AUDIT ARTICLE

Cardiac surgery clinical outcomes in 70 years and over patients

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Abstract

Objectives: To analyse the experience of a cardiac surgery centre with all types of cardiac interventions in the elderly in order to evaluate outcomes.

Methods: The retrospective study was conducted at Middle East Hospital, Mersin, Turkey, and comprised data of patients aged ≥70 years who underwent cardiac surgery from December 1, 2010, to March 31, 2016. Clinical outcomes, postoperative length of hospital stay and mortality rates were evaluated. SPSS version 15 software for Windows (IBM Corporation, Armonk, NY) was used for data analysis.

Results: Of the 1920 cases, 276(14.35%) patients were aged >70 years. Of them, 70(25.4%) were males and 206(74.6%) were females. The overall mean age was 71.39±2.26 years (range: 70-82 years). Coronary artery bypass grafting was the most frequent intervention 268(97%). Of the total, 6(2.2%) patients were treated urgently and 1(0.4%) was treated very urgently. The mortality rate was 8(2.9%) Preoperative and intraoperative findings didn't affect outcomes ($p>0.05$), but variables predicting mortality and length of hospital stay included operation priority, postoperative neurological and pulmonary complications and wound infection ($p<0.05$ each).

Conclusion: Morbidity and mortality rate was found to be acceptable in elderly patients who underwent cardiac surgery.

Keywords: Elderly, Cardiac surgery, Outcomes. (JPMA 69: 1677; 2019). **doi: 10.5455/JPMA.301659.**

Introduction

The elderly represent an increasing percentage of candidates for major surgery. These patients are different from other age groups, as they often present multiple co-morbidities, have undergone chronic therapies and present a unique physiology in terms of respiratory, cardiovascular and metabolic systems.[1]

Cardiac surgery is increasingly performed in elderly patients too. The impact of the surgery, including the extent of surgery, use of cardiopulmonary bypass, prolonged general anaesthesia, haemodynamic instability, and admission to the intensive care unit (ICU) post-surgery may have a detrimental effect on the outcome of this patient population compared to the younger patients. Despite these strong important differences, the most appropriate clinical management has never been determined, having been left mainly to physicians' clinical decision.[1-3]

The current study was planned to audit the experience of a cardiac surgery centre with all types of cardiac interventions performed in elderly patients with the intention to evaluate outcomes.

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Methods

The retrospective study was conducted at Middle East Hospital, Mersin, Turkey, and comprised data of patients aged ≥70 years who underwent cardiac surgery from December 1, 2010, to March 31, 2016. Data included details related to patients receiving cardiac surgical procedures aged ≥70 years. All types of on-pump and off-pump cardiac surgeries were included, except transplantation and transcatheter aortic valve (AO) implantation.

Clinical routine procedures had been applied to all patients. Patients were admitted two days before elective surgery. Clinical criteria for hospital discharge included haemodynamic and cardiac rhythm stability, the absence of incision site infection, an afebrile condition, normal bowel movement, independent ambulation and feeding.

All cardiac surgeries had been performed by the same surgeon who had been working at the cardiovascular surgery clinic for 10 years. Demographics and clinical

characteristics were collected electronically together with preoperative, intraoperative and postoperative data. Postoperative complications data included myocardial infarction (MI), stroke, congestive heart failure (CHF), renal failure, pulmonary failure, bleeding and revision and wound infection. Body Mass Index (BMI) of all patients had been calculated as weight (kilograms) divided by height (meters) squares. Patients' clinical outcomes like postoperative length of hospital stay (LOS) and mortality rates were noted. Death of patients was defined as in-hospital mortality. For further evaluation, patients were classified into two age-based groups, with Group 1 having those aged 70-75 years and Group 2 having 76-82 years. The differences between these two groups were evaluated in terms of preoperative assessment, intraoperative / postoperative findings, and outcomes.

