Impact of Septal Myocardial Infarction on Outcomes After Surgical Ventricular Restoration

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Background. **Surgical ventricular restoration (SVR) is classically performed in heart failure patients with anteroseptal infarction. It is unknown how the extent of septal myocardial infarction (SMI) affects prognosis. We reviewed our experience to evaluate the impact of the extent of SMI on outcomes after SVR.**

Methods. **We retrospectively reviewed SVR patients from January 2002 to December 2005. Patients were stratified based on the extent of SMI assessed by magnetic resonance imaging and intraoperative findings; SMI was graded as less than 50%, 50% to 74%, and 75% or greater of the length or height, or both, of the septum. Follow-up was 100%.**

Results. **Seventy-eight patients underwent SVR. Twenty-eight patients had less than 50%, 30 patients had 50% to 74%, and 20 patients had 75% or greater involvement of the length or height, or both, of the septum. Patients with 75% or greater involvement had a significantly lower ejection fraction and larger left ventricular volumes preoperatively by magnetic resonance imaging. All patients with 75% or greater involvement were New York Heart Association (NYHA) class III/IV preoperatively, and 50% (10 of 20) had significant mitral regurgitation requiring a concomitant mitral valve procedure. Operative mortality was similar between groups. Cardiac function improved and was similar among the three groups postoperatively. The PR intervals on electrocardiography were similar among the three groups, but did show trends toward longer duration for those with more extensive SMI. Preoperative mean QRS duration was significantly longer for patients with 75% or greater SMI. Three-year Kaplan-Meier survival was also similar among groups; 75% or greater involvement was not a predictor of mortality on Cox regression (odds ratio = 1.4; 95% confidence interval: 0.3 to 7.0; $p = 0.6$). Three quarters (15 of 20) of patients with 75% or greater involvement of the septum improved to NYHA class I/II at follow-up.**

Conclusions. **This study has evaluated the impact of the extent of SMI on SVR outcomes. These data demonstrate similar survival and significant functional and clinical improvement after SVR regardless of the extent of SMI.**

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Congestive heart failure (CHF) is a significant public health burden, with a prevalence of 5 million patients in the United States alone [1]. The majority of these patients have CHF secondary to ischemic cardiomyopathy. Despite optimal medical management, patients with CHF have a poor 2-year survival of approximately 50% [2, 3]. Limitations in medical therapy and the paucity of surgical alternatives demand innovative strategies to improve survival and functional outcomes for CHF patients.

Surgical ventricular restoration (SVR) is an alternative therapy for some CHF patients with ischemic cardiomyopathy. Surgical ventricular restoration attempts to reverse the maladaptive shape changes of postinfarction ventricular remodeling by reducing left ventricular size and restoring a more elliptical shape to the cavity to reduce myocardial wall stress and improve ventricular function. Surgical ventricular restoration is performed in conjunction with myocardial revascularization and mitral valve repair or replacement, as needed. Indications for SVR include anterior wall myocardial infarction (MI) with subsequent left ventricular dilatation, akinetic or dyskinetic segments, and reconstructable coronary artery and valvular disease [4–8].

The interventricular septum plays an important role in left ventricular function. Septal infarction has many deleterious effects, among which are the loss of contractile function, impairment of electrical conduction, and loss of ventricular synchrony. The major arterial blood supply to the ventricular septum is from the septal branches off the left anterior descending artery whereas the uppermost, posterior portion of the septum receives blood from branches off the posterior descending artery [9]. As a result, many patients with left anterior descending artery territory infarction may have MI of the ventricular sep-

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Abbreviations and Acronyms

AICD = automated internal cardoversion defibrillator
CHF = congestive heart failure
EF = ejection fraction
LVEDVI = left ventricular end-diastolic volume index
LVESVI = left ventricular end-systolic volume index
MRI = magnetic resonance imaging
SMI = septal myocardial infarction
SVR = surgical ventricular restoration

tum in addition to the anterior wall of the left ventricle. The septum plays a pivotal role in all of the reconstruction techniques used currently for SVR. Despite this, no investigator has studied the impact of the extent of septal MI (SMI) on outcomes after SVR. Owing to the central role of the ventricular septum on cardiac function, we sought to evaluate the impact of the extent of SMI on outcomes after SVR.

