SURGICAL TREATMENT OF ACUTE AORTIC DISSECTIONS

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Aortic dissections still presents one some of the most fascinating and challenging problems in cardiac surgery. Between February 1992 and December 1997 of 12257 open heart operations, 34 patients (29 male; 1 female; median age 44.9 years, ranging from 21 to 66 years) underwent operations on the ascending aorta, and/or aortic arch due to acute aortic dissection. Isolate replacement of the ascending aorta was performed in 6 patients, ascending aortic replacement with hemiarch replacement in 5 patients, ascending aortic replacement with arch replacement in 3 patients, ascending and arch replacement with elephant trunk to the descending aorta in 17,Bentall De Bono (BDB) with aortic arch replacement in 1 and isolate BDB in 2 patients. Hypothermic circulatory arrest (18.5°C, 17 to 24.6°C) and retrograde venous total body perfusion (RVTBP) were implemented in all cases (median cardiopulmonary bypass time 163 min., range 120 to 246 min.; median cross clamp time 72 min., ranging 52 to 124 min.; median retrograde cerebral perfusion time 43.8 min.; ranging 10 to 87 min.). 9 hospital deaths occured.The remaining patients had no postoperative neurological damage. There has been no late mortality. Open distal anastomosis technique, progress in surgical materials, and artificial grafts, and RTVBP technique has made significant improvements in the results of surgical treatment of acute aortic dissections.

Key words: Acute aortic dissection, retrograde venous body perfusion, cerebral protection

The hospital mortality rate for medically managed patients with type A dissections exceeds 80% [1]. Surgical approaches for acute aortic dissections have been improved step by step in the last 50 years. The modern treatment of aortic dissection is a contribution of Michael De Bakey which was reported in 1955[2]. The successful outcome of the surgical treatment of acute aortic dissections has increased suprisingly with a reduction of hospital mortality of 40% in those times to 15-20% recently[3]. "Open" distal anastomosis technique, and adjunctive maneuvres to improve cerebral protection during hypotermic circulatory arrest (HCA); such as retrograde cerabral and body perfusion made significant contributions to the results surgical therapy. The recent clinical experience of the Koşuyolu Heart and Research Hospital in acute aortic dissections has been reported, and RVTBP technique has been described.

MATERIALS AND METHODS

Surgical intervention was performed on 34 patients due to acute aortic dissection between February 1992 and December 1997. There were 33 male and 1 female patients (median age, 44.9 years; ranging from 21 to 66 years). In all patients indications for operation were acute type A aortic dissections. Preoperative characteristics of the patients are summarized on Table 1 and Graph 1. The operations were performed on emergency basis in 7 patients who were in cardigenic shock, and urgently in 27 patients. The diagnosis was confirmed with transosephageal echocardiography, magnetic resonance imaging, computerized tomography and/or aortography in 29 patients, and only aortography in 5 patients. Ascending aortic replacement was performed in 6 patients, ascending aortic replacement with hemiarch replacement in 5 patients, ascending aortic replacement with total aortic arch replacement in 3 patients, ascending and aortic arch replacement with elephant trunk procedure (left subclavin artery was anastomosed to the aorta with a different graft in 1 patient) in 16 patients, BDB with total aortic arch replacement in 1 and isolate BDB procedure in 2 patients. Intraluminal graft interposition into the descending aorta was performed in 1 patient whose condition was complicated by acute tubuler necrosis secondary to progression of the dissection into the iliac arteries; which was confirmed by postoperative angiography. The operations performed are shown in Table 2.

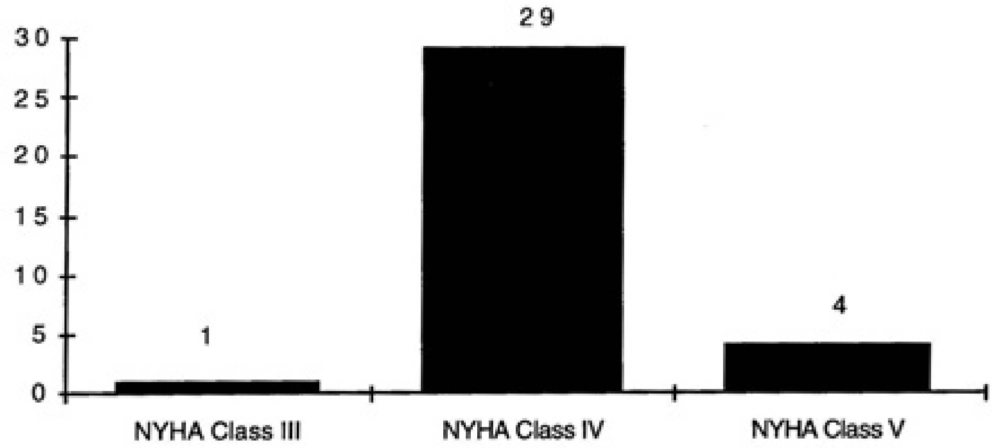
Table 1: Pre-operative Characteristics of the Patients (n:24)

	n	%
Angina Pectoris and back pain	14	58.3
Angina Pectoris and abdominal Pain	1	4.1
Back Pain and numbness in the extremity	13	38.2
Coldness in the extremity	3	12.5
Somnolence	2	8.3
Fever and shortness of breath	1	4.1

