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Left Ventricular Aneurysmectomy: Samsun Experience

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Abstract: Several surgical techniques are employed in the surgical treatment of left ventricular aneurysm, which is one of the probable complications peculiar to transmural myocardial infarctions. A total of 41 patients on whom left ventricular aneurysm had been diagnosed between January 1992 and December 2002 were examined retrospectively in our clinic. Aneurysm repairment was performed on 35 patients using "linear suturing technique" and on 6 patients using endoventricular patch technique. Three patients (7.32%) received only aneurysmectomy and 38 patients (92.68%) received coronary by-pass in addition to aneurysmectomy. Hospital mortality was 2.44%. Aneurysm surgery still maintains its significance in the treatment of ischemic heart diseases. The selection of repairment is made with respect to the pre-operative cardiac condition of the patient.

Key words: Left ventricular aneurysm, surgical treatment, coronary bypass

INTRODUCTION

Left ventricular aneurysm is one of the most serious complications of transmural myocardial infarction which leads to left ventricular disfunction and backward heart failure [1]. The true aneurysms of the left ventricle are scar sites which angiographically exhibit akinetic or diskinetic movements in the systole. Some researchers argue that this diskinetic site is supposed to reduce the left ventricular ejection fraction below 35%; on the other hand, others focus on the angiographic shape and systolic abnormal movement of the aneurysm [1,2]. The true left ventricular aneurysm occupies all layers of the ventricular wall[3]. The presence of left ventricular aneurysm leads to deterioration in both ventricular geometry and wall movements and, consequently hazardous arhythm, thromboembolism and backward heart failure emerge [1,4,5].

MATERIALS AND METHOD

A total of 41 cases on whom left ventricular true aneurysm had been diagnosed between January 1992 and December 2002 were retrospectively examined in Ondokuz Mayis University Hospital, Clinic of Cardiovascular Surgery. Patients who had undergone emergency surgical operations due to acute myocardial infarction were not included in the study. The pre-operative examination evaluated pre-operative symptoms and findings of the patients pertaining to angiography and echocardiography. Table 1 presents characteristic pre-operative findings of the cases.

Coronary angiography + left ventricle catheterization and echocardiography were conducted on all patients. Cine-angiograms were meticulously examined with respect to coronary arterial lesions, location of the aneurysm and presence of the thrombus. Lesions which resulted in a narrowing of 50% or above in the arterial lumen were considered as significant. Left Ventricular End-Systolic Diameter (LVESD), Left Ventricular End-Diasystolic Diameter (LVEDD) and left ventricular ejection fraction (EF) were measured with Simpson's bi-plan method applying echocardiography. The cases were examined for valve failure. Thirty-two cases had antero-lateral; eight cases had apical and one case had inferior valve failure. None of the patients exhibited mitral insufficiency according to echocardiography and angiography. As to operational indications, 28 patients (68.29%) had angina pectoris; 11 patients (26.83%) had angina pectoris + backward heart failure and 2 patients (4.88%) had backward heart failure.

Following the sternotomy conducted on the middle line, extracorporeal circulation was commenced from Standard atrio-caval venous and assendan aortic cannulation in all patients under general anesthesia. Moderate systemic hypothermy (oesophagus temperature to be 28°C) was applied. Cold (+4°C) crystalloid cardioplegia solution (Plegisol®) with antegrade potassium following the implementation of aortic cross-clamp was given in the first 19 patients of our series and the remaining 22 patients were given cold (+4°C) blood cardioplegia with antegrade potassium prior to internal

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Table 1: Pre-operative characteristics of the patients

	Number (n)	Percentage(%)
Gender		
Male	36	87.8
Female	5	12.2
Age Range	41-75 years old	
Angina (Canada)		
Class I	6 cases	14.63
Class II	24 cases	58.54
Class III	9 cases	21.95
Class IV	2 cases	4.88
Location of Aneurysm		
Anterior-lateral	32 cases	78.05
Apical	8 cases	19.51
Inferior	1 cases	2.44
Coronary Lesion		
Single-vessel disease	9 cases	21.95
Double-vessel disease	17 cases	41.46
Triple-vessel disease	15 cases	36.59
Operative Indication		
Angina	28 cases	68.29
Angina+Backward Heart Failure	11 cases	26.83
Backward Heart Failure	2 cases	4.88

Table 2: Technical Features Pertaining to Surgery and Supplementary Procedures

Surgical operation	Number (n)	Percentage(%)
Aneurysmectomy Technique		
Linear Suturing Technique	35	85.37
Endoventricular Patch Technique	6	14.63
Number of coronary artery bypass grafts		
applied with aneurysmectomyOnly aneurysmectomy	3	7.32
Aneurysmectomy +Single-vessel bypass (with LIMA)	5	12.2
Aneurysmectomy + Single-vessel bypass (with saphenous vein)	9	21.95
Aneurysmectomy + Double-vessel bypass	16	39.02
Aneurysmectomy + Triple-vessel bypass	8	19.51

cooling of pericardium. The said procedure enabled us to stop the heart.

