Long term follow up of left ventricular function after repair of left ventricular aneurysm. A comparison of linear closure versus patch plasty

Mirko Dossa,*, Sven Martens, Samir Sayour, Wolfgang Hemmer

Abstract

Objective: Suboptimal early and unsatisfactory late results after linear closure of left ventricular aneurysms, have focused attention on more physiologic concepts of aneurysmectomy, like endoventricular patch plasty. The aim of our study was to compare clinical results of linear closure and patch plasty 8 years after surgery. Methods: From a total of 102 patients with postinfarctional left ventricular aneurysms, clinical outcomes and echocardiographic measurements of left ventricular function in 32 patients who underwent linear closure were compared to those of 20 patients who had endoventricular patch plasty. Results: The two groups were matched with respect to age, gender, comorbid risk factors, functional class, urgency of the operation and concomitant procedures. In the patch plasty group, ejection fraction increased from 33.1 ± 12.2% to 34.4 ± 9.7%. In the linear closure group, ejection fraction decreased from 44.3 ± 10.9% to 40.1 ± 7.9%. Perioperative mortality and complications, long term survival and functional class were similar in both groups with a total perioperative mortality of 1.9%, an 8-year survival rate of 85.6%, and a mean NYHA functional class of 2.51. Conclusion: Long-term follow up showed a decline in ejection fraction in the direct closure group and a slight increase in the patch plasty group. We suggest that linear closure should be limited to small ventricular aneurysms and that large ventricular aneurysms extending into the septum should be treated by patch plasty.

Keywords: Left ventricular aneurysm

1. Introduction

After the first successful resections of left ventricular aneurysms in the late 1950's, the initial operative technique of direct closure was not significantly modified for 25 years. The relatively high mortality and disappointing long term results prompted the development of more physiologically orientated operative techniques (Jantene 1985 circular reduction plasty, Dor 1989 endoventricular patch plasty) aimed at reconstructing left ventricular geometry. These changes in operative technique lead to an increase in early postoperative ejection fraction for most patients. However, there are few long term data available, comparing these different operative approaches. The aim of this study was to evaluate left ventricular function after resection of left ventricular aneurysms, by linear closure compared to endoventricular patch plasty, 8 years postoperatively.

2. Methods

One-hundred and two consecutive patients underwent repair of postinfarctional left ventricular aneurysms, between 1989 and 1996. Long term follow up is available for 52 of these patients. Twenty patients underwent patch plasty and 32 patients had linear closure. Allocation to groups occurred in a non randomized fashion. There were 40 males and 12 females with a mean age of 62.3 years. Their mean preoperative ejection fraction was 37.5% (10–68%) and their preoperative NYHA functional class was 3.5. The aneurysms were localised in the anterior wall (n = 46) and the posterior wall (n = 6). There were no posterior wall aneurysms in the patch plasty group.

The indications for operation were congestive heart failure paired with angina pectoris and ventricular tachycardias in 46 patients. In four patients the primary indication was tachyarrhythmia and in another two patients congestive heart failure alone. Thirty-one patients had coronary three-vessel disease, 16 patients had two-vessel disease and patients had five one-vessel disease.

All operations were performed using cardiopulmonary...
bypass, cold crystalloid cardioplegia and moderate systemic hypothermia. For endoventricular patch plasty ($n = 7$), the aneurysm was opened parallel to the interventricular septum, the clot removed and an elliptical Dacron patch ($n = 13$) or bovine pericardium patch ($n = 7$) sutured to the viable myocardium border, using a continuous 4-0 polypropylene suture. For linear closure ($n = 32$), the aneurysm was resected, intracavitary clot was removed and edges were readapted using a continuous suture. If intraoperatively we found an aneurysm that extended into the interventricular septum, patch plasty was carried out.

2.1. Follow up

All clinical records were reviewed retrospectively, direct telephone contact with the patient or primary care physician was made in all 52 cases. Data obtained included survival, functional status, long term medical management and procedure related complications. All patients were scheduled for an echocardiographic follow up examination, in our outpatient department. Left ventricular ejection fraction was calculated using Simpson’s formula from biplane apical four- and two-chamber views. All examinations were carried out by one experienced cardiologist. These data were compared to the patients preoperative ejection fractions.

