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Long-term Results after Reconstructive Surgery for Aneurysms of the Left Ventricle

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ABSTRACT

Background: Aneurysms of the left ventricle (LV) present a serious consequence of myocardial infarction, causing mechanical, thromboembolic, and arythmogenic complications. We present our experience in LV remodeling and long-term follow-up results.

Methods: From May 1998 to February 2009, 85 patients with postinfarction LV aneurysm underwent reconstructive procedures. Mean age was 58.7 ± 8.9 years (range 36-79 years). Average LV ejection fraction was 39.8% ± 13.1% (range 20%-70%). Mean EuroScore was 6.0 ± 2.9 (range 3-19) and predictive mortality was 8.2% ± 11.9% (range 1.6%-85.6%). The majority of patients were in New York Heart Association functional class II (44%) preoperatively and 32% of patients were in New York Heart Association class III or IV. LV reconstruction was performed by using the endoventricular patch technique in 56 patients (66%). In 29 patients (34%) reconstruction was done by linear closure. In 79 patients (93%) concomitant myocardial revascularization was performed. Mitral valve procedures were performed in 11 patients (13%), (repair in 10 patients and replacement in 1).

Results: Perioperative mortality was 3.5% (3 patients). Long-term follow-up was completed by means of phone interview with an average duration of 31.6 months (range 3-120 months). There were 9 late deaths (11%) during follow-up. Actuarial survival rates at 1, 5, and 10 years were 91%, 77%, and 68%, respectively. Fifty-nine patients (72%) were in New York Heart Association functional class I and II postoperatively.

Conclusion: LV remodeling is a safe surgical procedure with low perioperative morbidity and mortality and excellent long-term survival, even in patients with severely reduced systolic function.

INTRODUCTION

Left ventricular (LV) aneurysm is a consequence of an acute myocardial infarction and carries a significant risk of future complications. Most frequently, patients experience arrhythmias (34% of all patients), thromboembolic phenomena (29%), congestive heart failure (29%), and recurrent myocardial infarction (22.5%). Although an uncomplicated course of the disease does not influence 10-year survival (90%), development of complications deteriorates 10-year survival to 46% [Grondin 1979]. Surgical treatments of LV aneurysms comprise 2 main methods: linear closure [Cooley 1958] and endoventricular patch repair [Dor 1989]. Some reports state that long-term survival and functional status outcomes are equally good using both methods [Lange 2001; Mickelborough 2001], whereas others state that better results are obtained with endoventricular patch repair [Sinatra 1997; Lundblad 2003]. We present our experience in surgical treatment of LV aneurysms using both repair techniques.

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MATERIALS AND METHODS

Patient Data

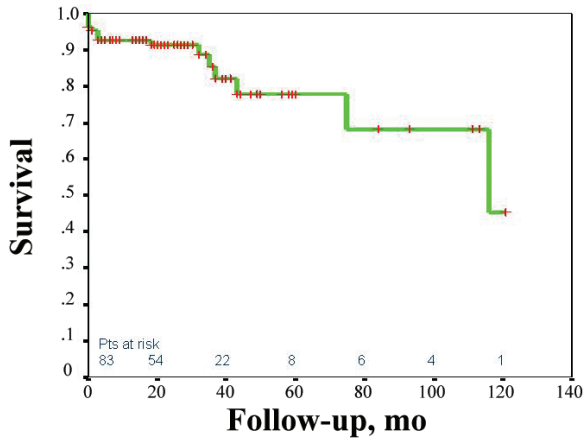
From May 1998 until February 2009, 85 patients (68 men, 17 women) underwent surgical repair of LV aneurysm. Average age was 58.9 ± 8.9 years (range 36-70 years). Seventy-seven patients (91%) had a documented history of previous myocardial infarction. The average number of diseased coronary vessels was 2.3 ± 0.7 (range 1-3). Mean predictive mortality, expressed as logistic value of EuroSCORE, was 7.4% ± 11.3% (range 1.6%-85.5%). Average LV ejection fraction was 40% ± 13% (range 20%-70%) with 41 patients (48%) with LV ejection fraction ≤35%. Preoperatively, 12 patients (14%) were in New York Heart Association class I, 37 patients (44%) in class II, 31 patients (36%) in class III, and 5 (6%) in class IV.

Surgical Technique

All procedures were performed using cardiopulmonary bypass. Cardioplegia was used for cardiac protection in 81 patients (95%). In 3 patients the procedure was performed on the beating heart with retrograde blood perfusion via the coronary sinus, and in 1 patient the procedure was performed in ventricular fibrillation with aortic cross-clamp.

Linear closure was performed in 29 patients (37%) and endoventricular patch repair in 56 patients (63%). The repair method was chosen on the basis of the localization and size of the aneurysm, with linear closure reserved for smaller aneurysms and those located on the anterior side of the heart.

Linear closure was performed by excising the edges of the aneurismal wall, leaving a 2-cm edge for reapproximation,



Kaplan-Meier survival curve for patients (Pts) undergoing surgical treatment of left ventricular aneurysm.

which was performed with 2-0 Prolene sutures over 2 Teflon strips placed longitudinally, parallel to the edges.