Three patients (7.32%) underwent only aneurysmectomy and 38 patients (92.68%) underwent aneurysmectomy and coronary bypass simultaneously. Fourteen patients (34.14%) underwent single coronary bypass; 16 patients (39.02%) underwent double coronary bypass and 8 patients (19.51%) underwent triple coronary bypass. Distal anastomosis was achieved at the cardiac arrest and proximal anastomosis was achieved in the still-beating heart under "site-biting" clamp on patients who were treated with both techniques simultaneously. Intra-Aortic Balon Pump (IABP) was placed on patients who required such a procedure. The technical features of the surgical operations conducted on patients and procedures conducted supplementary to aneurysmectomy are presented in Table 2.

In the post-operative intensive care period, all patients were removed from the mechanical ventilator under identical conditions. In order to provide hemodynamic stability, inotropic and vasodilator medication were given to the patients in need. Patients with arhythm were given anti-arhythmic medication. Hemodynamics of the patients were closely monitored by carefully recording the loss in chest tubes. All patients were monitored for 24 h in the post-operative period with respect to systemic invasive arterial pressure, central venous pressure, hourly urine ejection and continuous ECG. Pulmonary Capillary Wedge Pressure (PCWP) and cardiac output were not monitored except from exceptional cases.

RESULTS

Aneurysm repairment was achieved on 35 patients (85.37%) by applying linear suturing technique. The existence of scar tissue required separate implementation of teflon plegit supported "U" sutures. The sutures were applied wide on the scar tissue and narrow on the teflon plegit so as to achieve a longitudinal narrowing.

Afterwards, aneurysmectomy was finalized by applying over and over suturing technique over the

teflon plegit. Due to the fact that the remaining 6 patients (14.63%) had larger aneurysms, endoventricular patch technique was applied so as not to deteriorate the ventricular geometry. This technique implements purse-string suture on the border zone between normal myocardium and scar tissue. This technique further enabled a volume reduction of the aneurysm site on both axes simultaneously. Afterwards, a dacron patch was sutured over this location with continuous suturing technique. The remaining scar tissue was primarily sutured before closing of aneurysm tissue.

One patient was lost in the early post-operative period. Mortality was 2.44%. The 51-year-old male patient had left ventricular aneurysm accompanied by a 70% stenose in the Left Anterior Descending (LAD) and a 60% stenose in the circumflex artery. Furthermore, the distal right coronary artery was totally occluded in this patient. A linear aneurysmectomy was performed on this patient. In addition, the LAD artery was bypassed over the Left Internal Mammarian Artery (LIMA). Despite the application of IABP and positive inotropic support provided, the patient died on the 12th day of the post-operative period. Of the 41 patients who were operated on due to Left Ventricular Aneurysm Diagnosis, 9 patients (21.95%) had LAD lesion; 17 patients (41.46%) had double-vessel disease and 15 patients (36.59%) had triple-vessel disease. Single-vessel bypass was performed on 3 patients (7.32%) with isolated aneurysmectomy, on 5 patients (12.2%) over the left internal mammarian artery and on 9 patients (21.95%) using saphenous vein graft. 16 patients (39.02%) underwent double-vessel bypass and 8 patients (19.51%) received triple-vessel bypass.

Thrombus was detected within the aneurysm on 15 patients (36.58%) and it was cureted. In the pre-operative angiographic examination, thrombus was detected within the left ventricle on 12 patients (29.26%). Thrombus was detected during the operation on 3 patients (10.34%) for whom angiography previously had revealed no thrombus. Cardiac arhythmia was detected on 5 patients (12.19%) prior to the operation and of these patients, 4 patients (9.75%) had atrial fibrilation and 1 patient (2.44%) had left branch blockage. Atrial fibrilation continued after the operation on 2 patients and the remaining 3 patients did not exhibit any rhythm disturbance. Cerebral complication was observed on 2 patients (4.88%). One of these patients (2.44%) suffered temporary ischemic attack and the other patient (2.44%) had right hemiparesis on the first day of the post-operative period but the latter recovered leaving no sequel behind. None of the patients were taken for revision due to hemorrhage. Dehissence emerged on one patient and this patient was taken for surgical revision in order to re-fix the sternum.

