SciDoc Publishers
Infer, Interpret & Inspire Science

OPEN ACCESS

International Journal of Clinical Therapeutics and Diagnosis (IJCTD)
ISSN 2332-2926

Early Results of Ascending Aorta and Aortic Arch Surgery in Albania

Case Report

Likaj E[1*], Kacani A[1], Dumani S[1], Refatllari A[1]

[1] Cardiac Surgery Clinic, University Hospital Centre Mother Theresa, Tirana, Albania.

Abstract

Background: Treatment of aneurysms of the ascending aorta, arch aorta, or both are surgically challenging and has traditionally carried a high hospital mortality rate. The use of refined operative techniques has resulted in reduced hospital mortality rates.

Patients and Methods: We conducted a prospective analysis of consecutive patients who underwent 74 surgical procedures between January 2011 and January 2014, for graft replacement of the ascending aorta or transverse aortic arch. There were 58 men (78.4%) and 16 women (21.6%). The mean age was 55.3±9.8 years (range 30 – 74 years). The etiology was medial degeneration in 44 patients (59.5%), bicuspid aortic pathology in 28 patients (37.8%) and aortic dissection in 2 patients (2.7%). Fifteen patients (20.3%) were operated on an emergency basis for acute aortic dissection.

Results: The ascending aorta was replaced in all 69 patients (93,2%) and plicated in five patients (6.8%). Ascending aorta and aortic arch were replaced in 9 patients (12.1%). 17 patients had only ascended aortic procedure, 35 patients had separate aortic valve and ascending aorta replacement (47.3%), and 18 patients (24.3%) received a valved conduit (Modified Bentall procedure). Concomitant bypass grafting was performed in nine patients.

Mean cross-clamp and bypass times were 115.38±41.19 min and 143.26±55.79 min respectively. The Early hospital mortality rate was 3.38% (2 out of 59 patients) in the elective surgery group and 26.67% in the emergency group (4 out of 15).

Conclusions: Surgery of the ascending aorta and aortic arch can be performed with low morbidity and mortality rates at our clinic in Albania.

Keywords: Ascending Aorta, Aortic Arch, Surgery, Albania, Results, Circulatory Arrest.

***Corresponding Author**:
Ermal Likaj,
Cardiac Surgery Clinic, University Hospital Centre Mother Theresa, Tirana, Albania.
E-mail: likajermal@gmail.com

Received: September 26, 2014
Accepted: October 14, 2014
Published: October 15, 2014

Citation: Likaj E, Kacani A, Dumani S, Refatllari A (2014) Early Results of Ascending Aorta and Aortic Arch Surgery in Albania. Int J Clin Ther Diagn. 2(6), 64-69. **doi: http://dx.doi.org/10.19070/2332-2926-1400013**

Background

Treatment of aneurysms of the ascending aorta, arch aorta, or both are surgically challenging and has traditionally carried a high hospital mortality rate [1-5]. The development of low porosity or impermeable grafts [6], the introduction of hypothermic circulatory arrest with anterograde or retrograde cerebral perfusion [7], enhanced intraoperative myocardial protection, and improved hematologic treatment have resulted in reduced hospital mortality and morbidity rates. Moreover, advances in diagnostic studies, like, computed tomographic scanning [8,9], magnetic resonance imaging [10,11] and transesophageal echocardiography [12,13], as well as better patient selection have contributed to improved results [14].

Patients and Methods

Patient Population

We conducted a prospective analysis of 74 consecutive patients who underwent surgical procedures for graft replacement of the ascending aorta or transverse aortic arch in the period between January 2011 and January 2014. We used different types of statistical tests to analyze the data: Mann Whitney test, Chi Square test and Logistic Binary Regression test (for odds ratio).

In this patient population there were 58 men (78.4%) and 16 women (21.6%). The mean age was 55.3±9.8 years (range 30 – 74 years). Minimal age was 30 years (1 patient) and maximal age was 74 years (1 patient). Etiology of the aneurysm was medial degeneration in 44 patients (59.5%), bicuspid aortic pathology in 28 patients (37.8%) and aortic dissection in 2 patients (2.7%). Fifteen patients (20.3%) were operated on an emergency basis for aortic dissection. Other data related to this patient cohort are shown in the following table 1.

