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ORIGINAL ARTICLES

Aortic Valve Surgery in Patients Over 75 Years Old: Early Results and Predictors of Hospital Mortality

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Abstract

Background: Aortic valve surgery is the most essential part of worldwide heart valve surgery. In recent decades, the patient profile has changed even in our country, with the age of patients undergoing aortic valve surgery increasing significantly.

The primary objectives of this study are the early results of aortic valve replacement surgery in patients over 75 years old and the negative predictors that affect hospital mortality.

Materials and Methods: This is a retrospective study of 73 patients over 75 who underwent aortic valve surgery in 2014-2021 in our Cardiac Surgery Service, University Hospital Center "Mother Theresa" in Tirana. The patients' data regarding demographic, preoperative, operative, and postoperative variables were collected from the hospital's medical records. The data are presented in mean values and standard deviation. T-test and chi-squared test are also used.

Results: This study involved 73 patients, 50 males and 23 females. The age range was 75-85, averaging 77.12±2.31 years. Hospital mortality was 4.1%. The incidence of major perioperative complications such as low cardiac output, stroke, respiratory problems, bleeding, atrial fibrillation, wound infection, and conduction disturbances was 6.8%, 2.7 %, 4.1%, 2.7 %, 21.9 %, 2.6%, and 4.2 %.

Conclusions: Aortic valve surgery can be safely performed in elderly patients over 75. However, concomitant procedures, prolonged extracorporeal circulation, and emergency interventions are associated with a higher operative risk.

Keywords: Aortic valve surgery, aortic prosthesis, aortic valve, elderly

Introduction

In our country, aortic valve surgery is the most common type of heart valve surgery. Rheumatic aortic valve disease, which primarily affects those under 60-th, was the most prevalent valvular disease until a few decades ago. Even in our country, the patient demographic for aortic valve surgery has changed, with older patients now receiving the treatment as a result of increased life expectancies and lifestyle changes. The patient's old age has always been a standard risk factor of intervention, and new, less invasive treatment methods are introduced for this group of patients. The study will present the early results and risk factors of aortic valve replacement in patients 75 or older.

Materials and Methods

This retrospective study included 73 patients over 75 who underwent aortic valve replacement surgery between 2014 and 2021 at the Cardiac Surgery Service, University Hospital Center "Mother Teresa," Tirana, Albania. The data was collected from the operating room registers and the corresponding medical records. The study collected information on each patient's generalities, admission diagnosis, clinical diagnosis, urgency of treatment, comorbidities, intensive care unit (ICU) stay duration,

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follow-up, and common post-surgery complications like arrhythmias, infections, respiratory issues, stroke, and conduction abnormalities. The data are presented in mean values and standard deviation. T-test and chi-squared test are also used. The study aims to show the early outcomes of aortic valve replacement in patients aged 75 and older.

Results

Our group includes 73 patients: 50 (68.5%) are male, and 23 (31.5%) are female. The age range is 75-85, averaging 77.12±2.31 years. 81% of patients underwent elective surgery, while 19% underwent urgent

This study assessed the following comorbidities: obesity, coronary artery disease, diabetes mellitus, lung disease, and renal disease. Diabetes mellitus, coronary artery disease, and arterial hypertension were the three most prevalent comorbidities seen in this cohort (Table 1). Echocardiography is the primary diagnostic tool. The echocardiographic data are presented in Table 2.

General Data		**No**	**%**
Mean Age 77.12±2.31			
Gender	M	50	68.5 %
	F	23	31.5%
NYHA	1	4	5.6%
	2	24	33.8%
	3	40	56.3%
	4	3	4.2%
Admission	Urgent	14	19%
	Elective	59	81%
Smoking		9	12.3%
Hypertension		61	83.6%
Renal disease		1	1.4%
Diabetes		14	19.2%
Peripheral arteriopathies		1	1.4%
Obesity		5	6.8%
Coronary artery disease		37	50.4 %
Carotid disease		5	6.8%

Table 1. Epidemiologic data

	N	**Average**	**SD**	**Minimum**	**Maximum**
	Valid				
Ejection fraction	59	58.93	11.10	25.00	74.00
Annulus mm	57	20.86	3.16	1.00	28.00
ThPw	42	13.35	1.81	10.00	19.00
ThS	48	17.55	18.89	11.00	145.00
DtD	43	50.98	8.57	36.00	77.00
DtS	30	36.00	8.45	22.00	54.00
Maximal gradientmmHg	39	86.54	29.67	26.00	163.00
Mean gradient mmHg	66	51.48	16.85	10.00	104.00