Data was analysed using SPSS version 15 software for Windows (IBM Corporation, Armonk, NY). Categorical variables were reported as frequencies and percentages, whereas continuous variables were expressed as mean ± standard deviation (SD along with range. Simple descriptive statistics were used for demographic analyses. Between 2 independent groups, continuous values were compared with student t test or unpaired t-test. Proportions were compared with chi-square test. Spearman rank correlation coefficient was used to explore the correlations between measurements. Logistic regression analyses were used to identify independent factors that affected the length of hospital stay and mortality.

Results

Of the 1920 cases identified, 276(14.35%) patients were aged >70 years. Of them, 70(25.4%) were males and 206(74.6%) were females. The overall mean age was 71.39±2.26 years (range: 70-82 years. Hypertension (HTN) 155(56%) and diabetes mellitus (DM) 94(34%) were the most frequent comorbidities. Of all the patients, 18(6.5%) were malnourished, and 177(64.1%) were obese. At admission, 51(18.4%) patients had undated rhythm problems, including atrial fibrillation, supraventricular tachycardia and ventricular extra-systole, nodal arrhythmia. Cardiac insufficiency was seen in 21(7.6%) patients, and 28(10.1%) had ejection fraction (EF) <30% in Echo cardiographs. Of the total, 6(2.2%) patients were treated urgently and 1(0.4%) was treated very urgently (Table 1).

Table-1: Baseline Characteristics.

Variable	Value
Age, (mean, min-max) *year*	71.39±2.26 (70-82)
Gender (Male/Female), *n*	70 (25.4%)/206 (74.6%)
Body mass index (BMI) (mean, min-max), *kg/m²*	26.95 (17.57-43.64)±4.28
Underweight (<20.5)	18(6.5%)
Normal(20.5-24.9)	69(25%)
Overweight (25-29.9)	120(43.5)
Class 1obesity (30.0-34.9)	50(18.1%)
Class 2 obesity (35-39.9)	5(1.8%)
Class 3 obesity (≥40)	2(0.7%)
Smoking, *n*	
Current smoking	111(40.2%)
Former smoker	14 (5.1%)
Comorbidity, *n*	
Diabetes Mellitus (DM)	94 (34.1%)
Chronic Heart Failure (CHF)	21 (7.6%)
Kidney Function Disorder	73 (26.4%)
Hypercholesterolemia	73 (26.4%)
Hypertension	155 (56.2%)
Chronic obstructive pulmonary disease (COPD)	28 (10.1%)
Peripheral Arterial Disease (PAH)	39 (14.1%)
Previous Cerebrovascular Event	21 (7.6%)
Previous Myocardial Infarction (MI)	102 (37%)
New York Heart Association (NHYA)/CCS; Canadian Cardiovascular Society (class >3,4), *n*	
NHYA class >3	31 (11.2%)
NHYA class >4	6 (2.2%)
CCS class >3	43 (15.6)
CCS class >4	5 (1.8%)
Ejection Fraction (EF) <30%, *n*	28 (10.1%)
Atrial Fibrillation, n	7 (2.5%)
Operative priority	
Urgently, n	6 (2.2%)
Very urgently, *n*	1 (0.4%)
Planned, *n*	269 (97.4%)

Table-2: Surgical interventions.

Variable	Value
Acute Tamponade	1 (0.36%)
Atrial septal defect (ASD)	1 (0.36%)
Coronary Artery Bypass Grafting (CABG), n of patients	268 (97.1%)
Beating Heart with CABG	21 (7.6 %)
Isolated CABG	219 (79.3%)
CABG + carotid endarterectomy	7 (2.53 %)
CABG + mitralplasty (MP)	3 (1.08)
CABG + Aneurysmectomy	8 (2.89%)
CABG+ Aortic valve repair (AVR)	10 (3.62%)
Valve surgery, n of patients	6 (2.17%)
AVR	3 (1.08%)
Mitral valve repair (MVR)	1 (0.36%)
AVR+MVR	1 (0.36%)
AVR+ Myocardial perfusion (MP)	1 (0.36%)

Table-3: Outcomes.

