

## D-Ribose Enhances the Identification of Hibernating Myocardium

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Hibernating myocardium describes a persistent state of reduced left ventricular (LV) function associated with reduced blood flow. The reduction of flow and function may result from chronic, repetitive ischemia. Modalities used for detection of hibernating myocardium include positron emission tomography (PET), dobutamine stress echocardiography (DSE), and perfusion imaging using single photon emission computerized tomography (SPECT). PET imaging using radiolabelled fluorodeoxyglucose has been reported to be the most sensitive method for the detection of hibernating myocardium [1]. However, PET is not universally available; therefore, SPECT and DSE are the most commonly used techniques. Both techniques have >80% sensitivity for detection of hibernating myocardium but false-negative studies are not uncommon.

The prognosis of patients with coronary artery disease and LV dysfunction can be improved with revascularization. Up to 50% of patients with LV dysfunction have significant areas of hibernating myocardium [2]. Improvement in function of hibernating myocardium is thought to be one of the reasons for the prognostic benefit of revascularization. In a meta-analysis, Allman et al. [3] reported that there is a strong association between myocardial viability and improved survival after revascularization in patients with LV dysfunction. Therefore, the clinical chal-

lenge is to identify all patients with hibernating myocardium who could benefit from revascularization.

All cells require energy, i.e. adenosine triphosphate (ATP), to maintain their integrity and function. These energy compounds are continuously produced; however, during and following ischemia these energy levels are suppressed with demand outstripping supply. Lower myocardial ATP levels following ischemia can produce contractile dysfunction. Ribose, a naturally occurring pentose monosaccharide, has demonstrated a role in replenishing ATP levels following ischemia and in improving myocardial function [4, 5]. Further, D-ribose has been reported to enhance the detection of hibernating myocardium when utilizing DSE or SPECT [6–8].

DSE has revealed the enhancing benefit of D-ribose in detecting hibernating myocardium. Twenty-five patients with ischemic coronary artery disease and ejection fractions ranging between 18 and 48% underwent a randomized, double-blind, crossover design [placebo control (dextrose) vs. ribose infusion] study using DSE (up to 10 µg/kg/min of dobutamine infusion). Echocardiographic assessments were obtained at 4 h for both the D-ribose and control infusion without dobutamine (baseline) and again during a dobutamine (low dose) infusion. Blinded investigators interpreted myocardial segmental changes using echocardiography. D-ribose demonstrated more

segments with improved wall motion during DSE in comparison to the placebo (63 vs. 45,  $p = 0.02$ ). Eleven of the 25 patients underwent subsequent coronary artery bypass revascularization. Contractile reserve with the combination of D-ribose and dobutamine was more sensitive for prediction of segments with functional recovery in comparison to dobutamine plus placebo (61 vs. 46%,  $p =$  non-significant). Furthermore, D-ribose and dobutamine were also better than dobutamine plus placebo for predicting the improvement in global ventricular function following revascularization. The investigators concluded, 'D-ribose increased the frequency of response to DSE in hibernating regions with contractile dysfunction. The improvement in global systolic function with DSE + D-ribose predicted the magnitude of improvement achieved with revascularization' [6].

Two other clinical studies involving exercise thallium-201 stress imaging assessed the role of D-ribose in identifying hibernating myocardium. Both studies were randomized, placebo-controlled (saline), crossover design and involved male and female adult ischemic coronary artery disease patients with chronic stable angina. Each solution was infused for 30 min. Study 1 compared the

identifiable reversible differences in perfusion defects at 1 and 4 h between the D-ribose and saline solutions. It demonstrated that more reversible defects were identified with D-ribose at 1 and 4 h postexercise, as compared to control. The investigators concluded, 'Ribose appears to facilitate thallium-201 redistribution in patients with coronary artery disease and enhances the identification of ischemic myocardium' [7]. A second study compared the redistribution of thallium-201 at 4 h using either ribose or saline infusion. There was more redistribution of thallium-201 with the ribose infusion at 4 h than with placebo, when assessed at 4 and 24 h. They concluded, 'Ribose enhances the detection of thallium redistribution at 4 h compared with 4 and 24 h of the control images; and therefore, ribose substantially improves the identification of viable ischemic myocardium' [8].

The preliminary evidence cited above suggests that D-ribose may enhance detection of hibernating myocardium by DSE and SPECT thallium imaging. This enhanced detection of viability may provide a more accurate determination in patients who are eligible for revascularization.

## References

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