

Short-term outcomes in patients undergoing ascending aortic aneurysm and aortic valve replacement

Edlira Rruçi¹, Edvin Prifti¹

¹University Hospital Center “Mother Teresa”, Tirana, Albania.

Corresponding author: Edlira Rruçi, MD;
Address: Rr. “Dibres”, No. 371, Tirana, Albania
Telephone: 00355672084378; E-mail: edlirarruci@hotmail.com

Abstract

Aim: The aim of this study was twofold: i) to assess the early and mid-term outcomes, morbidity and major postoperative complications in Albanian patients undergoing surgery for combined ascending aortic aneurysm and aortic valve replacement, and; ii) to identify the predictors for mortality, morbidity and overall survival in this pool of patients.

Methods: From March 2006 to September 2014, in Tirana, there were 70 patients who underwent surgery for combined ascending aortic aneurysm and aortic valve replacement or ascending aortic aneurysm only. All patients’ data were collected retrospectively from operative records of the Statistics Unit of the University Hospital Center “Mother Teresa” in Tirana.

Results: Mean age of the patients was 54.1±12.5 years. Atherosclerosis was the most frequent cause of aortic aneurysm (50 patients, or 71.4%) followed by acute aortic dissection (18 patients, or 25.7%) and infective etiology (2 patients, or 2.9%). Overall, 21 (30.0%) patients presented aortic valve stenosis, 12 (17.1%) had bicuspid aortic valve, 29 (41.4%) had aortic valve regurgitation and 8 (11.5%) of the patients presented with combined stenosis and regurgitation of aortic valve. Five patients (7.1% of the total) underwent surgery for ascending aortic aneurysm and CoAo – operated in a single stage procedure.

Conclusion: Our study, involving a sufficient pool of patients, indicates that the ascending aortic aneurysm treated in the centers of cardiac surgery in Albania exhibit early and mid-term outcomes similar to those observed in other cardiac surgery clinics in some European countries and beyond.

Keywords: ascending aorta, aortic valve replacement, cardiac surgery.

Introduction

Mueller and associates combined allograft insertion with aortic valve repair in 1960 in a patient with Marfan syndrome (1). As the need for conduits grew, attention was shifted to the development of a suitable artificial conduit. Dacron was subsequently introduced by DeBakey, who discovered it in a Houston department store, and it soon became the artificial conduit of choice for aortic replacement (2). Technical improvements in graft replacements included the impregnation of these polyester grafts with albumin, collagen, or gelatin, which has greatly reduced the blood loss through the grafts (2). Replacement of the supracoronary ascending aorta with a synthetic graft and separate mechanical aortic valve replacement was performed by Starr and colleagues in 1963 (3).

Replacement of the ascending aorta with artificial conduit and the aortic valve simultaneously was attempted also by Wheat and colleagues in 1964 when they resected the ascending aorta and entire root except for the aortic tissue surrounding the coronary arteries (4).

There are very few studies conducted in Albania regarding the surgery for combined ascending aortic aneurysm and aortic valve replacement. After the breakdown of communist regime in 1990, Albania has been undergoing a difficult period of political and socioeconomic transition towards a market-oriented economy, which is characterized by a sharp increase in non-communicable diseases including cardiovascular disease mainly related to unhealthy lifestyle (5,6).

The aim of this study was twofold: i) to assess the early and mid-term outcomes, morbidity and major postoperative complications in Albanian patients undergoing surgery for combined ascending aortic aneurysm and aortic valve replacement, and; ii) to identify the predictors for mortality, morbidity and overall survival in this pool of patients.

Methods

From March 2006 to September 2014, in Tirana, there were 70 patients who underwent surgery for combined ascending aortic aneurysm and aortic valve replacement or ascending aortic aneurysm only. Aortic root was normal. This pool of patients included all the available treating techniques and associative procedures. Patients' data were collected retrospectively from operative records of the Statistics Unit of the University Hospital Center "Mother Teresa" in Tirana.

Patients with documented ascending aortic dilatation, or ascending aortic aneurysm underwent surgical treatment if the diameter of ascending aorta was >5.5 cm; elective surgery was performed for a diameter from 4.0 cm to 5.0 cm and a growth rate of >0.5 cm/year. Separate valve and ascending aortic replacement was performed in patients without significant root dilatation. All the patients included in this study underwent transthoracic color doppler echocardiography and CT-scan before surgery.

The diameters of coronary sinus, sinotubular junction, tubular portion and proximal arch were measured through CT images and echocardiography.

Patients' characteristics

Mean age of this study sample was 54.1 ± 12.5 years. In this series of 70 patients, atherosclerosis was the most frequent cause of aortic aneurysm (50 patients, or 71.4%) followed by acute aortic dissection (18 patients, or 25.7%) and infective etiology (2 patients, or 2.9%) [Table 1]. Overall, 21 (30.0%) patients presented aortic valve stenosis, 12 (17.1%) had bicuspid aortic valve, 29 (41.4%) had aortic valve regurgitation and 8 (11.5%) of the patients presented with combined stenosis and regurgitation of aortic valve. Five patients (7.1% of the total) underwent surgery for ascending aortic aneurysm and CoAo – operated in a single stage procedure (Table 1).

