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Evaluation of aortic valve insufficiency after supracoronary replacement with resuspension for acute type A aortic dissection

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Abstract

Aim: Aortic dissections emerge as severe pathologies reqiuring early diagnosis and immediate surgical intervention is mandatory in acute Type A aortic dissection, however, there are still controversies regarding the appropriate approach. The present study aims to demonstrate the effects of valve resuspension with supracoronary tube graft replacement on aortic valve insufficency in acute Type A aortic dissection.

Material and Methods: The study was conducted on 108 patients who had supracoronary aortic replacement with suspension for acute Type A aortic dissection and discharged from the hospital with cure between January 1997 and January 2014. The patients were evaluated for aortic valve function by transthoracic echocardiography at the postoperative 6^{th} and 12^{th} months.

Results: Gender distribution was 31 (29%) females and 77 (71%) males, their mean age being 53.24 ±11,3 years old. In the present study, valve function measured with preoperative and postoperative 6th and 12th months transthoracic echo revealed a significant decrease in terms of aortic valve insufficiency. After surgery, no patient required a reoperation for valve insufficency within the 1^{st} year.

Conclusion: All these have demonstrated that in the treatment of acute Type A aortic dissection, aortic insufficiency is not a restrictive factor for chosing the resuspension with supracoronary tube graft replacement method in patients without any organic disease of the aortic valve and root aneursym and in whom the rupture is not progressing proximally to affect coronary entries. By using the this method aortic dissections can treated with good results while native valve preserved.

Introduction

Acute aortic dissection is a pathology that requires emergency surgery. The classification of AAD follows two different systems: Stanford (which defines lesions as types A, on the ascending aorta, or B, on the descending aorta) and DeBakey, which also accounts for the extension of the aortic dissection. In the Stanford classification, type A AD involves the ascending aorta, and type B dissections are those that do not involve the ascending aorta. Although type A dissections require emergent surgical repair, the medical therapy is generally performed as the initial strategy of acute type B dissections. In Acute Aortic Dissection Type A (AADA) [1]. Typically, a rupture that starts from the ascending aorta progresses retrogradely to the sinotubular junction, includes the sinus region, and leads to aortic insufficiency. Even so, the aortic valve (AV) and anulus are not affected in most cases [2] . In dissection cases accompanied by aortic insufficiency, the Bentall operation is frequently performed because it prevents future interventions for aortic valve and does not leave aortic tissue behind. However, in this case, there is a risk of complications associated with sacrifice of the native aortic valve and the use of life-long anticoagulation. Therefore valve-sparing surgical interventions are being applied at an increasing rate. The two most important of these are supracoronary replacement with valve resuspension and valve sparing aortic root replacement (VSRR). In acute aortic dissection the most important parameter is to choose a fast and life-saving approach. In the present study, cases with acute aortic dissection treated with aortic valve resuspension + supracoronary tube graft replacement were

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evaluated in terms of aortic valve stenosis.

Materials and Methods

Patients who were diagnosed with acute type A dissection and treated with valve resuspension + supracoronary replacement between January 1997 and January 2014 in İstanbul Dr.Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital (1997 -2007) and SBU Antalya Research and Training Hospital (2010-2014) were reviewed. A total of 128 patients were operated and 108 of them were discharged from the hospital with cure. These 108 patients were included in the present study. Gender distribution was 31 (29%) females and 77 (77%) males, with a mean age of 53, 24 ± 11.3 years old in the patiens included in the present study. All patients were preoperatively evaluated with contrast thorax computerized tomography (CT) and transthoracic echocardiogram (ECHO) and performed emergency surgery with the diagnosis of AADA. During the same time period, patients who were performed Bentall or valve sparing root replacement methods (David or Yacoub method) or supracoronary replacement without suspension were excluded. The decision of valve intervention was taken as a result of preoperative echo findings and perioperative evaluation of the valve structure and sinotubular junction. The aortic valve insufficiencies were evaluated in 4 groups as group 0: no insufficiency; group 1: mild insufficiency; group 2: moderate insufficiency; and group 3: advanced insufficiency in accordance with the guideline of the American Society of Echocardiography (ASE). Preoperative evaluations revealed that 49 (45%), 37 (34%), and 22 (21%) patients were in Groups 1, 2, and 3, respectively.

