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Short Communication

Results of Teflon Felt Sandwich Technique for Acute Type A Aortic Dissection

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Abstract

Objective: Acute type A aortic dissection represents an emergency that requires immediate open-heart surgery to prevent aortic rupture and eventually death. The purpose of this study is to investigate the results of Teflon felt reinforcement sandwich technique for acute type A aortic dissection.

Methods: Thirty-eight patients who underwent surgery acute type A aortic dissection between 2015 and 2019 were examined retrospectively. Teflon felt the sandwich technique was used in all patients. Postoperative data of patients such as mortality and morbidity including the amount of drainage and the number of red blood cell transfusions were recorded.

Results: All patients underwent aortic root and hemiarch/arch repair with a sandwich technique using Teflon felt. Ten patients (26.3%) who had severe aortic regurgitation underwent a Benthal procedure. During the operation, the cardiopulmonary bypass time was 152.02 ± 18.41 minutes; cross-clamp time was 93 ± 11.56 minutes. The mean amount of drainage was 884.94 ml ± 165.2 ml. The mortality rate of 38 patients was 18.4% (7/38).

Conclusion: Aortic root reconstruction with a sandwich technique using Teflon felt can be successfully performed in most patients with acute type A aortic dissection and is associated with acceptable mortality and low root reoperation rates.

Keywords: Aortic dissection; Surgery; Bleeding; Cardioplegia

Introduction

The acute type A aortic dissection is a fatal disease that prevalence has been increasing in all age groups [1]. However, early mortality of surgery for acute type A aortic dissection has been around 10% even inexperienced cardiac centers. It typically begins with a tear in the ascending aorta above the sinotubular junction, with the dissection flap extending into the sinus segment, and results in significant aortic regurgitation. Aortic root repair remains a challenging problem. Stitching for the affected and weakened aortic root anastomosis due to dissection will result in more damage that can cause uncontrolled surgical bleeding [2]. One of the valuable technic to solve this fatal surgical problem is reinforcement the aortic layers within two strips Teflon felt like a sandwich. We aimed is to evaluate the surgical results of open-heart surgery for acute type A aortic dissection using Teflon felt sandwich technique in this study.

Materials and Methods

Patient data

Between April 2015 to April 2019, 38 patients underwent surgery for type A aortic dissection at our institution. This study was retrospectively reviewed by using data taken from hospital records. Clinical data of the operated patients were recorded by retrospective analysis of hospital records driven from the national health ministry database.

Patient demographics and related risk factors of the patients are given in Table 1. The diagnosis of dissection was established computed tomography angiography and transthoracic echocardiography.

Operative technique

All patients were operated on an emergency basis. In the operating room, after the anesthetic induction, a median sternotomy was performed in all patients and then the arterial perfusion was performed through the right axillary artery. Cardiopulmonary bypass was established through the right axillary artery and the right atrium and Unilateral Antegrade Cerebral Perfusion (UACP). The ascending aorta was cross-clamped and opened and then cold Custadiol

Table 1: Dermographic and clinical characteristics of patients.

	n	%
Mean age (years)	57.6 ± 12.07	
Male/female	23/15	39.47
Previous cardiac	2	5
operation		
Aortic insufficiency		26.3
Moderate	Oct-38	
Severe	Aug-38	21
Shock	15	39.4
Cardiac tamponade	10	26.3
Visceral ischemia	2	5
Spinal cord ischemia	1	2
Lower limb ischemia	5	13.1

Data are presented as mean ± standard deviation, number of patients and percentage

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cardioplegia was delivered by the left and right coronary ostia. After cardiac arrest established, the dissected aorta was partly removed and the aortic valve was controlled, and the site of anastomosis was prepared as follows. Two Teflon strips are prepared separately; these were approximately 10 mm wide. Then, the strips were placed outer and inner side of aortic layers. The aortic walls were sandwiched between the felt strips with a continuous 3-0 polypropylene suture as a matress suture technique to reinforce the aortic wall layers. Thereafter, the prosthesis was sutured to the sandwich with a 3-0 Prolene running suture.