We can highlight that the prevalence of smoking was 21.6% and the prevalence of arterial hypertension was, as expected, much higher up to 63.5%. On the other hand 6.8% of the patients suffered from diabetes mellitus and 12.2% from dislipidemia.

Table 1. Preoperative characteristics of the patient population

Characteristic	Patients	
	Number	Percentage
Mean Age	55.3 ± 9.8	
Age Group		
30-39 years	5	6.8
40-49 years	14	18.9
50-59 years	25	33.8
60-69 years	27	36.5
≥70 years	3	4.1
Sex		
Male	58	78.4
Female	16	21.6
Surgery		
Elective	59	79.7
Emergency	15	20.3
Etiology		
Degenerative	44	59.5
Bicuspidia	28	37.8
Dissection	2	2.7
Diabetes Mellitus	5	6.8
Arterial hypertension	47	63.5
Smoking	16	21.6
Low ejection fraction	7	9.5
Dilated left ventricle	31	41.9
Aortic valve		
Stenosis	27	36.5
Regurgitation	44	59.5
Both	11	14.9
Coronary disease	9	12.2
Aortic arch involvement	9	12.2

Most of the patient was diagnosed with an aneurysm of the thoracic aorta because of the aortic valve pathology related symptoms. In the following table 2 are shown the causes which brought to a diagnosis of ascending aorta aneurysm.

Table 2. Patient distribution according to the cause of diagnosis

Data	Number	Percentage
History		
Aortic stenosis	23	31.1
Aortic regurgitation	24	32.4
Routine check up	5	6.8
Dissection	13	17.6
Arrhythmias	3	4.1
CAD	3	4.1
Pain	2	2.7
Coarctation	1	1.4

CAD: Coronary Artery Disease

Operative technique

Median sternotomy where the surgical approach of choice in all patients, except two of them, in whom was released partial sternotomy "J" to the fourth intercostal space. Arterial calculation was done in the distal ascending aorta, femoral artery or axillary artery, depending on the extent of the pathology and the venous cannulation was achieved via the right atrial appendage with a dual stage cannula. Moderate hypothermia in 30º C was generally used during the extracorporeal circulation. In cases of hypothermia circulatory arrest with retrograde cerebral perfusion the body was cooled down to 18º C, and in cases with anterograde cerebral perfusion to 24-26º C. Anterograde mixed cold blood cardioplegia was used as myocardial protection every 20 minutes.

The choice of the surgical technique was done according to the extent of the aneurysmal disease, involvement of the coronary sinuses in the process and the situation of the aortic valve. In case of a normal aortic valve, we replaced only the ascending aorta with a prosthetic graft. If the coronary sinuses were not dilated, separate replacement of the aortic valve and ascending aorta was done. The basic procedure applied when we had to deal with the aortic root was the modified Bentall procedure. In some cases we replaced also totally or partially the aortic arch due to its involvement in the pathology (dilatation or dissection).

Results

Operative data

The ascending aorta was replaced in 69 patients (93,2%) and plicated in 5 patients (6.8%). Ascending aorta and aortic arch were replaced in 9 patients (12.1%). 17 patients had only ascended aortic procedure, 35 patients had separate aortic valve and ascending aorta replacement (47.3%), and 18 patients (24.3%) received a valved conduit (Modified Bentall procedure). Concomitant bypass grafting was performed in 9 patients.

Mean cross-clamp and cardiopulmonary bypass times were 115.38±41.19 min and 143.26±55.79 min respectively.

Hospital Morbidity Rate

The main complications observed in the immediate postoperative period are shown in the following table 4.

We had also a case of acute cardiac tamponade and one case of gastric perforation.

In the following table 5 are shown relationships between some of the complications and selected variables calculated by logistic binary regression test.

Hospital Mortality Rate

The hospital mortality rate was 3.38% (2 out of 59 patients) in the elective surgery group, 26.67% in the emergency group (4 out of 15) and the overall hospital mortality was 8,1% (6 out of 74 patients). In the following table 6 are shown the causes of in-hospital deaths.