Surgery

Before median sternotomy and pericardiectomy femoral or axillary cannulation performed,the patient was cooled to deep hypothermia. Cooling to a rectal temperature of 18-22 ^{o}C was initiated and cardioplegia was conducted with repetitive doses of cold blood cardioplegia via antegrad and retrograde cannula after aortic cross clamping and transsection of ascending aorta above the commissures. Aortic valve inspected carefully before the decision of which methods used. Supracoronary tube graft proximal anastomosis was completed by the valve resuspension, regardless of valve failure detected in preoperative echo, in patients with intact coronary ostia, no problem in valve structure, and no dilatation in the sinotubular region. To resuspend the AV, the valve commissures were elevated by using a sandwich technique with a pledget inside the lumen above the commissures that was sutured to the felt outside the aorta in a horizontal plan. After rectal temperature achieved 18-22 ^{o}C , to allow the open distal anastomosis , head was placed downward, cardiopulmonary bypass was discontinued with antegrad cerebral perfusion, and the aorta was trimmed appropriately for the extent of the replacement. Distal anastomosis was completed at the appropriate level under total circulatory arrest (TCA) cardiopulmonary bypass restart again and warming stated. Following the operation all patients were taken to the Intensive Care Unit (ICU). After ICU follow-ups, the patients were taken to the Clinic and then discharged from the hospital.

In the present study, patients were evaluated in terms of preoperative aortic valve insufficiency, demographic data, total circulatory arrest (TCA) time, cross-clamp time (XCT), and total pump time (TPT). All patients were evaluated for aortic valve insufficiency before discharge and by performing 6th month and 1st year transthoracic echo. Patients' time to leave the intensive care unit and time to hospital discharge was also evaluated.

Results

Median sternotomy was performed in all patients. TCA was reached through cannulation of the femoral artery in 35 (32%) and the axillary artery in 73 (68%) patients. Mean times for TCA, XC, and total pump were 25 ± 6.8 min; 76 ± 19 min; and 119 ± 23.1 min, respectively. Additionally, 6 patients were performed the arcus replacement and in 4 patients, the descending aorta was replaced with the elephant trunk graft. Mean time of postoperative ICU stay was 3.1 ± 2.1 days. Mean hospitalization period was 7.2 ± 5.3 days (Table 1). Patients who were performed supracoronary aortic replacement for acute Type A dissection but died at the perioperative period or at the hospital were excluded. As required by our hospital protocol, all patients who were discharged with cure were checked for valve failure in the 6th and 12th months with transthoracic echo if they did not have any additional problems. Patients again were grouped into 4 in accordance with the ASE echo guideline. At the 6th month follow-up, 18 (17%) patients were group 0, 68 (63%) patients were group 1, and 22 (20%) patients were group 2. None of the patients had advanced insufficiency. At the 12th month echo control, 23 (21%), 72 (67%), and 13 (12%) patients were in groups 1, 2, and 3, respectively. The maximum and mean follow-up periods were 39 months and 15.64 ± 7.3 months, respectively (Table 1).

Table 1. Patient demographics

	n(%) and mean ± SD
Female	31(29%)
Male	77 (31%)
Age (years)	53.24 ± 11.3
XCT (min)	76 ± 19
TPT (min)	119 ± 23.1
ICU stay (days)	3.1 ± 2.1
Hospital stay (days)	7.2 ± 5.3

Data are mean ± SD.