We observed the 38 patients for perioperative mortality, complications and postoperative outcome during hospitalization. The durability of the root repair was assessed by follow-up transthoracic echocardiography and computed tomographic angiography 6 and 12 months postoperatively and annually thereafter.

Statistical analysis

Data were expressed as mean ± Standard Deviation (SD) and the number of patients and percentage. Categorical and continuous variables are presented as numbers and percentages and as mean ± SD, respectively. SPSS version 17.0 software (SPSS Inc, Chicago, IL) was used to perform the statistical analyses.

Results

Operative details and concomitant procedures are given in Table 2. All patients underwent aortic root and hemiarch/arch repair with a sandwich technique using Teflon felt. Ten patients (26.3%) who had severe aortic regurgitation underwent a Benthal procedure. During the operation, the cardiopulmonary bypass time was 152.02 ± 18.41 min, cross-clamp time was 93 ± 11.56 min. The mean amount of drainage in the first 24 hours postoperatively was 884.94 ml ± 165.2 ml.

Table 2: Operative Procedures.

	n	%
Supra-coronary aortic graft	20	52.6
Bentall procedure	10	26.3
Hemiarch replacement	5	13.1
Aortic arch replacement	3	7.8
Axillary cannulation	38	100
Unilateral arterial perfusion	8	21
CPB time/minutes	152.02 ± 18.41	
X clamp time	93.55 ± 11.56	

Data are presented as mean ± standard deviation, number of patients and percentage

The mortality rate of 38 patients was 18.4% (7/38). The primary reasons for in-hospital deaths were heart failure in 2 (20%), acute renal failure in 1 (20%), multisystem organ failure in 3 (30%) and a neurological event in 1 patient (10%). No myocardial infarction, stroke or left limb ischemia developed (Table 3).

Discussion

Acute type A aortic dissection is associated with a high rate of short term mortality. The prior aim of surgery in the acute phase is to save patient's lives. In the majority of patients with type A aortic dissection, the intimal tear is commonly seen just above the coronary sinuses in the proximal ascending aorta. The standard procedure for the acute type A aortic dissection in the international area is the replacement of ascending aorta from coronary sinuses to the just beyond the aortic arch to reduce the risk of cardiac tamponade or aortic rupture by preventing the proximal extension of dissection [3-6].

Table 3: Postoperative Data.

	n	%
Drainage, ml	884 ± 165.2	
Arrhythmia n (%)	20/38	52.6
Need for inotrope n (%)	30/38	78.9
Renal insufficiency n (%)	Mar-38	7.8
Neurologic complication n (%)	0	0
Reoperation for bleeding n (%)	0	0
Mortality n (%)	Jul-38	18.4

Data are presented as mean ± standard deviation, number of patients and percentage

To achieve a successful repair, the extremely fragile dissected aortic layers must be reconstructed proximally and distally. The bleeding from proximal and distal anastomoses in aortic surgery is a very important factor that prolongs the cardiopulmonary bypass and cross-clamping times resulted in prolonged hypothermia and entering the cycle of bleeding over and over, and then additional blood and plasma transfusions and increased mortality are inevitable [7]. International Registry of Acute Aortic Dissection (IRAD) reported the in-hospital mortality rate as 23% to 30 % in this high mortality patient population group. Many efforts have been made to improve outcomes. Many factors influence the vigorous outcomes of this invasive surgery including body heat of the patient, proximal and distal anastomosis, antegrade brain perfusion, protection of the main distal organs, and the cannulation strategy concomitant with the perfusion techniques [7].

Excessive bleeding after aortic surgery is generally related to a combination of several alterations in the hemostatic system about the dilution and activation of the coagulation system, which is mainly attributed to the use of extracorporeal circulation. To stop bleeding particularly from anastomoses, many different techniques or ideas were used in this surgical area. Bioglue application directly to the anastomotic suture line or wrapping the ascending aorta with a Dacron graft in a tubular fashion by attention to the coronary arteries that come to mind. However, each has some difficulties while applying the bioglue needed dry area at the anastomotic site where the blood is everywhere or troublesome while squeezing whole material around the posterior side of the distal aortic anastomosis, and while wrapping the ascending aorta avoidance from the compressing the coronary arteries.