DISCUSSION

Four to twenty per cent of the patients may have left ventricular aneurysm after mycardial infarction[6]. Transmural damage was observed on 50% of the patients who had had myocardial infarction in the first 48 hours. It was found out that inflammation and cicatrization phases were effective in the formation of aneurysm during this period[7]. Despite the fact that it was tolerated relatively high, its long-term prognosis had adverse effects. The statistics revealed the 5-year-survival between 12% and 17% [8,9].

Left ventricular aneurysm repairment was first conducted by Likoff and Bailey in a still-beating heart in 1955. In 1958, Cooley achieved it using "linear aneurysmectomy" technique under cardiopulmonary bypass. Abid Jaten from Brazil brought on ventricular reconstruction concept in 1985 [10]. This was followed by Vincent Dor who introduced circular endoventricular patch plasty in 1989 [11].

The literature reports early mortality concerning left ventricular aneurysm as 2-23%[12]. Dor *et al.* detected operative mortality between 1.5% and 3%. The 2.44% mortality ratio which we observed in our series of patients is in conformity with the literature. Due to the fact that circular endoventricular patch plasty was performed only on 6 patients in our series, we did not conduct any statistical assessment between the two techniques. However, the patient who was lost in the early post-operative period had undergone aneurysmectomy accompanied by linear technique. In spite of the fact that some researchers argue that there is no statistically significant difference between the two techniques with respect to early mortality, Jatene reported that recovering the geometrical deterioration in the ventricle reduced the operative mortality[7,10,13,14]. On the other hand, Cooley, during the post-operative period, observed a 71% increase in ejection fraction on 24 patients who had undergone endoventricular aneurysm repairment but the increase was only 51% on those who had undergone linear aneurysm repairment [15].

The primary indications for surgical treatment in left ventricular aneurysm are angina, backward heart failure and ventricular arhythm which does not respond to medical treatment[12,16,17,18,19,20]. In our series, 68.29% of the patients had angina; 4.88% of the patients had left ventricular failure and 26.83% of the patients had both angina and left ventricular failure.

Komeda *et al.* emphasizes the importance of complete revascularization. They argue that LAD artery must certainly be bypassed if a scar tissue is not observed in the location which is blood supplying by one third

proximal of LAD artery during the operation. Moreover, they underline the fact that liguration of distal LAD artery conducted during the aneurysm repairment will adversely affect the blood supplying of marginal arteries if the right coronary is occlused[21]. It is a widely confirmed concept that revascularization of LAD and diagonal branches contribute to the blood supplying of anterior wall and interventricular septum in the heart[22]. In their study, Vural *et al.* revealed the fact that revascularization reduced the frequency of low heart flow occurrence in the post-operative period and that it did not affect the early mortality and long-term survival. They also indicated that their strategy was complete revascularization[13]. The general strategy which we follow in our clinic favours complete revascularization, as well. We believe that left anterior descending artery must be bypassed on cases which exhibit relatively high stenose or occlusion in the right coronary artery. The study carried out by Stahle *et al.* reports that utilization of internal mammarian artery as bypass graft reduces mortality and that early and late outcomes are relatively desirable in comparison with saphenous vein graft with respect to graft patency[23]. The incidence of aneurysm with multiple arterial disease ranges between 72.5% and 80% in the literature [24]. This ratio was 78.04% in our series. Of these patients, 7.32% underwent only aneurysmectomy; 26.83% underwent incomplete revascularization and 65.85% underwent complete revascularization. The literature reports that pre-operative cardiac conditions of the patients who underwent aneurysm repairment with circular and linear techniques were not similar to each other. Aneurysm repairment method is not selected haphazardly by the surgeons. The circular repairment is performed in wide, clear-cut aneurysms which develop an adequate cervix portion while linear repairment is selected for relatively small aneurysms which have not developed a cervix[13]. The prognosis in left ventricular aneurysm is closely related with the dimensions of the aneurysm and the condition of the myocardium[12].

As a consequence, both linear and circular methods have proved their reliability as aneurysm repairment techniques thanks to short and long term studies. We believe that the best outcome can be achieved if and only if the right method is selected in accordance with the pre-operative cardiac condition of the patient.

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