The change observed in the preoperative, 6th month and 12th month echo findings is statistically significant (p:0.001; p<0.01). The decrease found in the 6th month echo findings when compared to the preoperative echo findings is statistically significant (p:0.001; p<0.01). The regression found in the 12th month echo findings when compared with the preoperative echo fondongs is statistically significant (p:0.001; p<0.01). The comparison of the change in echo fondongs at the 6th and 12th months revealed no statistical significance (p: 0.170; p>0.05) (Table 2 , Table 3). Statistical analyses were performed using the SPSS software version 21. The variables were investigated using analytical methods (Kolmogorov- Simirnov/

Table 2. Changes in Echo Findings at the Preoperative Period and at the 6th and 12th Months

	Preoperative	PO 6th	PO 12th
	n(%)	Month n(%)	Month n(%)
None	0	18 (16.7)	23 (21.3)
Mild	49 (45.4)	68 (45.4)	72 (66.7)
Modarate	27 (34.3)	72 (66.7)	13 (12)
Advanced	22 (20.4)	0	0
p*			0.001**
Preoperative – 6th month +			0.001**
Preoperative – 12th month+			0.001**
6th month – 12th month+			0.170

PO: Postoperative P * : Friedman Test , + : Wilcoxon sign test
** : p < 0,01

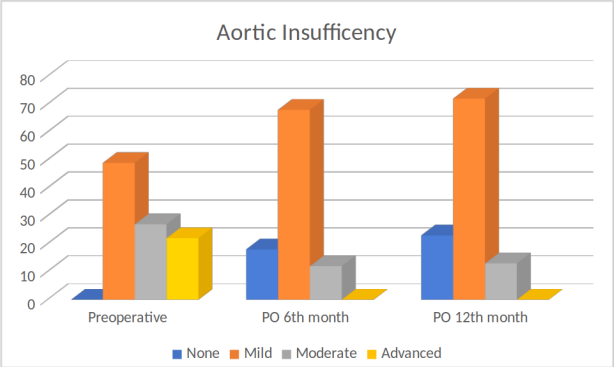

Figure 1. Aortic Insufficiency, PO: Postoperative

Shapiro – Wilks's test) to determine whether or not they are normally distributed. Friedman tests were used to test whether there is a significant change in preoperative , 6th and 12th month ECHO results. The Wilcoxon test was performed to test the significance of pairwise differences.

