Early And Long Term Outcomes Of Aortic Valve Surgery Combined Or Not With Cabg Surgery

Review Article

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Abstract

Objective: The number of patients doing aortic valve surgery with or without CABG (Coronary Artery Bypass Graft) is increasing continuously in our country. The goal of this study is to evaluate the early and long-term results of aortic valve surgery alone or combined with CABG surgery.

Methods: This is a retrospective and prospective study. We included the patients underwent aortic valve surgery (replacement or another procedure) with or without CABG from January 2007 to January 2013 . The population of 330 patients is divided into two groups: Group I included 81 patients combined surgery; Group II included 249 patients with isolated aortic valve surgery. In the early results we referred hospital mortality and perioperative complications. The follow-up time is from 2 to 73 months for 303 cases that were discharged from hospital. The long-term results were evaluated in terms of mean survival ,quality of life and prosthetic-related complications.

Results: The hospital mortality was 3.6 % in general. The hospital mortality: group I is 4. 9% and group II is 3. 2 %. The difference is not statistically significant. Low cardiac output, conduction disturbances, stroke, pulmonary complications, renal complications, bleeding, atrial fibrillation, wound infections, ventricular arrhythmias are respectively14. 8% vs. 9. 6%, 3. 7% vs. 6. 9%, 3. 7% vs. 0. 4%, 9. 9 % vs. 2. 8%, 3. 7% vs. 1. 2%, 6. 3% vs. 2.0%, 14. 8 % vs. 19.7%, 11. 3% vs. 1. 6 %, 6. 2% vs. 5. 6 % respectively for the group I and II. The differences were statistically significant only for low cardiac output, stroke, pulmonary and wound complications. The long-term outcomes: overall mortality 3. 9%, bleeding 1. 9%, prosthetic endocarditis and thrombosis 1.3%. Endocarditis and thrombosis are more frequent in group I. During the follow-up survival was 93% and 96% respectively for group I and II, with no significant difference between groups.

Conclusions: Simultaneous coronary artery by-pass with aortic valve increases slightly the operative mortality and perioperative complications. CABG surgery does not influence long–term results of aortic valve surgery.

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Introduction

Surgery of aortic valve began since the years '80 of the last century treating initially the rheumatic and infectious pathology of aortic valve continuing later with degenerative one in our country. It has been seen a trend of change of nature of aortic valve pathology toward atherosclerotic etiology in the last two decades with the change of life style, increase of mean age of population and progression of surgical management of old age patients.

Ischemic heart disease is the most frequent pathology that accompanies the pathology of aortic valve and especially aortic valve stenosis [1,2] and the most frequent intervention coupled with surgical correction of aortic valve pathology is coronary artery by-pass grafting. We tried to expose our experience in surgical treatment of aortic valve pathology combined or not with CABG surgery in this contest.

Materials and Methods

This is a retrospective and prospective study. All patients included in this study, underwent intervention in two cardiac surgical centers, the first one is public and the other one a private cardiac surgical center in Tirana. The data were collected from hospital records and registers of hospital statistics. Follow-up of patients in long-term is obtained through clinical visits and telephone interviews with patients and/or their family. All survivors underwent a questionnaire regarding the overall health status compared with the time before the operation, current quality of life based on NYHA-s classification, the use of anticoagulants; re-hospitalization and specific complications have been throughout the period after intervention.

Preoperative evaluation of risk of intervention is made according to EUROSCORE [3]. Surgical indication for aortic valve and re-vascularization surgery are decided according to ESC and AHA/ACC guidelines.[2,4,5].

Perioperative mortality and major complications like myocardial

infarction, cerebral accidents, pulmonary problems, renal problems, infections and late mortality, complications after early period of surgery as re-hospitalizations, hemorrhage, thromboembolism, thrombus on the prosthesis, endocarditis etc. are considered end-points for the evaluation respectively of early and late results of surgery of aortic valve alone or combined with by-pass surgery.

Patients

In this study are included 330 patients that underwent surgery of aortic valve alone or in combination with by-pass surgery from January 2007 to January 2013. The population is divided in two groups. Group I the patients with combined surgery 81 pt. Group II the patients with isolated aortic valve surgery 249 pt.