Endoventricular patch repair was performed by longitudinal opening of the aneurysm and identification of the edges of the infarcted tissue at the base of the aneurysm. A double-armed pledgeted 2-0 Prolene suture was passed at the base of the aneurysm after determination of the required residual LV volume by insertion of a saline-filled balloon inside the ventricle. Residual volume was calculated as 55 mL/m^2 of patient body surface area [Menicanti 2002]. After the circular suture was tied, an elliptical-shaped Dacron patch was sutured in with a continuous 2-0 Prolene suture. Aneurysm edges were then reapproximated over the patch and 2 Teflon strips.

Concomitant myocardial revascularization was performed in 79 patients (93%). Eleven patients (13%) required a concomitant procedure for mitral regurgitation. Mitral valve repair was performed in 10 patients (8 ring annuloplasties, 2 transventricular edge-to-edge repairs) and mitral valve replacement in 1 patient.

Follow-up

Follow-up data were obtained via a telephone interview with standardized questions to determine patient's functional status.

Statistical Analysis

All continuous data were presented as mean ± standard deviation. Mann-Whitney test was used to determine statistical significance. A P value < .05 was considered statistically significant. Kaplan-Meier analysis was performed to determine patient survival. All data were analyzed with SPSS software, release 11 (SPSS, Chicago, IL, USA).

RESULTS

There were 3 perioperative deaths (3.5%). Two deaths were due to sepsis and subsequent multiorgan failure, and 1 was due to multiorgan failure in a patient who underwent concomitant cardiac surgery and abdominal aortic aneurysm resection. Four patients (5%) required intraaortic balloon pump support postoperatively. Two (3%) underwent reexploration for bleeding. Ventricular rhythm disturbances occurred in 3 patients (4%) in the early postoperative period, none of whom required later implantable cardioverter defibrillator (ICD) implantation.

Mean follow-up was 31 ± 28 months (range 3-120 months). Twelve patients (14%) were lost to follow-up. There were 9 deaths (11%) during the follow-up period. Four of those (44%) were cardiac related. Actuarial survival rates at 1, 5, and 10 years were 91%, 77%, and 68%, respectively (Figure). Mean functional class status decreased from 2.3 ± 0.8 preoperatively to 1.6 ± 0.7 (P < .001).

DISCUSSION

Surgical treatment of LV aneurysms can be performed with low perioperative mortality and morbidity. It offers excellent symptomatic relief and good long-term survival.

We have observed perioperative mortality of 3.5%, which is comparable with literature reports of mean perioperative mortality of 7.9% [Klein 2008]. However, we have observed increased frequency of septic rather than cardiac causes of perioperative mortality, which are reported to be as high as 85%. Cardiac problems were the predominant cause of late mortality in our study (44%), a situation similar to the majority of reported studies, with heart failure and ventricular arrhythmia being dominant modes of late cardiac death [DiMatia 1999; Matthias Bechtel 2004]. There were 3 arrhythmic events early postoperatively in our series. However, none of the patients needed subsequent ICD placement. Neither of the patients who experienced arrhythmia in our study underwent additional procedures aimed at reducing arrythmogenic complications, such as cryoablation or subendocardial scar excision [Dor 1998; Mickelborough 2001]. No later than 1 month after discharge, the patients who had arrythmogenic complications underwent electrophysiological studies that revealed no abnormalities, indicating that early rhythm disturbances can be ascribed to tissue edema and inflammation and electrolyte abnormalities. Total myocardial revascularization, scar exclusion, and volume reduction probably have a protective effect concerning ventricular rhythm abnormalities, and we would not recommend placing an ICD early postoperatively, even in patients with documented preoperative arrhythmic episodes. However, we would recommend electrophysiological testing in such patients.

Almost all patients in our group underwent concomitant myocardial revascularization. We did not observe any added early or late mortality in patients undergoing concomitant coronary artery bypass graft surgery. Isolated left anterior descending arterial stenosis distal to the strongest septal branch or clear evidence of nonviable myocardium precluding meaningful revascularization were excluding criteria for performing coronary artery bypass graft in those patients. Total myocardial revascularization, as well as septal perfusion, contribute favorably to early and late mortality, as well as decreasing ventricular arrhythmias [Lundblad 2004].

Concomitant mitral surgery did not carry any additional risk for early or late death in our series, contrary to literature reports. Mitral regurgitation is usually a product of LV dilatation and indicates a more severe stage of LV dysfunction, thus precluding higher incidence of early and late mortality [Menicanti 2004].

Long-term survival in our series was excellent, with 91%, 77%, and 68% at 1, 5, and 10 years, respectively, being comparable to the results reported in the literature [Sinatra 1997; Lange 2001; Lundblad 2004]. Functional recovery was excellent, with the majority of patients in groups I and II postoperatively. However, we did observe several patients remaining in the same functional class or even worsening, indicating some issues in patient selection. Patients from that group were hospitalized more frequently postoperatively with congestive heart failure symptoms, and this group of patients was at higher risk for late death.

There are several limitations to this study. One is the retrospective design. Furthermore, LV function preoperatively was not consistently reported, neither was LV end diastolic volume. We have encountered the same problems during follow-up, thus making us unable to precisely quantify the aforementioned values or perform any statistical analysis of these variables. Thus, the questionnaire was left as the only real evaluation tool, with its shortcomings as a not fully objective method.

In conclusion, we consider surgical treatment of LV aneurysms to be a safe procedure with excellent short-term results and good long-term survival and functional results.

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