In the following table 7 are shown the risk factors for early hospital mortality, according to the statistical analysis with the binary logistic regression test.

We can note that the main predictive factors for early mortality are long cross-clamp and bypass times, low hematocritis during extracorporeal circulation, circulatory arrest application and its prolonged time.

Table 3. Patient distribution according to the operational data

Variable	Total	Sex		P value
		Male	Female	
Cannulation				0.158 †
Femoral	14 (16.6) *	10 (17.9)	4 (12.5)	
Aortic	57 (79.2)	45 (80.4)	12 (75.0)	
Auxiliary	3 (4.2)	1 (1.8)	2 (12.5)	
Surgical Procedure				0.036
Ascending aorta replacement	17 (23.0)	9 (15.5)	8 (50.0)	
Asc. aorta+ Aortic valve replacement	35 (47.3)	30 (51.7)	5 (31.3)	
Modified Bentall Procedure	18 (24.3)	16 (27.6)	2 (12.5)	
David Procedure	2 (2.7)	1 (1.7)	1 (6.3)	
Right coronary sinus resection	2 (2.7)	2 (3.4)	0 (0.0)	
Arch involvement	65 (87.8)	51 (87.9)	14 (87.5)	0.963
No	9 (12.2)	7 (12.1)	2 (12.5)	
Yes				
Combined procedure (CABG)				0.093
No	65 (87.8)	49 (84.5)	16 (100.0)	
Yes	9 (12.2)	9 (15.5)	0 (0.0)	

* Number of individuals and percentage in brackets, † P value according to chi square test
CABG: coronary artery bypass grafting

Table 4. Postoperative complications in total and divided according to sex

Variable	Total	Sex		P value
		Male	Female	
Arrhythmia (AF)				0.888†
No	61 (82.4) *	48 (82.8)	13 (81.3)	
Yes	13 (17.6)	10 (17.2)	3 (18.8)	
Complete AV block				0.353
No	71 (95.9)	55 (94.8)	16 (100.0)	
Yes	3 (4.1)	3 (5.2)	0 (0.0)	
Low cardiac output				0.301
No	69 (93.2)	55 (94.8)	14 (87.5)	
Yes	5 (6.8)	3 (5.2)	2 (12.5)	
Stroke				0.615
No	71 (95.9)	56 (96.6)	15 (93.8)	
Yes	3 (4.1)	2 (3.4)	1 (6.3)	
Cerebral edema				0.301
No	69 (93.2)	55 (94.8)	14 (87.5)	
Yes	5 (6.8)	3 (5.2)	2 (12.5)	
Mediastinitis				0.353
No	71 (95.9)	55 (94.8)	16 (100.0)	
Yes	3 (4.1)	3 (5.2)	0 (0.0)	
Respiratory failure				0.093
No	65 (87.8)	49 (84.5)	16 (100.0)	
Yes	9 (12.2)	9 (15.5)	0 (0.0)	
Renal failure				0.353
No	71 (95.9)	55 (94.8)	16 (100.0)	
Yes	3 (4.1)	3 (5.2)	0 (0.0)	
Revision for bleeding				0.451
No	72 (97.3)	56 (96.6)	16 (100.0)	
Yes	2 (2.7)	2 (3.4)	0 (0.0)	
Pericardial effusion				0.963†
No	65 (87.8) *	51 (87.9)	14 (87.5)	
Yes	9 (12.2)	7 (12.1)	2 (12.5)	

* Number of individuals and percentage in brackets, † P value according to chi square test
AF: Atrial Fibrillation, AV: Atrioventricular

Table 5. Relationship between some of the complications and selected variables

Variable	Low CO	Stroke	Resp. Failure	Medias-tinitis	AF
Age	0.732†	0.211	0.234	0.806	0.305
Sex	0.351	0.533	-	-	0.96
Smoking	0.696	-	0.686	0.825	0.862
Diabetes	-	-	0.138	0.011	0.276
Emergency	0.008	0.046	0.59	0.631	0.243
Low EF	0.433	-	-	-	0.043
Dilated LV	0.345	-	0.91	0.891	0.324
Procedure Asc. Aorta replacement Asc. aorta+aortic valve Bentall operation	 0.74 - -	 0.87 0.265 -	 0.716 0.18 -	 - - -	 - - -
Cross clamp time	0.012	0.108	0.178	0.917	0.694
CPB time	0.009	0.087	0.341	0.151	0.773
Hct	0.008	0.185	0.658	0.85	-
Circulatory arrest **Time of CA**	0.012 0.011	0.035 0.09	0.329 0.598	0.264 0.063	0.021 -