The general demographic and clinical data are presented in Table 1. As we can see in the table below mean age of all population in study is 59. 04± 12.1 years with a higher mean age in group I; there are 221 males and 109 females; there are not significant differences between groups about the comorbidities except diabetes, hypertension and smokers that are more present in group I.

Transthoracic echocardiography was the main diagnostic tool. We see that there were 202 patients with pure aortic stenosis from the echocardiographic data; 73 patients with aortic insufficiency and the rest of patients had mixed pathology of aortic valve (55 pt). Angiography was performed according the guidelines ESC/AHA/ACC [2,4]. The CAD was the primary diagnosis in group 1 in 10 patients. Echocardiographic data are presented in Table 2. There are not differences between two groups in terms of ejection fraction, gradients, aortic valve opening surface etc. except Dtd.

Surgical technique

Standard cardiac surgery monitoring was used. The operation was performed through a complete median sternotomy. Before the institution of cardiopulmonary by-pass the grafts were harvested in group I. The left internal mammary was harvested in the hemi-skeletonized fashion. The saphenous vein was harvested in the standard fashion or using the skin bridge technique.

After heparin administration cardiopulmonary by-pass was instituted, aortic cross clamping ante grade cardioplegia was done.

In group I venous coronary artery by-pass was performed first following with the aortic procedure finishing with LIMA grafting. The aortic procedure was performed directly in group II normally.

We made always transverse aortotomy. The leaflets were removed and meticulous decalcification was made. Separated suture technique was performed to implant the aortic prosthesis. Sutures Ticron 2/0 with pledged in the aortic face in most cases and in ventricular face in the rest were used. The heart was de-aired and the aortic clamp removed after the closure of the aorta. At the end of the operation the cannulas were removed and protamine was given. Temporary pacemaker (PM) wires and mediastinal and pleural drains were placed before chest closure.

Statistical analysis

Continuous variables were presented as mean and standard deviation.

Categorical variables were presented in absolute value and percentages. Student t-test for two independent samples was used to analyze the differences between two continuous variables and $\chi 2$-test was used to analyze the differences for categorical variables.

A p-value less than 0. 05 was considered to be statistically significant.
SPSS (Statistical Package for Social Science) 19. 0 was used to

Table 1. Baseline characteristics

General data		All group (n=330)	Group		Value p
			With CABG (n=81)	Without CABG (n=249)	
Age		59. 04±12. 1	62. 80±14. 1	55. 95±15.03	<0. 001*
Sex	M	221 (67. 0%)	60 (72. 0%)	161 (62. 5%)	Ns**
	F	109 (33. 0%)	22(28. 0%)	87 (37. 5%)	
NYHA	I	9 (2. 70%)	2 (2. 50 %)	7 (2. 80 %)	Ns**
	II	78 (23. 6%)	24(29. 6%)	54(21. 7%)	
	III	221 (67. 0%)	52 (64. 2%)	169 (67. 9%)	
	IV	22 (6. 70%)	3 (3. 70%)	19 (7. 60%)	
Admission	urgent	18 (5. 50%)	7 (8. 60%)	11 (4.40%)	Ns**
	selective	311 (94. 2%)	74(91. 4%)	238 (95. 6%)	
Body mass		72. 28±16. 5	73. 93±16. 9	72. 6±14. 6	Ns**
Smoke		57 (17. 3%)	22 (27. 2%)	35 (14. 1%)	0. 007**
HTA		162 (49. 2%)	56 (69. 1%)	106 (42. 7%)	0. 035**
Renal		7 (2. 10%)	2 (2. 50%)	5 (2. 00%)	Ns**
DM		48 (14. 6%)	23(28. 4%)	25 (10. 1%)	0. 002**
AP		6 (1. 80%)	2 (2. 50%)	4(1. 60%)	Ns**
Obesity		9 (2. 7%)	3 (3. 70%)	6 (2. 40%)	Ns**
COPD		13 (4. 00%)	5(6. 20%)	8 (3. 20%)	Ns**
Carotids		3 (0. 90%)	2 (2. 50%)	1(0. 40%)	Ns**