ThPw- thickness of the posterior wall, ThS -thickness of septum, DtD-diastolic diameter, DtS-systolic diameter

Table 2. Echocardiographic data

According to the echocardiographic data, the average ejection fraction is 59%, ranging from 25% to 74%; the average annulus diameter is 20.86 mm. The most frequent part of patients was with aortic valve stenosis, and the mean transvalvular gradient was 51.48 mmHg. (Tab. 2)

Concomitant Surgeries	**No**	**Percentage**
CABG	37	50.4
Mitral valve replacement	3	4.1
Ascending aorta replacement	2	2.7

CABG-coronary artery bypass grafting

Table 3. Simultaneous Surgeries

More than half of the patients (50.4%) underwent CABG as a concomitant procedure, which is predicted given the high prevalence of coronary artery disease in this age range. Mitral valve replacement was performed in three cases, whereas ascending aorta replacement was performed in two cases. (Tab. 3)

Grafts	**No**	**Percentage**
LIMA	30	81.1 %
VSM	29	79.1 %
Radial artery	2	5.4 %

Arterial and venous grafts used in CABG: LIMA-left anterior mammary artery VSM-vena saphenous Magna

Table 4. Bypass conduits used

Extensive use of LIMA was observed in 30 cases (81.1%) and VSM in 29 cases (39.7%), while the radial artery was involved in two cases. (Tab.4)

The average duration of hospital stay is 10.67 days, with values ranging from 5 to 26 days, whereas the average stay in the intensive care unit is 64.71 hours. (Tab.5)

We analyzed the following postoperative complications: mortality, conduction abnormalities, low cardiac output, myocardial infarction, wound infection, atrial fibrillation, bleeding, renal failure, pulmonary disease, and stroke.

The hospital mortality rate was 4.1%, which is pretty acceptable given their advanced age, comorbidities, and concomitant procedures.

The complications are listed in the above table as follows: Low cardiac output 6.8%, stroke 2.7%, pulmonary disease 4.1%, bleeding 2.7%, Atrial fibrillation 21.9%, and wound infection 2.7 %. One patient was supported with IABC. This analysis demonstrated that the most frequent postoperative complication is atrial fibrillation. (Tab.6)

	N Valid	Average	SD	Minimum	Maximum
Hours in ICU		64.71	68.41	9.00	384.00
Hospital Stay-days	21	10.67	5.24	6.00	26.00
Postoperative days	71	9.99	5.30	6.00	40.00
Respiratory assistance-hours	73	23.58	54.85	4.00	384.00

ICU-intensive care unit

Table 5. Postoperative times

Complications	No	Percentage %
Mortality	3	4.1
Myocardial infarction	0	.0
Low cardiac output	5	6.8
Stroke	2	2.7
Pulmonary disease	3	4.1
Renal failure	0	.0
Hemorrhage	2	2.7
VA	0	.0
Atrial fibrillation	16	21.9
Wound infection	2	2.7
Conduction abnormalities	3	4.1
Low cardiac output	5	6.8
IABC	1	1.4

IABC-intra aortic balloon counter pulsation, VA-ventricular arrhythmias

Table 6. Postoperative complications.

Respiratory assistance and extracorporeal circulation are risk factors for mortality. Mortality was unaffected by ejection fraction.

Patients with fatalities had an average of 148.33 hours in respiratory assistance compared to 18.23 in the surviving group. The average time of extracorporeal circulation in patients with fatalities was 148.33 min, while the average time in surviving patients was 107.32 min. No significant correlation was found with other parameters. (Tab.7)

No significant correlation was found between the group with low EF (EF<60) and the group with normal EF for any of the above variables. (Tab.8, 9)

Variables	Deaths	N	Average	SD	t	df	p
Postoperative days	yes	2	12.50	4.95	.678	69	.500
	no	69	9.91	5.33	□		□
Respiratory assistance	yes	3	148.33	204.61	4.537	71	.000
	no	70	18.23	34.93	□		□
Extracorporeal circulation	yes	2	148.50	7.78	2.034	62	.046
	no	62	107.32	28.40	□		□
Ischemic heart time	yes	3	106.00	32.45	1.233	64	.222
	no	63	86.06	27.19	□		□
Ejection fraction	yes	3	60.00	5.00	.170	57	.866
	no	56	58.88	11.36	□	□	□

Table 7. Statistical analysis of negative predictors in mortality

Variables	Calcified annulus n=48	Non-Calcified Annulus n=25	p*
Postoperative days	9.96±5.46	10.04±5.09	.950
Respiratory assistance	30.06±66.77	11.12±7.06	.058
Hours in ICU	73.40±82.15	48.04±19.57	.047
Extracorporeal circulation	106.52±30.59	112.59±25.49	.429
Ischemic heart time	85.39±28.49	90.14±25.69	.498
Urgency	18 (72.0)	7 (28.0)	.143**