Variable	Total	Group 1 (70-75)	Group 2 (76-82)	*p*-value
Length of hospital stay	6.51±3.98	6.33±3.08	8.80±9.73	0.008*
Impaired renal functions at admission				
Normal levels	203	189	14	0.04*
Serum creatinine levels>1	61	58	9	
Serum creatinine levels>2	12	9	3	
Hospital mortality			>0.05	
Alive	268(97.1%)	249	19	
Dead	8(2.9%)	7	1	
Postoperative complications				
Bleeding				
None	269 (97.46%)	249	20	>0.05
Re-operation	7(2.53%)	7	0	
Pulmonary				
None	271(98.2%)	235	36	0.03*
Re-intubation	4(1.4%)	4	0	
Tracheostomy	1(0.4%)	0	1	
Neurological				
None	271(98.2%)	236	35	0.02*
Permanent stroke	3(1.1%)	1	2	
Renal				
None	272(98.5%)	253	19	>0.05
Medical treatment	4(1.44%)	3	1	
Wound infection				
None	273 (98.9%)	253	20	>0.05
Wound infection	3(1.08%)	3	0	

**p<0.5, **p<0.01*

Coronary artery bypass grafting (CABG) was the most frequent intervention 268(97%), followed by valve repair 6(2.17%) (Table 2).

The mean cardiopulmonary bypass time of patients undergoing open heart surgery was 80.8±30.5 min (range: 24-283 min). The mean time of cardiac catheterisation (CC) was 52.41±19.55 min. (range: 12-127 min). Besides, 63(22.8%) of the ICU patients received positive inotropic support. Intra-aortic balloon pump (IABP) was used in 2(0.7%) patients. Extracorporeal membrane oxygenation (ECMO) was not used. Postoperative transesophageal echocardiography (TEE) was not needed. Minimally invasive intervention was not preferred because of patients' vascular structure. There was a significant relationship between inotropic support use and hospital stay (p=0.009). There was no statistical relationship between mortality and inotropic support (p>0.05). Mean bleeding after surgery was 461.29±307.17cc (range: 50-2500cc) and was accepted as within reasonable levels. Two units of blood were used in 61(22.1%) patients, and fresh frozen plasma more than 1 unit was used in 79(28.6%). Also, 1(0.36%) patient underwent MI postoperatively, 1(0.36%) patient was taken to revision due to deep tissue infection in the sternum, 2(0.7%) patients were infected with leg injuries and 7(2.5%) underwent revision due to bleeding. In ICU monitoring, significant deterioration in renal function was noted in 4(1.44%) patients',and 1(25%) of them needed dialysis.

Table-4: Variables predicting mortality and length of hospital stay.

Mortality (Adjusted R squared=0.43, p=0.001**) Variable	*p*-value	Length of hospital stay (Adjusted R squared=0.78, p=0.001**) Variable	*p*-value
Operation priority	0.001**	Pulmonary complications	0.01*
Neurological deficit	0.002**	Wound infection	0.001**
Wound infection	0.96	Neurological deficit	0.001**
Pulmonary complications	0.98	Renal complications	0.28
Age	0.96	Age	0.37
		Gender	0.23
		Operation priority	0.61
		Body Mass Index (BMI)	0.67
		Ejection fraction (EF)	0.21

**p<0.5, **p<0.01*

Mean postoperative hospital stay was 6.5±3.98 days (range: 3-49 days). Overall hospital stay was a minimum of 8 days for 242(87.8%) patients and these patients were discharged from hospital in good clinical condition. Of all the patients, 8(2.9%) died.

