

Ribose Preserves Ventricular Function Following Aortic Valve Surgery

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Citation:

Clarence Johnson, John St.Cyr: Ribose Preserves Ventricular Function Following Aortic Valve Surgery. *The Internet Journal of Thoracic and Cardiovascular Surgery*. 2005. Volume 7 Number 2.

Patients with aortic valve disease can present with different clinical symptoms, ranging from minimal exertional difficulties to progressive heart failure. With progression of disease, cardiac hypertrophy or dilatation can produce a state of myocardial dysfunction, further limiting functional capacity even with aggressive pharmaceuticals. Patients at this stage have few options and may eventually undergo valve replacement due to compromised ventricular function.

Experimental animal models producing cardiac hypertrophy with subsequent failure have revealed low myocardial high-energy phosphate levels, which are speculated as a plausible mechanism contributing to failure.^{1, 2, 3} Neubauer et al. and Hardy et al. reported that an impairment in high-energy phosphate metabolism occurs in heart failure patients with cardiomyopathy.^{4, 5} Conway et al. reported that patients with aortic valve disease have a normal phosphocreatine-adenosine triphosphate ratio in the absence of failure⁶; however, this ratio decreases substantially when heart failure develops.^{6, 7} More recently, Ingwall and Weiss have reviewed the need of energy in the failing heart and point out that therapies should address this mechanistic issue for the most effective therapeutic benefit.⁸ A myocardial energy imbalance has been shown to correspond to a state of diastolic dysfunction^{7, 9}, affecting a patient's mortality and morbidity.

D-ribose, a naturally occurring pentose sugar, has shown to enhance the recovery of depressed myocardial ATP molecules and improve diastolic dysfunction following reversible global ischemia in animal studies.^{9, 10} Clinically, ribose has demonstrated a similar benefit in class II and III congestive heart failure patients by improving diastolic function, quality of life, and physical function.¹¹ Knowing that patients with advanced aortic valve disease might have abnormal myocardial energetics and function, ribose may offer a benefit to these patients.

Vance et al. investigated the role of D-ribose in patients undergoing aortic valve replacement for aortic valve disease. Twenty adult patients with a pre-operative ejection fraction of at least 35% were randomized into two equally matched study groups.¹² Once randomized, one group received intravenous D-ribose in D₅W and the other intravenous D₅W (placebo) peri-operatively. Serial echocardiographic and hemodynamic assessments were performed at baseline and post-operatively in all patients. Eighty percent of the placebo treated patients sustained a decline in their ejection fraction (EF)

of greater than 15% at post-operative day 7 compared to baseline assessment ($p=0.0025$). In contrast, only 20% of the ribose treated patients demonstrated a reduction of at least 15% in their ejection fraction ($p=0.49$). Due to different echocardiographic mode assessments used throughout the study, transesophageal and trans-thoracic, no comparison of other functional parameters was possible. There was no significant difference in hemodynamic parameters.

This positive hemodynamic finding by Vance et al. revealed yet another benefit of D-ribose in patients undergoing aortic valve replacement. Assuming that a metabolic abnormality may exist with advanced aortic valve disease and that a potential functional compromise may evolve following cardiopulmonary bypass surgery, novel efforts should be considered in replenishing and/or maintaining myocardial energy levels and thereby aiding in preserving post-operative function. >From these above reported studies, D-ribose may offer such a solution to this dilemma.

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