Patients and Methods

Study Design

Retrospective review of all patients who underwent SVR between January 2002 and December 2005 was conducted after Institutional Review Board approval; individual waiver for consent was granted. The extent of SMI was based on preoperative magnetic resonance imaging (MRI) studies with delayed enhancement using gadolinium contrast and intraoperative inspection of the opened left ventricle by a single surgeon (J.V.C.). When MRI was available, our routine preoperative work-up included careful delineation of viable myocardium using gadolinium contrast to help plan the left ventricular reconstruction. Magnetic resonance imaging findings were then used to guide the surgeon's inspection of the left ventricular chamber and estimation of height and length of the septum involved. Some patients with automated internal cardoversion defibrillators (AICD) either were not able to have MRIs done or they were of insufficient quality to use for septal measurements. A detailed map demonstrating the extent of infarction was prospectively filled out for each patient (Fig 1). These observational data were then used to estimate the height and length as less than 50%, 50% to 74%, or 75% or greater. Patients were divided into three groups based on the extent of septal involvement with MI: group A, less than 50% of the height or length, or both; group B, 50% to 74% of the height or length, or both; and group C, 75% or greater of the height or length, or both (Fig 2).

Our SVR exclusion criteria included the presence of hypokinesis without akinetic or dyskinetic segments, and poor basilar function. We did not exclude patients with multiterritory MI [10], preoperative pulmonary hypertension [11], severely depressed left ventricular function [12], or patients who were candidates for transplantation (n = 39).

Patient Variables

Data collection included demographics, New York Heart Association (NYHA) functional status, clinical and electrocardiographic characteristics, cardiac function determinants, and postoperative complications and procedures. Magnetic resonance imaging and echocardiography were used to measure cardiac function parameters: Left ventricular ejection fraction (EF), left ventricular end-systolic volume index (LVESVI), and left ventricular end-diastolic volume index (LVEDVI).

Operative Technique

Our surgical technique has been previously described [10–13]. Surgical ventricular restoration was performed after coronary artery bypass grafting and mitral valve repair/replacement, if necessary. Our method of antero-

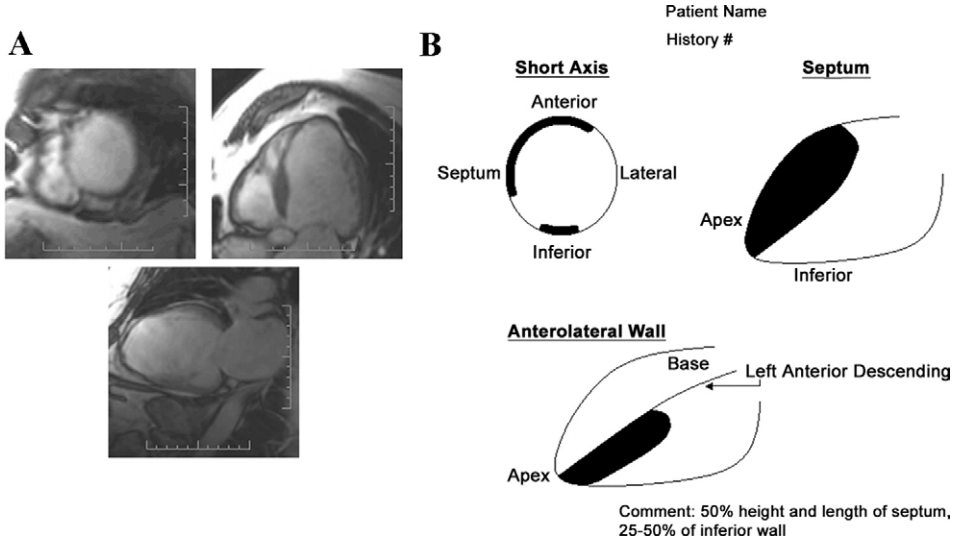

Fig 1. Magnetic resonance imaging (MRI) and operative map detailing the extent of infarction. (A) First-pass perfusion MRI images after 0.1 mmol/kg gadolinium. Delayed T1-weighted after additional 0.1 mmol/kg gadolinium. The MRI short- and long-axis cine images showing marked dilatation of the left ventricle, thinning in the apex, and anteroseptal and inferolateral akinesis. (Ejection fraction = 20.7%; left ventricular end-systolic volume index = 97.9 mL/m^2, left ventricular end-diastolic volume index = 123.4 mL/m^2.) (B) Operative map based on intraoperative inspection of the opened left ventricle.