† P value for every variable according to a model adjusted for sex and age AF: atrial fibrillation
LV: left ventricle, Hct: hematocritis, CPB: cardiopulmonary bypass, CA: circulatory arrest

Table 6. Causes of intrahospital deaths

Pts	Age	Sex	Procedure	Diagnosis	Cause of Death
1	66	F	ascending+ arch aorta	Acute dissection	Bleeding
2	52	M	ascending+ arch aorta	Acute dissection	Multiorgan failure
3	64	M	ascending+ arch aorta	chronic dissection	sepsis
4	56	M	ascending+ arch aorta	Acute dissection	stroke, Renal failure
5	45	M	ascending aorta	Aortic aneursym	Intraoperative AMI
6	64	F	ascending aorta	Acute dissection	stroke

Table 7. Relationship between mortality and risk factors (Binar Logistic Regression)

Risk Factors	Model adjusted for age and sex	
	OR (95% CI)	P value
Emergency	19.99 (2.15-185)	0.008
Low ejection fraction	2.09 (0.19-22.85)	0.543
Dilated left ventricle	0.26 (0.03-2.38)	0.231
Cross-clamp time	1.05 (1.01-1.08)	**0.006**
Bypass time	1.05 (1.01-1.08)	**0.008**
Hematocrit during CPB	0.48 (0.29-0.81)	**0.005**
Circulatory arrest		
Yes	24.82 (3.13-196)	0.002
No	1.00 (reference)	
Circulatory arrest time	1.06 (1.02-1.10)	**0.002**
Combined procedure (CABG)	5.85 (0.64-53.22)	0.117
Revision for bleeding	40.8 (1.4-1152)	0.029

OR: Odds Ratio, CI: Confidence Interval

Follow up

Follow up data were collected from 63 patients (92.6%). The follow up ranged from 59 days to 3.17 years with a mean of 16.35±11.77 months. All the patients were examined by echocardiography and some of them by computed tomography. At the completion of the follow up all the hospital survivors (100%) were alive and without any important complications. Two patients had minimal prosthetic leaks and one patient dilatation of the aortic root, without a surgical indication in all of the cases.

Discussion

Early Mortality

Contemporary and modern surgical treatment of the ascending aorta and aortic arch aneurysms has significantly improved early and long term results. But, these results vary according to different authors [1-5]. However, some of the series excludes cohorts of high risk patients [15].

Mortality in elective surgery ranges from 2 to 5% and in emergency surgery goes sometimes beyond 20 % [16]. IRAD consortium which includes a group of studies, reports a dramatic increase up to 20% in the early mortality of acute aortic dissection patients [17]. But these results can be highly improved in the excellent surgical centers [7,8,18].

According to these data we can say that we have very good results in elective surgery and acceptable results in emergency surgery for acute aortic dissection. However, the comparison is very difficult because of the heterogeneity of the patient groups. Some of the series does not report emergency cases and redo cases, meanwhile there is a great variation in the arch replacement between the groups.

The main reported cause of hospital mortality is cardiac failure, followed by bleeding and respiratory failure [19-23].

Emergency surgery is the clearest predictive factor for early mortality [24-26]. Other reported predictive factors of hospital mortality include advanced age [22,24,25], long cardiopulmonary bypass time [21,22], previous cardiac operation [23,24] and the need for simultaneous coronary bypass surgery.

We attribute these results to the growing experience of the surgical team, an aggressive treatment in the preoperative and postoperative period and the application of improved surgical techniques. Careful preoperative evaluation of pulmonary function and appropriate medical treatment before surgical intervention has allowed us to treat potential respiratory problems more effectively. The usage of transesophageal echocardiography avoids contrast material in patients with marginal renal function and in cases of acute dissection, it allows for more rapid surgical intervention. In addition, the use of transesophageal echocardiography interpretive aids in selecting the aortic cannulation site, documenting the success of aortic valve repair, assessing the adequacy of daring techniques, and evaluating ventricular function when cardiopulmonary bypass is discontinued.