Pinheiro et al. [2] were found another useful way to reduce bleeding from the anastomotic suture lines described as 'Dacron graft intussusception technique'. The common goal of all these techniques is to create a more secure anastomosis and to reduce surgical bleeding. The authors also claimed that the amount of drainage from the mediastinal and thoracal cavity via the chest tubes was 654 ml totally and that the bleeding-revision rate was also recorded as 4.1%.

It is suggested that obliteration of the false lumen with the Teflon felt strip is sufficient reinforcement, therefore Bioglue (CryoLife Inc., Kennesaw, GA) that is used to reapproximate the dissected aortic wall layers, is rarely used at our department and we are aware of the associated risk of tissue necrosis [8]. In our study, the mean amount of drainage in the first 24 hours postoperatively was 884 ml. surprisingly; we did not revise our patients for the reason of bleeding from any surgical site.

Through GERAADA, underlying disease and the applied surgery are very close to each other, those affect the survival after acute aortic dissection surgery combining the factors related to them. Many

influencing factors, for example, advanced age, consciousness before the operation, hemodynamic instability due to rupture or tamponade, malperfusion of the vital organs before the surgery are cornerstones of survival after acute aortic dissection surgery. Particularly, advanced neurological corruption such as unconsciousness, stroke, and seizures, as well as cardiopulmonary resuscitation, are associated with very challenging clinical conditions in the early postoperative period that resulted easily in mortality. On the contrary, such factors as prolonged duration of cardiopulmonary bypass and cross-clamping time are not directly related to the early mortality, because they are more modifiable factor than the severity of the disease. Rather, it is all about the complexity of the repair of the dissected aorta. Also, the right axillary artery cannulation site for the arterial perfusion of the whole body has no effect on early mortality as an access vessel in this analysis. The real content of the surgical operation did not influence the early mortality after acute aortic dissection repair [9].

We have found that axillary artery cannulation provides a safe and feasible alternative to the historically used femoral artery, by enabling antegrade aortic flow through the true lumen, ensuring adequate arterial inflow, and minimizing the risk of retrograde atheroemboli. The use of the axillary artery may decrease the risk of stroke and visceral organ malperfusion that is associated with peripheral cardiopulmonary bypass in this high-risk group of patients [10]. Recently, the use of selective antegrade cerebral perfusion has been gaining popularity in the repair of aortic arch aneurysms or dissections [11]. We have also performed antegrade perfusion via the right axillary artery in acute type A dissection.

In our clinics, we have been using routinely tepid blood cardioplegia in particular for complex cardiac operations since January 2012 as Custodial. Our indications for the use of Custodial were not different from worldwide, for the reported reasons in the literature. These can be encountered as minimally invasive mitral and aortic valve procedures with sutureless bioprosthesis, redo cases, and complex aortic root surgeries and hemi or total arch replacements [12]. After applying cross-clamping, a single dose of the Custodial solution is enough for the entire operation to preserve the myocardium from ischemia. Beyond this practical point, there some theoretical information about the custodial such as buffer effect leading to anaerobic glycolysis, supporting the environment in the Krebs cycle and finally providing a precursor of nicotinamide adenine dinucleotide. Additionally, it keeps the stability of the cell membrane and decreases interstitial edema. Briefly, custodial is an ideal solution for myocardial protection in complex cardiac operations nowadays until the new one appears [12].

We believe that these results are due to our aggressive surgical management of aortic repair: the intimal tear should always be resected and if it is not found immediately after the opening of the dissected aorta, one should look for it in the intima. In our current operative strategy, we always try to identify the intimal tear. Therefore, the inspection of the distal ascending aorta or the aortic arch should follow with the use of UACP; if the aortic valve is not morphologically normal or if the annulus is dilated, a Bentall procedure might be recommended.

In conclusion, our experience indicates that the patients with an acute type A aortic dissection should have preoperative hemodynamic stability being the key predictor of operative success, emphasizing the need for urgent surgical repair in patients with acute type A aortic dissection before the onset of hemodynamic instability. Aortic root reconstruction with a sandwich technique using Teflon felt can be successfully performed in most patients with acute type A aortic dissection and is associated with low in-hospital mortality and low root reoperation rates.

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