Table 2

ECHO Data	Groups		Value p*
	With CABG (n=81)	Without CABG (n=249)	
EF	59. 43±9. 47	59. 94±10. 22	ns
PsAP	43. 21±11. 83	52. 69±16. 63	0. 049
Anulus	21. 84±1. 61	22. 25±2. 20	ns
AVE	0. 96±0. 26	0. 97±0. 51	ns
TMP	12. 8±1. 94	12. 8±1. 88	ns
TS	14±2. 0	13. 8±1. 9	ns
Dtd	55. 28±9. 15	58. 4±9. 02	0. 034
Dts	37. 6±9. 3	39. 2±8. 7	ns
Max-grad	77. 98±26. 1	84. 52±23. 18	ns
Mean-grad	47. 76±13. 9	51. 40±13. 75	ns
Asc Ao	38. 8±6. 3	40. 9±7. 90	ns

EF-ejection fraction, PsAP- systolic pulmonary artery pressure, AVE-aortic valve area, TMP-posterior wall, TS-septum, Dtd-telediastolic diameter, Dts- telesystolic diameter, Max-grad-Maximal gradient, mean grad— mean gradient.

Table 3. Intra-operative data

Operative data	All group (n=330)	Groups		Value p
		With CABG (n=81)	Without CABG (n=249)	
CPB	109. 7±32. 2	130. 43±33. 16	101. 34±37. 61	<0. 001
XT	83. 4±29. 4	103. 14±25. 96	75. 62±28. 76	<0. 001
AVR Mechanical prot.	274 (81. 8%)	62(75. 3%)	212 (83. 9%)	Ns
Biological prot	55 (15. 8%)	19 (22. 20%)	36 (13. 70%)	Ns
Other procedure	8 (2. 4%)	2 (2. 50%)	6 (2. 40%)	Ns
Prosthesis number	21. 6±1. 7	21. 4±1. 6	21. 8±2. 7	Ns
MVR	46 (13. 90%)	3 (3. 70%)	43 (17. 30%)	0. 002
AAS	40 (12. 10%)	6(7. 40%)	34(13. 70%)	Ns
Tricuspid	21 (6. 40%)	21(8. 40%)	0 (0. 00%)	Ns
Grafts number	--	1. 9±0. 7	-	-
LIMA	--	58 (74. 40%)	-	-
Radial artery		4 (5. 10%)	-	-

CPB-cardio-pulmonary; XT-cross-clamp time, AVR-aortic valve replacement, LIMA-left internal thoracic artery; MVR-mitral valve replacement; AAS-ascending aorta surgery.

analyze data.

Results

Operative results

As it is expected we have a longer cardiopulmonary-by-pass and ischemic time in the group with combined surgery figured by the table. The difference is statistically significant. There are used 274 mechanical prosthesis, 55 biological prosthesis and in 8 cases we have done procedures such as in 1 case aortic valve repair, in 7 patients we have done aortic annulus enlargement (Manouguain technique). The mean number of grafts is 1.9 +/- 0.7 in the population with combined surgery and the LIMA is used in 58 patients. We can see from a general view of database that it is an increasing trend of biological prosthesis use.

Hospital mortality and post-operative morbidity

The results about operative mortality and morbidity that are the primary and secondary respectively end-points of early results are presented in the table 4.

The overall hospital mortality was 3. 6% (12/330). The hospital mortality for Groups I and II was 4.9% (4/81) and 3. 2% (8/249), respectively, with no statistical difference (P = 0. 471). Mortality in the group with combined surgery is higher but without reaching statistical significance. The overall length of ICU and hospital stay is importantly longer in group I than in group II respectively 102. 41±147. 81 hours, 13. 99±14. 20 days versus 65. 17±78. 78 hours, 10. 41±6. 34 days.