We prefer the Bentall button technique because it is more anatomically correct and prevents suture line tension. The Bentall button technique for reimplanting the coronary Ostia as opposed to the classic Bentall or Cabrol technique avoids reported complications of false aneurysm formation [27] and graft thrombosis [5,15].

Stroke

Stroke is one of the most important complications of aortic aneurysm surgery associated high morbidity and mortality. We had 3 patients (4.1%) with stroke in the early postoperative period, and it is a good value compared with other groups of patients in the literature.

Nowadays, cerebral protection is considered a key factor in the prevention of stroke after this type of surgery. Although there is a wide consensus that anterograde cerebral perfusion is superior to retrograde perfusion and deep hypothermia, some studies demonstrate that for short periods of time up to 30 minutes, the method of cerebral protection is not important [28,29]. Despite this, our team is oriented in applying as much as possible the selective cerebral perfusion in cases of circulatory arrest. Unfortunately, the number of patients (7 pts with anterograde cerebral perfusion, 3 points with retrograde cerebral perfusion) which underwent circulatory arrest was too small to allow statistical analysis in our series.

Conclusions

Surgery of the ascending aorta and aortic arch can be performed with low morbidity and mortality rates at our clinic in Albania. Surgical techniques include all the spectrums of the routine procedures applied nowadays widely. Avoidance of the modifiable risk factors can also contribute to better early results. Experience is necessary to improve the results in emergency surgery for acute aortic dissection. We have to follow up this population of patients to evaluate long term survival and morbidity.

References

[1]. Ruberti U, Odero A, Arpesani A, et al. Surgical treatment of thoracic aortic aneurysms: personal experience. *J Cardiovasc Surg* 1988;29:245– 6.

[2]. Crawford ES, Svensson LG, Coselli JS, et al. Surgical treatment of aneurysm and/or dissection of the ascending aorta, transverse aortic arch, and ascending aorta and transverse aortic arch. *J Thorac Cardiovasc Surg* 1989;98:659–74.

[3]. Lytle BW, Mahfood SS, Cosgrove DM, Loop FD. Replacement of the ascending aorta: early and late results. *J Thorac Cardiovasc Surg* 1990;99:651–8.

[4]. Skupin M, Blum U, Krause E, et al. Results of surgical repair for 110 thoracic aortic aneurysms. *Thorac Cardiovasc Surg* 1990;38:175– 80.

[5]. Minale C, Splittgerber FH, Wendt G, Messmer BJ. One-stage intrathoracic repair of extended aortic aneurysms. *J Cardiovasc Surg* 1994;9:604–13.

[6]. Griepp RB, Stinson EB, Hollingsworth JF, et al. Prosthetic replacement of the aortic arch. *J Thorac Cardiovasc Surg* 1975;70:1051– 63.

[7]. Klein JJ, Ergin MA. Principles of cerebral protection during operations on the thoracic aorta. In: Franco KL, Verrier ED, Eds. *Advanced Therapy in Cardiac Surgery.* Hamilton, Canada: BC Decker Inc; 2003:291–303.

[8]. Hirose Y, Hamada S, Takamiya M, Imakita S, Naito H, Nishimura T. Aortic aneurysms: growth rates measured with CT. *Radiology* 1992;185:249–52.

[9]. Takasu J, Masuda Y, Watanabe S, et al. Progression and regression of atherosclerotic findings in the descending thoracic aorta detected by enhanced computed tomography. *Atherosclerosis* 1994;110:175– 84.

[10]. Nienaber CA, Spielmann RP, von Kodolitsch Y, et al. Diagnosis of thoracic aortic dissection: magnetic resonance imaging versus transesophageal echocardiography. *Circulation* 1992;85:434–7.

[11]. Link KM, Loehr SP, Baker DM, Lesko NM. Magnetic resonance imaging of the thoracic aorta. *Semin Ultrasound*, CT MR 1993;14:91–105.