Table 1. Selected characteristics of the patients included in the study (N=70)

Characteristic	Number	Percentage
Cause of aortic aneurysm:		
Atherosclerosis	50	71.4
Acute aortic dissection	18	25.7
Infective etiology	2	2.9
Type of disorder:		
Aortic valve stenosis	21	30.0
Bicuspid aortic valve	12	17.1
Aortic valve regurgitation	29	41.4
Stenosis and regurgitation of aortic valve	8	11.5
Surgery for ascending aortic aneurysm and CoAo:		
Yes	65	92.9
No	5	7.1

Surgical technique

Median sternotomy under general anesthesia was performed in all patients. The ascending aorta was cannulated in the majority of the patients. Femoral arterial cannulation was done for the patients who had aortic dissection, or if the aneurysm of the ascending aorta extended to the aortic arch, and also for the majority of re-operations. A two-stage cannula was used for venous cannulation via the right atrium except in a few patients whose femoral vein was cannulated due to an emergency status. After establishment of cardiopulmonary bypass (CPB), blood or crystalloid cold cardioplegia and moderate hypothermia were applied to achieve cardiac arrest. Deep hypothermia was induced in five patients who had aortic arch involvement. When the aortic valve and root were normal, patients underwent surgery for ascending aortic aneurism and associative procedures. When we found aortic valve not normal, aortic root normal and ascending aortic aneurism, patients underwent surgery for aortic valve replacement and ascending aortic aneurism

Anaesthesia consisted of propofol (3mg/kg/h) combined with fentanyl 20-30 mcg/kg and pancuronium 0.1mg/kg. Median sternotomy was the surgical approach of choice in all patients, arterial

cannulation was done in the distal ascending, 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 30° C was generally used during the extracorporeal circulation. In cases of hypothermic circulatory arrest with retrograde cerebral perfusion, the body was cooled down to 18° C, and in cases with antegrade cerebral perfusion to 24-26° C. Anterograde-mixed cold blood cardioplegia was used as myocardial protection every 20 minutes. The choice of surgical technique was separate replacement of the aortic valve and ascending aorta was done. After clamping the ascending aorta, a longitudinal aortotomy was made and extended near the sinuses of aorta. Subsequently, the native aortic valve was replaced with prosthetic mechanical/biologic aortic valve with a series of pledgeted matters sutures with 2-0 Ethibond. Next, after the anastomosed proximal side, the distal ascending aorta was transected and anastomosed to the aortic graft with continuous 3/0-4/0 Prolene suture and in most cases reinforced by a strip of teflon felt placed outside of the aorta.

In this study there were included all the kinds of techniques as follows:

- Ascending aortic replacement + AVR + CABG in 6 patients (6.67%);
- Ascending aortic replacement + CABG in 6 patients (6.67%);
- Ascending aortic replacement + aortic arch replacement in 4 patients (4.4%);
- Ascending aortic replacement + hemiarch replacement in 9 patients (10%);
- Ascending aortic replacement + AVR + mitral valve repair in 1 patient (1.1%);
- Ascending aortic replacement + MVR in 1 patient (1.1%);
- Ascending aortic replacement + AVR + MVR in 2 patients (2.2%);
- Ascending aortic replacement + CABG + AVR + hemiarch replacement in 1 patient (1.1%);
- Ascending aortic replacement + aortic coarctation in 4 patients (4.4%);
- Ascending aortic replacement + AVR + aortic coarctation in 1 patient (1.1%);
- Ascending aortic replacement + aortic valve repair in 1 patient (1.1%).

Perioperative data included low cardiac output incidence, intensive care unit stay, complications and early death were determined.

The survival status was determined by contacting all patients via telephone. Clinical follow-up data were obtained by means of direct contact with the patients, parents, their referring cardiologist and family physicians. The first control visit was performed within one year after surgery. Duration of the follow-up period was 38 ± 29 months. Mortality during the follow-up period involved nine patients. All contacted survivors underwent transthoracic color dopler echocardiography.

Statistical analysis

The statistical analysis was performed through STATISTICA program and Microsoft Excel. The univariate analysis was performed to assess selected risk factors for early and overall mortality. The multivariate logistic regression model was employed for the early mortality analysis. The

multivariate Cox regression analysis was performed to determine independent variables associated with overall death during the follow-up period. Long-term survival rates were calculated using the Kaplan-Meier method and the statistical significance was assessed by the log rank test. A p-value ≤ 0.05 was considered as statistically significant in all cases.