About the complications low cardiac output, conduction disturbances, stroke, pulmonary complications, renal complications, bleeding, atrial fibrillation, wound infections, ventricular arrhythmias about the complications are 14. 8% vs. 9. 6%,3. 7% vs. 6. 9%, 3. 7% vs. 0. 4%, 9. 9 % vs. 2. 8%, 3. 7% vs. 1. 2%, 6. 3% vs. 2. 0%, 14. 8 % vs. 19. 7%,11. 3% vs. 1. 6 %, 6. 2% vs. 5. 6 % respectively for the group I and II. If we see carefully the results in general we have a greater incidence of complications in group

Table 4. Hospital mortality and post-operative morbidity

Postoperative data	Group		Value p
	With CABG (n=81)	**Without CABG (n=249)**	
ICU stay (h)	102. 41±147. 81	65. 17±78. 78	0. 004*
Respiratory assistance(h)	39. 60±104. 86	23. 20±55. 58	Ns
Hospital Stay(d)	13. 99±14. 20	10. 41±6. 34	0. 003*

Mortality and morbidity	CABG		All group Nr=330	Value p
	With CABG (nr=81)	**Without CABG (nr=249)**		
Mortality	4 4. 90%	8 3. 20%	12 3. 60%	0. 471
Low cardiac output	12 14. 80%	24 9. 60%	36 10. 90%	0. 04
Stroke	3 3. 70%	1 0. 40%	4 1. 20%	0. 018
Pulmonary	8 9. 90%	7 2. 80%	15 4. 50%	0. 008
RI	3 3. 70%	3 1. 20%	6 1. 80%	0. 145
Hemorrhage	5 6. 30%	5 2. 00%	10 3. 10%	0. 056
Ventricular arithmias	5 6. 20%	14 5. 60%	19 5. 80%	0. 853
Atrial Fibrilation	12 14. 80%	49 19. 70%	61 18. 50%	0. 327
Wound infection	9 11. 30%	4 1. 60%	13 4. 00%	<0. 001

where surgery of aortic valve is accompanied with CABG surgery but only for low cardiac output, stroke, pulmonary, and wound complications, the difference reaches significance.

Long-term results

From 318 patients that were discharged from the hospital follow-up is obtained for 95% of them. 15 patients are considered lost. Follow-up time is from 2 to 73 months. During this period 12 patients have died of which 5 patients in group I and 7 patients in group II. The survival statistical analysis for each group noted that for group I mean survival is 31 ± 20. 7 months while for group II 29 ± 19. 6 months (P = 0. 472). Kaplan-Meier curve comparing survival between the two groups shows no significant difference.

Regarding valve prothesis-related complications is noted that at a slightly higher frequency encountered thrombosis and endocarditis of prostheses in the combined surgery. These complications data are presented in the following table (Table 5)

NYHA-class, before and after surgery demonstrates a very important improvement of quality of life for the entire population in the study group. Following the presentation appears that over 90% of patients are independent of cardiac problems.

Discussion

Aortic valve surgery occupies an important part in surgical activity in different cardiac surgical centers all over the world. The significant increase of the average age of the population in developed countries, but also in our country, has made this pathology significantly associated with coronary heart disease. Simultaneous surgical correction of aortic valve pathology and performing Coronary Bypass certainly, increase the complexity of the operation and influence the early and late results of intervention. Performing coronary by-pass surgery accompanying gesture of aortic valve surgery has attracted the attention of renowned authors to assess the impact of this gesture in aortic valve surgery. In this context, our study has as priority to report the early and late results of aortic valve surgery isolated or simultaneous with CABG.

Early results

European Association for Cardiothoracic Surgery Adult Cardiac Surgery 2010 database provides evidence that the mortality for isolated aortic valve surgery was 3. 7% while in the combination with coronary bypass goes up to 6. 2%. [6].

Based on the most serious works in the field of adult cardiac surgery [1] aortic valve surgery mortality is about 4. 3%, ranging from 1-8%, while in combined surgery mortality ranges from 2-10%. There are authors who claim that coronary by-pass associated with aortic valve surgery, increases mortality 1, 6-1,8% [7]. CABG appears not as an independent risk factor in both cases.