Table 2: Summary of Treatment

Operation	n	%
AA replacement	6	25
AA+Hemiarch replacement	5	20.8
*AA+arch replacement	3	12.5
AA+arch replacement (ET)	16	47
AA+arch replacement (ET)+ Left subclavian-aorta bypass	1	4.1
BDB+arch replacement	1	4.1
BDB	2	8.3

*Intraluminal graft interposition into the descending aorta. AA: ascending aorta, ET: elephant trunk, BDB: Bentall DeBono



Graph 1: Preoperative Functional Capacity of the Patients

SURGICAL TECHNIQUE

All operations in this serie were performed through a median sternotomy. Heparinization was monitored with activated clotting time, and acid-base management during hypothermia via an alpha-stat approach. Before hypothermic circulatory arrest, all patients received thiopentane (5 mg/kg), mannitol (1 g/kg), nimodiphin (1.5 mg/kg, 1cc/dk), and 1 gm methylprednisolone. Arterial cannulation was initially made through the femoral artery. The SVC was usually cannulated with a wire-reinforced cannula inserted via the right atrial appendage. Cannulation of the inferior vena cava was either through a right atrial purse string suture or through the femoral vein.

In all patients cardiopulmonary bypass was established, and systemic cooling was initiated immediately. The aorta then was clamped, and myocardial protection was achieved by retrograde, continious coronary sinus blood cardioplegia. During systemic cooling and rewarming, it was cared to maintain a thermal difference lesser than 10°C between the arterial and venous blood temperatures. Total circulatory arrest was performed when systemic hypothermia reached 18°C (Table 3). During this period the aortic valve and aortic root was checked, and the concomittant procedures were completed (aortic valve replacement, or reconstruction, proximal aortic greft inteposition and coronary ostium re-anastomosis if necessary). Following total circulatory arrest the aortic arch and proximal descending aorta was inspected, and the strategy of the surgical approach was decided. If the aortic arch or descending aorta was involved, the tourniguet around the SVC was tightened and the cannula was replaced into the internal jugular vein via a swan-ganz catheter, and then RVTBP was initiated. Venous flow was maintained to be around 150-300 ml/min. Desaturated blood flowed back into the aortic arch from the cerebral vessels, and was removed from the aorta by a sump sucker and was returned to the pump. This technique provides excellent exposure of the aortic arch and proximal descending aorta. After the descending and aortic arch anastomosis were completed, the aorta was filled with desaturated blood, and the arterial cannula was inserted into the neo-aorta (aortic graft). The head was shaken by the anesthesiologist to dislodge any trapped air, and systemic perfusion was restarted. At this point rewarming was begun, while proximal anastomosis was completed. Autotransfusion and hemofiltration were used routinely in all cases. Autologuous fresh blood, which was prepared by plasmapheresis, was transfused to the patient following cessation of the cardiopulmonary bypass and protamin sulfate infusion.

RESULTS

Nine postoperative deaths (26.47%) occured. Six of these were patients requiring emergency operations. The first patient, who was in cardiogenic shock, underwent ascending aorta and arch replacement. Cerebral protection was achieved by hypothermic total circulatory arrest (HCA). The patient died on the second postoperative day from low cardiac output. The second patient was also in cardiogenic shock at the time of operation. At operation,

Table 3: Perfusion Parameters

	mean	min.	max.
Bypass Time (min.)	163	120	246
Myocardial Ischemia (min)	72	52	124
RVTBP Time (min)	43.8	10	87
Rectal Temparature (C)	18.5	17	24.6

RVTBP: Retrograde venous total body perfusion the pericardium was filled with hematoma. This patient underwent ascending and aortic arch replacement. The patient was lost on the sixth postoperative day from multiorgan failure. The third patient was admitted to our hospital with acute tubuler necrosis (ATN), Stanford type A dissection extending to the renal artery. Ascending and arcus aorta replacement was performed emergently. Following the operation anuria was established at the 26th postoperative hour, and aortagraphy was repeated. It was observed that the dissection extended to the left iliac artery. He was re-operated emergently, and intraluminal graft interposition into the descending aorta was performed. The patient awoke from the operation neurologically intact, but died of renal failure on the third postoperative day. The fourth patient presented in extremis with an infected pseudoaneursym at the site of previous aortic root enlargement. He underwent BDB with arcus aorta replacement. In the early postoperative period, low cardiac output and ARDS was established. The patient died on the 21st postoperative day. The fifth patient was operated on emergency when somnolonce developed suddenly. He underwent an ascendan, and arcus aorta replacement with elephant trunk inserted into descending aorta. He died in the early post operative period because of low cardiac output. The sixth patient had coldness on his right leg a few hours before admission. Type A dissection was diagnosed following TEE. He underwent ascending with hemiarcus aorta replacement. The patient died on the 7th post operative day from ATN and low cardiac output (Table 4). Three other patients were lost because of acute tubular necrosis.