**t-test; ** chi-square test*

Table 8. Univariable analysis of calcified annulus

Variables	EF<60 n=17	EF>60 n=42	p*
Postoperative days	11.71±8.08	9.54±4.18	183
Respiratory assistance	30.769±61.93	24.55±60.79	.725
Hours in ICU	83.71±99.44	61.64±62.96	.406
Extracorporeal circulation	119.07±24.43	104.66±32.18	.124
Ischemic heart time	89.56±26.94	84.82±29.25	.579
Urgency	5 (29.4)	4 (9.5)	.068**

**t-test; ** chi-square test*

Table 9. Univariable analysis of EF.

Discussion

The decision between conservative treatment and open-heart surgery for this age group is challenging for both the patient and the surgeon. The number of valve operations performed at these ages in many countries has increased [1]. Age as a particular risk factor is not a contraindication, even though these patients are relatively old [2]. Numerous studies [3,4,5,6] have shown that operations in this age group have a higher but acceptable risk compared to younger patients and can be performed with good postoperative outcomes.

In our study, the early mortality rate, within 30 days after intervention, was 4.1% and is satisfactory compared to some studies [3, 6, 7, 8]. Even though low EF and emergency intervention affect early mortality [1, 3], our analysis found no statistical correlation between these predictors and mortality. In the literature, NYHA-class of 3-4, small surface body, EF <40%, and emergency intervention [1, 2, 3, 4, 9] are reported as negative predictors of mortality. In our study, the negative predictors of mortality are prolonged respiratory assistance and extracorporeal circulation.

The most common concomitant procedure in aortic valve surgery is CABG, performed in 50.4% of patients, with significant use of LIMA in 81.1% of cases. According to the literature, the concomitant procedure significantly influences mortality [6, 8]. Concomitant surgeries did not significantly correlate with mortality in our investigation. Additionally, it was noted that patients with NYHA class 3-4 who survived the operation had a satisfactory quality of life, whereas NYHA decreased significantly, with an acceptable mortality rate.

Revascularization with CABG has enhanced the recovery [6, 8]. Only one patient received IABC support even though five patients (6.8%) had low cardiac output. In specific investigations, the intra-aortic balloon independently predicts early mortality [3, 4]. Low cardiac output lengthened hospital stays, ICU stays, and hours of respiratory assistance.

Atrial fibrillation was the most frequent postoperative complication (21.9%), and some studies showed that the onset of atrial fibrillation is caused by low EF, old age, high transvalvular gradients, and the thickness of the interventricular septum [10, 11, 12].

Over the past ten years, numerous studies have shown the short- and long-term benefits of transcatheter aortic valve implantation (TAVI) and open-heart aortic valve surgery. For older patients with severe symptomatic aortic stenosis who are either inoperable or highly at risk for surgery, TAVI represents a novel and comprehensive alternative treatment [13, 14, 15, 16].

Although the procedure's safety and effectiveness have been proven thus far, advancements in transcatheter valve technology, process outcome optimization, and verification of the transcatheter prosthesis' long-term stability are still needed.

Regarding the problems of TAVI, there is also a great deal of uncertainty. Over time, it has been established that the five potential periprocedural problems significantly impact survival following TAVI. The "Big Five" complications are as follows: major vascular complications and hemorrhage; strokes; acute renal failure; conduction abnormalities, most common being complete atrioventricular block necessitating the implantation of a permanent cardiac pacemaker; moderate/severe paravalvular leakage (PVL) [15,16].

TAVI has a decreased morbidity and mortality rate when none of these problems arise.

The term "Big 5" originated among hunters in southern Africa, referring to the five most feared animals that pose a significant threat when encountered on foot. This implies that encountering one of the "Big Five" complications during a procedure must be prevented at all costs.

No evidence suggests that TAVI provides more favorable clinical outcomes than open heart surgery [14]. Although the results of the early experience with TAVI are promising, long-term follow-up is necessary before the procedure can be expanded to lower-risk or younger patients. Under these circumstances, the surgical replacement of the aortic valve remains, even today, the right approach for patients over 75 years of age with mild to moderate risk with very satisfactory postoperative outcomes.

Conclusion:

Aortic valve surgery in patients over 75 years of age poses unique challenges for cardiac surgeons globally; however, it can be performed with outstanding results.

COI Statement: This paper has yet to be submitted in parallel, presented fully or partially at a meeting, podium, or congress, published, or submitted for consideration beforehand.

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