In an overview of some specific works note that mortality of aortic valve surgery combined with by-pass ranges from 1. 9% to 9. 4% and mortality in isolated aortic valve surgery ranges from 1. 2% to 6. 8% [8,14].

Dell'Amore et al [15] show us the following data: The overall mortality 5. 3%, mortality in the group with isolated aortic valve surgery 4. 3%, while in the group with combined surgery mortali-

Table 5

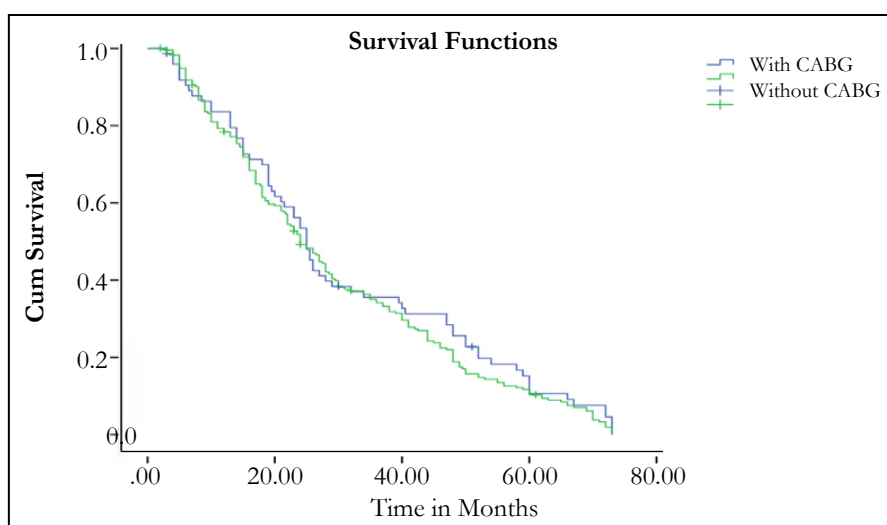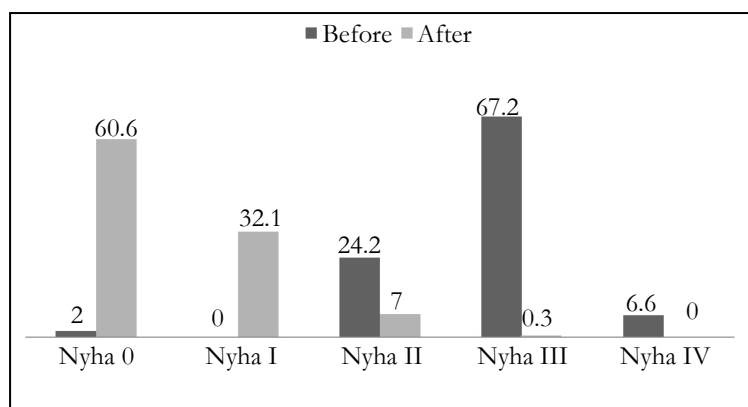| Prothesis –related complications	Groups		All groups	Value p
	With CABG (n=72)	Without CABG (n=231)		
Hemorrhage	2 2. 70%	4 1. 70%	6 1. 90%	0. 441
Thrombus	3 4. 10%	1 0. 40%	4 1. 30%	0. 044
Endocarditis	3 4. 10%	1 0. 40%	4 1. 30%	0. 044
Fistula	3 4. 10%	3 1. 20%	6 1. 90%	0. 15
Rehospitalization	6 8. 20%	11 4. 70%	17 5. 50%	0. 196
Reoperation	1 1. 30%	4 1. 70%	5 1. 60%	0. 656

Figure 1. Survival Functions

Figure 2. NYHA-class, before and after surgery

ty is 7. 2%. Regarding the perioperative events: low cardiac output 4. 8% vs. 18. 6%, atrial fibrillation 34% vs. 44. 3%, stroke 2. 7 vs. 3. 1%, re-thoracotomy for hemorrhage 5. 3 vs. 7. 2% , renal insufficiency 12. 8 vs. 16. 5% 6. 9 vs. 10. 3% pulmonary problems.