Comparison of the two age-based groups showed there was no relationship between age and hyperlipidaemia and hypertension (p>0.05). No relationship was found between age and smoking, and between smoking and chronic obstructive pulmonary disease (COPD) (p>0.05). There was no relationship between age groups and EF (p>0.05). There was a negative correlation between age and BMI (p=0.01). As age progressed, there was no significant relationship between postoperative arrhythmia frequencies (p>0.05). Re-operations were not related to age groups (p>0.05). There was no relationship between age groups and mortality (p>0.05). There was a significant relationship between age groups and LOS (p=0.008). Postoperative pulmonary, neurological, infectious and renal complications became a problem as the age increased (p<0.05) (Table 3).

Among the variables predicting mortality and LOS, operation priority, postoperative neurological and pulmonary complications and wound infection proved to be significant (Table 4).

Discussion

As the availability of health services increases in Turkey, there is an increase in patient age groups and patient diversity that can benefit from these services.[4] On the other hand, the increase in healthcare provided to the same group has made it necessary to reduce economic costs and increase surgical success.[4,5] Surgery in elderly patients is associated with the risk of death, complications, functional decline and disability. It is necessary to increase the surgical success in the patient group aged >70 years and therefore to increase efficiency for decreasing care costs. With the progressively increasing population of the elderly, the need for cardiac surgery in elderly patient is rising. However, the clinical results of cardiac surgery for elderly are still under investigation.[6]

In the last 2 decades, extraordinary technological developments and evaluation of knowledge have led to a reduction in mortality. Such developments include improvements in surgical technique, cardiopulmonary bypass (CPB) technology and circuits, the management of cardioplegic circulation, transfusion policy, haemodynamic coagulation monitoring, and post-cardiac surgery care. Clinicians share the common idea that nowadays candidate to cardiac surgery is older and sicker than in the past, but a decreasing mortality rate has been reported in literature for CABG.[1,7,8] Bridgest et al[9] published a study on a very large number of patients. In a three-year study period, a total of 59,576 patients who underwent cardiac surgery aged between 80 and 89 years were evaluated and the mortality was 7.1%. Scandroglio et al. found the mortality rate 3.4% in CABG patients.[1] Park et al.[10] reported an operative mortality of 5%. In our study the mortality rate was 2.9% which was comparable with previous studies. If surgery is urgent, mortality and morbidity are expected to increase.[11,12] Ishikawa et al.[6] reported a 4-fold increase in operative mortality in urgent or emergency operation group compared to the elective cases. In our study, 7(2.6%) patients underwent urgently surgery. Female gender has been identified as an independent risk factor for early mortality after CABG surgery.[12-14] In our sample, women were also high in number, but gender did not make a difference on clinical outcomes.

In general, the most obvious risks and complications noted in our study were in line with literature. Carrascal et al.[15] reported a postoperative stroke ratio of 4.1% in octogenarian patients who underwent cardiac surgery. Studies have reported that increasing age was a risk factor for not operative mortality but also postoperative complications.[6,10] The postoperative complication rate was 25% (5/20) in a study in Korean octogenarians.[6] Our postoperative complication rate was 9.2%. Postoperative complications occur more frequently in older patients and this may result in longer hospital stays. In our study, problems with postoperative pulmonary and neurological functions increased with age. This happens due to insufficient compensation mechanisms and / or slowing down as the age progresses.[13-17]

The current study has several limitations. First, we have only retrospectively analysed patients aged >70 years and didn't have corresponding data for a younger population. There were also no 30-day and 1-year follow-ups.

Conclusions

Postoperative complications increased with age and this led to prolonged hospital stay and mortality. However, postoperative complications rate was quite low, and elderly patients had acceptable hospital mortality rates post-surgery. Cardiac surgery, as such, could be performed in all ages and favourable long-term clinical outcomes can be expected in patients aged >70 years.