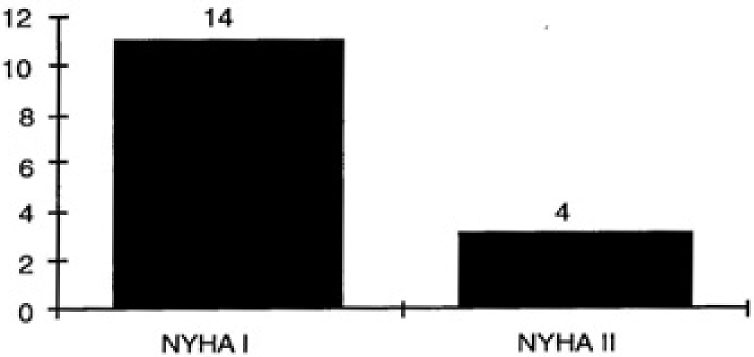
Two patients suffered from neurological events, but these patients had had nerulogical symptoms before the operation. On the following postoperative days neurological sequele regressed spontaneously. Both patients are now well. Minimal residual sequele (right hemiparezis, right facial palsy) was present while they were discharged from the hospital (Table 5). All survivors have been followed up between 3 to 48 months (17.5 patients /year) and are NYHA Class II, and I (Graph 2).

Table 4: Causes of early deaths

	n
Low cardiac output	3
Multiple organ failure	2
Acute tubular necrosis	4
Total	**9**

Table 5: Morbidity

	n
Reoperation secondary to bleeding	2
Right hemiplegia	1
Right facial palsy	1
Peripheral embolism	1
Acute tubular necrosis	1



Graph 2: Postoperative functional capacity of the patients

DISCUSSION

When the acute aortic dissection is known to involve the ascending aorta with or without the proximal portion of the transverse arch, immediate operation is indicated [4]. The only contraindications are advanced age, frailty, severe incurable coexisting disease, and paraplegia [5]. Increased operative risk has been associated with the degree of the dissection, old age, presence of angina, congestive heart failure, renal or pulmonary disease or severe aneurysmal symptoms, including renal -visceral ischemia, neurologic deficits, rupture and tamponade [6]. All the cases in our series had acute Stanford type A dissections and as a result early surgical intervention were performed in all patients. Seven of the 9 patients who died in the early postoperative period were in cardiogenic shock and also one was in pre-shock clinical stiuation. Pre-shock and shock are one of important factors which increases operative mortality. There was only two mortalities in patients who was operated urgently.

Hypothermia with retrograde cerebral and whole body perfusion has made a significant contribution in the surgical treatment of the aortic dissections, and has begun a new period in this field. Analysis of a large series of adult patients undergoing aortic arch operations has demonstrated an increased risk of cerebral complication with more than 40 minutes of hypothermic circulatory arrest. Griepp et. al. [7] noted that the evidence of diffuse cerebral injury was increased in frequency as the time of circulatory arrest approached 60 minutes. However complex aortic procedures may require longer periods of circulatory arrest. A number of strategies have been advocated to increase the safety limit of HCA. These include: treatment with barbiturates [8], corticosteroids, and administration of oxygen free radical scavengers [9] before institution of HCA, use of alpha-stat pH control during cooling and rewarming [10], slow rate of cooling [11], avoidance of hyperglycemia [12] and more recently, retrograde cerabral perfusion through the SVC. Some of the advantages of retrograde cerebral perfusion are: simplicty of use and avoidence of vasculer trauma,[12] excellent exposure, [13] retrograde flow that minimizes embolisation of air and atherosclerotic debris[14], and effective cerebral oxygen delivery[13]. In this series of operations, surviving patients with retrograde cerebral perfusion recovered their consciousness without any neurological sequele. Retrograde cerebral perfusion without cannulation of aortic arch branches provided an excellent operative view, resulted with a shorter aortic arch repair period and a decrease in HCA time.

Elephant trunk technique was used when the dissection extented into the descending aorta or when there was a reentry tear. This technique excluded the neccesiaity of multiple stage aortic procedure and decreased the related complications [15]. In the long term results of this technique, we have not seen any pseudoaneurysm or reaneurysm formation which is an advantage of this technique.

CONCLUSION

We conclude that, recent advances in diagnostic tools such as transesophageal echography, magnetic resonance imaging, and three dimensional computed tomography and progress in surgical materials, and artificial grafts have made signicifiant improvement in our surgical strategies and results.

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