional pulmonary artery banding (PAB) is not always suitable for mature sub pulmonary ventricle retraining, with disappointing results in older patients. This study sought to assess myocardial function and glucose 6-phosphate dehydrogenase (G6PD) activity of the subpulmonary ventricle hypertrophy submitted to traditional versus intermittent PAB protocol in an adult animal model.

Methods: 18 adult goats were divided into three groups: Sham (n = 6, wt: 26.42 ± 2.63kg, loose PAB, with no systolic overload), Traditional (n = 6, wt: 26.33 ± 2.32kg, continuous systolic overload with fixed PAB), Intermittent (n = 6, weight = 25.17 ± 2.48kg, daily 12-hour systolic overload with adjustable PAB). During a 4-week protocol, systolic overload was adjusted to achieve a 0.7 RV/systemic pressure ratio. RV, PA and aortic pressures were measured throughout the study. All animals were submitted to echocardiographic studies on a weekly basis, while hemodynamic evaluations were performed three times a week. After the study period, the animals were humanely killed for morphological and G6PD activity assessment.

Results: A 55.7% and 36.7% increase occurred in the Intermittent and Traditional RV masses, respectively, when compared with the sham group (p<0.05), despite less exposure of Intermittent group to systolic overload. No significant changes were observed in RV water content in the 3 groups (p=0.27). A worsening RV myocardial performance index occurred in the Traditional group throughout the protocol, compared with the Intermittent group (P=0.024). Compared with the sham group (1.36±0.14 nmol/min/mg protein), RV G6PD activity was elevated 55.15% in the Traditional group (2.11±0.88 nmol/min/mg protein, p=0.05) and only 10.29% in the Intermittent group (1.50±0.24 nmol/min/mg protein).

Conclusions: Traditional continuous systolic overload for adult subpulmonary ventricle retraining causes upregulation of myocardial G6PD activity and RV dysfunction. It may suggest that the undesirable "pathologic systolic overload" is influenced by activation of pentose pathway and cytosolic NADPH availability. This altered energy substrate metabolism can elevate levels of free radicals by NADPH oxidase, an important mechanism in the pathophysiology of heart failure. In contrast, intermittent systolic overload promoted RV hypertrophy with better preservation of myocardial performance and smaller G6PD activity.