3. Results

There was no significant difference between the groups with respect to age, gender, urgency of the procedure, preoperative left ventricular ejection fraction, functional status, and comorbid risk factors. Indications for operation included angina, congestive heart failure, ventricular arrhythmias or a combination of these presentations, with similar distributions between the groups. Concomitant myocardial revascularization was performed in 20 patients (100%) with patch plasty and 26 patients with linear closure, with an average of 2.5 grafts per patient. Endoventricular resection with mapping was performed in 13 patients and four patients required the implantation of an automatic implanteable cardioverter defibrillator device. Two patients had redo-surgery after previous coronary bypass operation and another two patients had concomitant mitral valve surgery. Perioperative mortality after patch plasty was 5% ($n = 1$) and 0% after linear closure (Table 1). The 8-year mortality was 9.37% ($n = 3$) in the linear closure group versus 0% in the patch plasty group. The overall mortality was 7.84%. Overall perioperative mortality was 1.9%. Merely one patient died of low cardiac output on the 6. postoperative day. Eight-year survival and freedom from cardiac death did not differ significantly in both groups (Fig. 1).

The preoperative ejection fraction was higher in the linear closure group: 44.3 versus 33.1%. Eight years postoperatively the ejection fraction increased to 34.4% in the patch plasty group and decreased to 40.05% in the linear closure group (Fig. 2). Preoperative and 8-year postoperative NYHA functional class were similar in both groups, with a mean preoperative NYHA class of 3.53 and a mean postoperative NYHA class of 2.51.

4. Discussion

The natural history of patients with postinfarction left ventricular aneurysms shows a high early mortality rate (50%) and also a high 5 year mortality rate (50–53%) [1]. Modern medical therapy, including angiotensin-converting

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Table 1
Clinical results after left ventricular aneurysmectomy (linear closure versus patch plasty)

<table>
<thead>
<tr>
<th></th>
<th>Linear closure</th>
<th>Patch plasty</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV-EF</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pre-op</td>
<td>44.3%</td>
<td>33.1%</td>
<td>38.6%</td>
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<tr>
<td>8 years</td>
<td>40.1%</td>
<td>34.4%</td>
<td>37.1%</td>
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<tr>
<td>NYHA</td>
<td></td>
<td></td>
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<tr>
<td>Pre-op</td>
<td>3.55</td>
<td>3.52</td>
<td>3.53</td>
</tr>
<tr>
<td>8 years</td>
<td>2.52</td>
<td>2.50</td>
<td>2.51</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peri-op</td>
<td>0%</td>
<td>5%</td>
<td>1.9%</td>
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<tr>
<td>8 years</td>
<td>9.4%</td>
<td>0%</td>
<td>7.8%</td>
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enzyme inhibitors, may effectively control symptoms, often delaying hemodynamic decompensation for years. However, once decompensation occurs, deterioration may be rapid and patients may die before surgery can be properly considered. Therefore, these patients should be followed closely and scheduled for surgery when signs of decompensation first occur. In comparison to the natural history, surgical management of left ventricular aneurysms has a significantly reduced early and long term mortality. In our study the overall perioperative mortality was only 1.9%.

Although both operative techniques eliminate the paradoxical motion of the left ventricular free wall, patch plasty also excludes the septal akinesis and theoretically may decrease the tension on the transitional zone, encourage revascularization of the left anterior descending artery and improve alignment of the muscle fibers, resulting in a more physiologic contraction.

Although there was a trend toward reduced mortality (5 vs 9.3%) after patch plasty, this did not reach significance, presumably because of the small sample size. However, similar findings of improved clinical results after patch plasty have been reported by others in large series of patients [2–5].

We found a slight decrease in left ventricular ejection fraction after resection and direct closure of left ventricular aneurysms and an increase in ejection fraction after patch plasty. Our study thereby confirms previous reports that repair of left ventricular aneurysm using plastic reconstructive techniques, results in a significantly greater postoperative increase in left ventricular ejection fraction, when compared with linear closure [2–8].

As described earlier, we did not attempt linear closure in patients with septal scarring. We are well aware that some groups have good results with linear closure and the use of septal patches in large aneurysms extending into the interventricular septum. However, in our study we chose to correct aneurysms with septal involvement by endoventricular patch plasty. Therefore, we view our results with care as anatomical differences and resultant choice of surgical technique might have influenced the outcome.

Eight years postoperatively we found a profound improvement of functional class in both groups. Functional class predominantly reflects the ability of the cardiovascular system to respond to exercise, however the mechanism underlying this improvement remains unclear.

4.1. Limitations of the study

Our study was retrospective, with the two groups operated upon in series by several surgeons. The sample size was small and therefore, significant differences in outcome have to be interpreted with care. It is possible that part of the improved functional status observed in the patch plasty group reflect the fact that, if intraoperatively we found an aneurysm that extended into the interventricular septum, patch plasty was carried out. Linear closure was therefore confined to smaller aneurysms. Undoubtedly, a prospective, randomized trial would provide more definitive conclusions regarding superiority of a particular technique.

References