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References

1. Scandroglio AM, Finco G, Pieri M, Ascari R, Calabro MG, Taddeo D, et al. Cardiac surgery in 260 octogenarians: a case series. BMC Anesthesiology 2015; 15: 15.
2. Deschka H, Schreier R, El-Ayoubi L, Erler S, Müller D, Alken A, et al. Prolonged intensive care treatment of octogenarians after cardiac surgery: a reasonable economic burden? Interactive Cardiovasc Thorac Surg 2013; 17: 501-6.
3. Coccia F, Rozzini R. Goals of surgery and assessment tools for elderly patients referred for cardiac and noncardiac surgery. monaldi [Online] 18 Jul 2017 [cited 2019 Jul 22]; 87(2). Available from: https://www.monaldi-archives.org/index.php/macd/article/view/849.
4. Bureau of Census: Projections of population of the United States by age, sex and race:1983-2080. Curent Population Reports, 1984.
5. Loop FD, Lytle BW, Cosgrove DM, Goormastic M, Taylor PC, Golding LA, et al. Coronary artery bypass graft surgery in the elderly. Indications and outcome. Cleve Clin J Med 1988; 55: 23-34.
6. Ishikawa S, Buxton BF, Manson N, Hadj A, Seevanayagam S, Raman JS, et al. Cardiac surgery in octogenarians. ANZ J Surg 2004; 74:983-5.

7. Song HK, Diggs BS, Slater MS, Guyton SW, Ungerleider RM, Welke KF. Improved quality and cost-effectiveness of coronary artery bypass grafting in the United States from 1988-2005. J Thorac Cardiovasc Surg 2009; 137: 65-9.
8. Ferguson BT, Hammill BG, Peterson ED, DeLong ER, Grover FL, STS National Database Committee. A decade of change: risk profiles and outcomes for isolated coronary artery bypass grafting procedures, 1990-1999 - a report from the STS National Database Committee and the Duke Clinical Research Institute. Society of Thoracic Surgeons. Ann Thorac Surg 2002; 73: 480-9.
9. Bridges CR, Edwards FH, Peterson ED, Coombs LP, Ferguson TB. Cardiac surgery in nonagenarians and centenarians. J Am Coll Surg 2003; 197: 347-56.
10. Park MK, Park, SV, Lee SC.Clinical outcome of cardiac surgery in octogenarians. J Korean Med Sci 2005; 20: 747-51.
11. Ko W, Krieger KH, Lazenby WD, Shin YT, Goldstein M, Lazzaro R, et al. Isolated coronary artery bypasses grafting in one hundred consecutive octogenarian patients. A multivariate analysis. J Thorac Cardiovasc Surg 1991; 102: 532-8.
12. Lahey SJ, Borlase BC, Lavin PT, Levitsky S. Preoperative risk factors that predict hospital length of stay in coronary artery bypass patients > 60 years old. Circulation 1992; 86 (5 Suppl): II181-5.
13. Craver JM, Puskas JD, Weintraub WW, Shen Y, Guyton RA, Gott JP, et al. 601 octogenarians undergoing cardiac surgery: outcome and comparison with younger age groups. Ann Thorac Surg 1999; 67: 1104-10.
14. Klein LW1, Block P, Brindis RG, McKay CR, McCallister BD, Wolk M, et al. Percutaneous coronary interventions in octogenarians in the American College of CardiologyNational Cardiovascular Data Registry: development of a nomogram predictive of in-hospital mortality. J Am Coll Cardiol 2002; 40: 394-402.
15. Carascall Y, Guerrero AL, Blanco M, Valenzuela H, Pareja P, Laguna G. Postoperative stroke related to cardiac surgery in octogenarians. Interactive Cardiovasc Thorac Surg 2014; 18: 596-601.
16. Ghosh P, Holthouse D, Carroll I, Larbalestier R, Edwards M. Cardiac reoperation in octogenarians. Eur J Cardiothorac Surg 1999; 15: 809-15.
17. Akins CW, Daggett WM, Vlahakes GJ, Hilgenberg AD, Torchiana DF, Madsen JC, et al. Cardiac operations in patients' 80 years old and older. Ann Thorac Surg 1997; 64: 606-14; discussion 614-5.