[12]. Barzilai B, Marshall WG Jr, Saffitz JE, Kouchoukos NT. Avoidance of embolic complications by ultrasonic characterization of the ascending aorta. *Circulation* 1989;80 (Suppl 1): 275–9.

[13]. Bryan AJ, Barzilai B, Kouchoukos NT. Transesophageal echocardiography

and adult cardiac operations. *Ann Thorac Surg* 1995;59:773–9.

[14]. Cary L. Stowe, Mary A. Baertlein, Mercedes D. Wierman, Michael Rucker and George Ebra. Surgical management of ascending and aortic arch disease: refined techniques with improved results. *Ann Thorac Surg* 1998;66:388-395

[15]. Cohn LH, Rizzo RJ, Adams DH, et al. Reduced mortality and morbidity for ascending aortic aneurysm resection regardless of cause. *Ann Thorac Surg* 1996;62:463– 8.

[16]. Himanshu J. Patel and G. Michael Deeb. Ascending and Arch Aorta: Pathology, Natural History, and Treatment. *Circulation*. 2008;118:188-195

[17]. Mehta RH, Suzuki T, Hagan PG, Bossone E, Gilon D, Llovet A, Maroto LC, Cooper JV, Smith DE, Armstrong WF, Nienaber CA, Eagle KA. Predicting death in patients with acute type A aortic dissection. *Circulation*. 2002;105:200 –206.

[18]. Knipp BS, Deeb GM, Prager RL, Williams CY, Upchurch GR Jr, Patel HJ. A contemporary analysis of outcomes of operative repair of type A aortic dissection in the United States. *Surgery*. 2007;142:524 –528.

[19]. Kouchoukos NT, Wareing TH, Murphy SF, Perrillo JB: Sixteen year experience with aortic root replacement: Results of 172 operations. *Ann Surg* 1991; 214:308.

[20]. Merrill WH, Achuff SC, White RI Jr, et al: Late false aneurysm following replacement of ascending aorta: The problem of the Teflon graft in combination with a silk suture anastomosis. *Ann Thorac Surg* 1985; 39:271.

[21]. Lewis CT, Cooley DA, Murphy MC, et al: Surgical repair of aortic root aneurysms in 280 patients. *Ann Thorac Surg* 1992; 53:38.

[22]. Raudkivi PJ, Williams JD, Monro JL, Ross JK: Surgical treatment of the ascending aorta: Fourteen years' experience with 83 patients. *J Thorac Cardiovasc Surg* 1989; 98:675.

[23]. Jault F, Nataf P, Rama A, et al: Chronic disease of the ascending aorta: Surgical treatment and long-term results. *J Thorac Cardiovasc Surg* 1994; 108:747.

[24]. Crawford ES, Svensson LG, Coselli JS, et al: Surgical treatment of aneurysm and/or dissection of the ascending aorta, transverse aortic arch, and ascending aorta and transverse aortic arch: Factors influencing survival in 717 patients. *J Thorac Cardiovasc Surg* 1989; 98:659.

[25]. Ergin MA, Spielvogel D, Apaydin A, et al: Surgical treatment of the dilated ascending aorta: When and how? *Ann Thorac Surg* 1999; 67:1834.

[26]. Vogt PR, Turina MI: Management of infected aortic grafts: Development of less invasive surgery using cryopreserved homografts. *Ann Thorac Surg* 1999; 67:1986.

[27]. Marvasti MA, Parker FB Jr, Randall PA, Witwer GA. Composite graft replacement of the ascending aorta and aortic valve: late follow-up with intra-arterial digital subtraction angiography. *J Thorac Cardiovasc Surg* 1988;95:924– 8.

[28]. Svensson LG, Hussain A, Penney DL, et al. A prospective randomized study of neurocognitive function and S-100 protein after antegrade or retrograde brain perfusion with hypothermic arrest for aortic surgery. *J Thorac Cardiovasc Surg* 2000;119:163–6.

[29]. Svensson LG, Nadolny EM, Penney DL, et al. Prospective randomized neurocognitive and S-100 study of hypothermia circulatory arrest, retrograde brain perfusion, and antegrade brain perfusion for aortic arch operations. *Ann Thorac Surg* 2001;71:1905–12.