Results

The overall hospital mortality consisted of 7 (7.8%) patients. As for the morbidity, the most frequent complication was the atrial fibrillation which was evident in 20 (22.2%) patients. Nine patients (10%) experienced postoperative renal complications; further 12 patients had neurological complications (cerebral edema and coma); and eight patients had respiratory complications. Conversely, seven patients underwent reoperation for bleeding.

The univariate analysis between survived patients and deaths revealed aortic dissection and CA >40 min as strong predictors of in-hospital mortality. The incidence of perioperative renal failure, neurological complications, sepsis, heart failure and MOF were significantly higher in patients with CA >40 min, in patients who underwent associative procedures and in those with total aortic arch replacement.

Aortic dissection was the most important factor for early hospital mortality. All of these patients (five cases) had combined surgery of the aortic arch. One of them died from multi-organ failure. One patient died from renal failure. One patient died because of postoperative bleeding. The fourth patient died from neurological complications. One patient died eight days from the operation after extubation from sepsis and the last one from ventricular fibrillation.

Patients with aortic aneurysm had a mean survival time greater than those with dissection of ascending aorta. Patients who had ascending aortic surgery with or without AVR had a greater survival time compared to the patients who had root

interventions. Yet, this finding was not statistically significant.

On the other hand, there was a significant association between mortality and CA>40, where patients with CA>40 had a risk of death twice as high as those with CA<40.

However, the operative technique did not affect the incidence of complications and the overall mortality ($P>0.05$).

Discussion

Even in the current time of advanced surgical procedures and alternative endovascular techniques for the treatment of aortic pathologies, ascending aortic aneurysm remains a challenging problem for every cardiac surgeon. Although graft replacement for an ascending aortic aneurysm is now performed relatively safely and remains the accepted surgical procedure, we cannot ignore the hospital mortality rate of 4.5% to 20% and the morbidity related to such extended operations.

The introduction of all techniques due to surgeons' experience has improved significantly the postoperative outcome, providing satisfactory early and mid-term results, especially in patients with aortic dissection (7). As shown in this study, there were 70 patients who underwent surgery for ascending aortic aneurysm and associative procedures with a 4:1 male/female ratio, similar to other studies conducted elsewhere (7).

The overall hospital mortality in our study was 7.8%, which is similar to the reported series of patients undergoing these surgical procedures in other studies

Conflicts of interest: None declared.

References

1. Mueller WH, Dammann FJ, Warren WD. Surgical correction of cardiovascular deformities in Marfan's syndrome. *Ann Surg* 1960;152:506.
2. Westaby S, Cecil B. Surgery of the thoracic aorta, in Westaby S (ed): *Landmarks in Cardiac Surgery*. Oxford, Isis Medical Media; 1997:223.
3. Starr A, Edwards ML, McCord CW, Griswold HE. Aortic replacement. *Circulation* 1963;27:779-83.
4. Wheat MW, Wilson JR, Bartley TD. Successful replacement of the entire ascending aorta and aortic valve. *JAMA* 1964;188:717-9.

(7). Mortality in elective surgery ranges from 2% to 5% and in emergency surgery it goes sometimes beyond 20% (7). IRAD consortium which includes a group of studies reports a dramatic increase up to 20% in the early mortality of acute aortic dissection patients (7). But, these results can be highly improved in the excellent surgical centers. We observed that the postoperative morbidity was strongly correlated with a long circulatory arrest, aortic dissection and extended surgical procedure to the aortic arch.

In the reported series of patients, presence of aortic dissection and a long circulatory arrest were strong predictors of early death like in Bachet study (8). Also, strong predictors for an operation with negative feedback are aortic dissection, total arch replacement, chronic renal failure and patients who undergo similar associative procedures.

In our study, the multivariate analysis revealed the presence of preoperative aortic dissection, chronic renal failure, total aortic arch replacement and long circulatory arrest as strong predictors for overall survival. Such predictors seem to be similar to the findings of other studies conducted elsewhere, although with some differences (7).

We may conclude that, based on the reported indexes, our study is similar compared to other studies in the international literature (7). This study, involving a sufficient pool of patients, indicates that the ascending aortic aneurysm treated in the centers of cardiac surgery in Albania exhibit early and mid-term outcomes similar to those observed in other cardiac surgery clinics in some European countries and beyond.

5. Albanian Institute of Public Health. National health report: Health status of the Albanian population. Tirana, Albania; 2014.
6. Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Database. Seattle, WA: IHME, University of Washington, 2014. [http:// www.healthdata.org](http://www.healthdata.org) (Accessed: May 13, 2017).
7. Prifti E. “Akti i kardiokirurgjise” (Aneurizmat e aortes dhe problem të tjera kirurgjikale të enëve të gjakut). Tirana Albania; 2016. [In Albanian] p. 320-37.
8. Bentall H, De Bono A. A technique for complete replacement of the ascending aorta. *Thorax* 1968;23:338-9.