There is a general agreement that coronary by-pass surgery accompanying surgery of aortic valve, increases early mortality but in multi-factorial analysis it turns out not as an independent risk factor. [2].

In our series, the mortality of all group goes up to 3. 6%; 3. 2% in the group of isolated aortic surgery and up to 4. 9% in the group with combined surgery. At the same time note that we have a higher incidence of complications where only some of them such as those low cardiac output, stroke, pulmonary problems and wound infection, reach statistical significance. In our opinion, these results can be explained considering the clinical data of patients also by the specifics surgical procedure. We can mention smoking, age, arterial hypertension, diabetes, peripheral arteriopati data, obesity, are more expressed in the group of patients with a combined surgery based in general facts and clinical data. In addition we see that in the combined surgery from the intervention data, we have: longer ischemic and cardio-pulmonary by-pass time, bigger surgical trauma. In these conditions it can be

concluded that in combined surgery group we have patients with more comorbidities and more complex surgical procedure. These facts also explain us these results.

Looking our results and comparing them with other works in the same context, note that our results are comparable. By-pass surgery increases mortality in our experience but without reaching statistical significance.

Long-term results

Impact of CABG in long-term results of aortic valve surgery that is treated in numerous papers. [14-16,21-29]. In this group of works is referred that coronary surgery affects adversely survival but without reaching to be independent risk factor in the late results in patients with combined surgery. Brenan et al[21]from a study which has involved 1,026 cardiac surgical centers, reported median survival 12.8 years , 9.2 years , 6.2 years for the group with isolated aortic valve surgery and 10.4 years , 8.2 years and 5.9 years for the group with combined surgery for age groups 65-69 years respectively from 70 to 79 years old and over 80 years old respectively. We can see that combined surgery group has worse prognosis but as independent risk factors are age, renal and pulmonary disease. Folkman et al [14] refer one year post-operative mortality is higher for the combined surgery group 20 % versus 16.2 % for the surgery group with isolated aortic surgery. Also quality of life is reported to be better in a year follow-up for the group with isolated surgery but in both cases there is no statistical significance.

Another group of authors go beyond the fact that CABG affects negatively the results aortic valve surgery. They refer coronary surgery as an independent risk factor[31-36]. Cohen G et al [31] report that survival in the group with combined surgery is significant lower compared with the group with isolated valve surgery that aorta (p < 0. 0001), regardless of age under or over 65 year. In 12 years, survival analyzed in the Kaplan Meier was 65 ± 4 % for the isolated surgery group and 35 ± 8 % for the combined surgery group. Akins et al [32] emphasize that coronary disease and combination with aortic valve surgery significantly reduce survival as much as for the patients with combined surgery the age of implanting biological prostheses may be lower compared with the group with isolated aortic valve surgery. Jones et al [36] refer that adverse influence is significant only in the group with aortic valve replacement is associated with venous graft to the LAD and the number of grafts is not an independent risk factor. In results of our study have no survival difference between the two groups which are 93 % and 96 % respectively for group I and II (p = 0. 472).

In addition to these facts mentioned above there are also studies with totally different results than discussed above: Kolh et al [16] report hospital mortality 13% in total, 9% for isolated aorta and 24% mortality for combined surgery. CABG emerges as an independent risk factor. In the other side Melby et al [17] report lower mortality in combined surgery 6% vs.10% for isolated aortic valve surgery presented CABG no as risk factor but totally on the other hand as a protector. While in long-term, correcting of aortic valve pathology in combination with coronary bypass, significantly improves survival [36].

Another aspect to discuss was about the use of biological prostheses in relation to mechanical prostheses. Now time, it is confirmed a growing trend to use biological prosthesis in accordance with the indications in the developed world [18-20]. It's noticed a line with such a trend, even in our experience despite small num-

bers.

Conclusions

Isolated aortic valve surgery or combined with surgery of coronary arteries in our country achieved very good early and late results comparable to those of developed countries. CABG increases mortality when superimposed aortic surgery compared with the latter isolated, without reaching statistical significance. By-pass coronary surgery does not affect long-term performance of aortic valve surgery. The use of biological prostheses is increasing in aortic valve surgery.

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