Discussion

Acute Aortic Dissection Type A (AADA) is still one of the major life-threatening conditions among cardiovascular diseases [3]. Due to this high mortality, the importance of rapid and precise diagnosis increases. The golden standard of diagnosis is contrast thorax CT. If possible, transthoracic echo must performed before surgery to evaluate valve function. In AADA, 90% of cases who were not surgically treated are lost within the first 2 weeks after dissection [4, 5]. For this reason, emergency surgery is essential in all dissections involving the aorta even if serious complications have developed. The applied operative techniques are spread over a wide spectrum. The common goal in all surgical techniques is to resect a dissected aorta and to replace it with graft, to remove the intimal region of rupture and to eliminate the connection between real and false lumens. While there is a consensus that the approach is surgical in aortic dissection other than non-complicated type B dissection, there is still controversy about the surgical method to be chosen. In the choice of surgical method, many factors are effective. These are patient characteristics (age, comorbid factors, and degree of aortic valve failure, aortic root diameter, leaflet morphology, and presence of genetic anomalies such as Marfan syndrome), whether or not the method to be applied will require future reoperation(s) and most importantly, the surgeon's experience [6]. Previous studies reported that AV insufficiency (AI) complicates 40% to 60% of acute type A dissections [7, 8]. Despite the high incidence of AI, many researchers have suggested preservation of the native AV by the relatively straightforward technique of supracoronary ascending aortic replacement with AV resuspension (SVR) [9, 10]. Among the surgical methods, the most preferred are: aortic replacement with supracoronary tube graft, Bentall procedure and valve-spearing and -protecting methods, which have been increasing in recent years. While supracoronary replacement is preferred as it can be applied in a short time, the patient's time related parameters like TCA time, XCT, TPT are short, and lifetime anticoagulant use is not required. On the other hand diseased tissue is left behind and thus redissection and aneurysm becomes a limiting factor [11]. In the present study, we evaluated the changes of the aortic valve functions in the pre- and postoperative period in patients without structural valve disorders, with no serious aortic root dilatation and no valvular intervention, all of whom were treated with valve resuspension and supracoronary tube graft replacement by the sandwich method. In aortic dissections, aortic valve insufficiencies are known to result from progression of dissection to the proximal rather than organic valve pathologies. In a study, it has been shown that accompanying aortic insufficiency can usually be corrected by commissural resuspension in approximately 50-60% of cases with acute proximal aortic dissection [12]. As a result, the methods in which the native valve is protected are resuspension + supracoronary replacement and valve spearing techniques. However, there are serious differences between these two methods in terms of operation time, TCA time, bypass time, and the need for surgical experience [13]. The most important parameters in terms of postoperative complications are operation, cross-clamp, and total circulatory arrest times [14, 15]. There is a significant relation between the longer duration of these time parameters and high rates of morbidity and mortality [16]. Thus, resuspension + supracoronary replacement becomes a simple, fast, and reliable method. It has been recognized that aortic replacement with supracoronary tube graft is one of the easiest methods to treat type A aortic dissection. It has been demonstrated that the aortic sinus and valve geometry are preserved in 90% of patients operated with this method [17]. At the end of the present study, there was a statistically significant regression in terms of pre- and postoperative failure parameters. However, echo follow-ups at the 6th and 12th months revealed no significant difference with regard to aortic valve failure. This was interpreted as an indication that the reason of valve failure in dissections is more functional than organic. The present authors think that there is no need for additional intervention to the native aortic valve in cases without any organic valve lesion and no aortic root dilatation. In replacement with a composite graft, bleeding or thromboembolic events due to lifetime use of anticoagulants or valve-related dis-

advantages such as the need for reoperation due to valve degeneration in biological valves can be encountered [18]. In valve resuspension or supracoronary aortic replacement, the remaining diseased aortic tissue can have future dissection and thus an aneurysm of Valsalva or aortic insufficiency may develop. Due to problems with the mechanical valve, David and Feindel have described a valve protection method. With this method, after the ascending aorta is completely resected, the native valve is implanted into the Dacron tube graft. Glover et al. reported that aortic insufficiency has never been observed in 5 years and been present at a rate of 20% in 10 years in patients who underwent valve resuspension because of aortic insufficiency [19]. In cases in whom the aortic valve is not affected by dissection, the probability of normal valve function is 94% in 5 years and 92% in 10 years. In cases with the aortic root dilatation, no connection was detected between diameter and survival. In cases treated with supracoronary replacement, it is recommended to check with postop close follow-up [20]. In the study of Grater et al., cases with composite replacement, supracoronary and valve suspension for aortic valve failure were followed. The method to be used in patients was chosen according to the aortic root diameter. At the end of the study, it is stated that the rate of reoperation is higher in those who underwent aortic replacement with supracoronary tube graft [21]. In the present study, after a mean follow-up of 16.58 $\pm$ 8.6 months, no reoperation was required due to aortic valve failure and there was regression in terms of insufficiency.

Conclusion

As a conclusion, patients' preoperative condition, comorbid factors, observation by the surgeon in the preoperative period, emergency facilities, and the experience of the surgical team play important roles in the selection of surgical methods in acute type A aortic dissections, and there is no consensus. If aortic root and valve does not have an independent indication for replacement in terms of size , damage or tissue disorder , AV resuspension is an efficient strategy for native AV preservation. Resuspension with supracoronary aortic replacement is the first method to consider because of its easy applicability, short operation time, and lack of lifetime anticoagulant requirement since the native aortic valve is protected.

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