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Open-Heart Surgery in Octogenarians: Early Outcomes and Procedure-Specific Mortality From a Single-Center Experience

mohammad alsalaldeh

dr-alshalaldeh@hotmail.com

Pamukkale Üniversitesi Hastaneleri

gökhan önem

Pamukkale Üniversitesi Hastaneleri

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Abstract

Objective: With increasing life expectancy, we are seeing more patients aged 80 years and older being referred for open-heart surgery. In this study, we reviewed our early results in this age group and looked at the possible impact of procedure complexity, preoperative LVEF, and length of hospital stay on in-hospital mortality.

Methods: We retrospectively analyzed octogenarian patients (≥80 years) who underwent open-heart surgery in our center between January 2014 and December 2024. Clinical and operative data were collected from hospital records. Procedures were classified as isolated or combined operations, and early postoperative outcomes were assessed. We also explored clinical factors that might be linked to in-hospital mortality.

Results: A total of 66 patients were included, with a mean age of 83.0 years. Overall in-hospital mortality was 33.3%. Isolated procedures generally had better early outcomes. There were no deaths after isolated low-complexity CABG, and mortality after isolated AVR was 14.3%. In contrast, combined and more complex procedures carried a clearly higher risk, especially cases involving aortic and mitral valve surgery or ascending aortic replacement. Mean preoperative LVEF was 49.6%, and the average length of stay was 18.3 days. Age, LVEF, and length of stay showed only weak associations with early mortality.

Conclusion: Open-heart surgery can be performed with acceptable early results in carefully selected octogenarians, particularly when an isolated procedure is planned. However, combined and complex operations are associated with markedly higher early mortality, emphasizing the need for careful patient selection.

INTRODUCTION

The progressive aging of the planet's population has caused an increase in the number of geriatric patients referred for heart surgery. Projections of global health trends reveal a sharp increase in the percentage of people aged 80 years and over. This has brought a series of challenges to healthcare systems around the planet [1,2]. Improved methods of surgery and postoperative intensive care have made heart surgery accessible for the more aged patient populations. However, the very old patient constitutes a susceptible group due to their reduced physiological reserves and frequent presence of associated diseases [3,4].

Cardiovascular disease is a major cause of morbidity and mortality, and surgery is a mainstay in the improvement of survival and quality-of-life outcomes in selected patients [3,4]. Nevertheless, the postoperative course in octogenarians is still associated with a worse result than in younger patients, with a greater incidence of perioperative morbidity and mortality [5,6]. The poor postoperative course has been ascribed not only to the patients' age but also to the patients' comorbidity, the patients' ventricular dysfunction, and the complexity of the operation. Emerging data also show that chronological age by itself is not a reliable predictor of surgical risk in elderly patients. Rather, functional ability, frailty, and the

nature of the planned surgical procedure may be more important determinants of early postoperative outcomes [5–7]. Specifically, combined and complex cardiac surgical procedures entail long cardiopulmonary bypass times and high physiological stresses, which may be particularly risky in octogenarians with depleted functional ability.

While various publications have assessed the results of cardiac surgery in elderly patients, many have analyzed data for large age ranges, which may have masked the particular risks and courses of recovery for octogenarians [8,9]. Additionally, differences between institutions in patient and surgical characteristics underscore the value of individual institution-level data for clinical decision-making [10]. This study aims to evaluate the early surgical outcomes of patients undergoing open-heart surgery at the age of 80 years and older in a single tertiary cardiovascular institution. The objective of this study is to determine through procedure types, left ventricular ejection fraction, and hospital stay how much procedure complexity versus age contributes to early surgical mortalities. A better understanding of this aspect may help in improving the selection and surgical management of this growing and high-risk subgroup of patients.

MATERIALS AND METHODS

Study Design and Patient Population

The objective of this single-center, retrospective observational study is the early postoperative outcome analysis of patients aged 80 years and older who have undergone open-heart surgery. Patients aged 80 years and older who underwent open-heart surgery procedures from January 2014 to December 2024 were included.The subjects for this study were identified through the institution’s electronic medical record system. The inclusion criteria involved all patients who were 80 years of age and older at the time of surgery and who had undergone open heart surgery. There were no subjects who were excluded based on gender and type of surgery. The study focused on the initial in-hospital outcomes that occurred after the surgical procedure.

Surgical Procedures

The range of surgical procedures included isolated coronary artery bypass grafting (CABG) with one to five distal anastomoses, isolated aortic valve replacement (AVR), and isolated mitral valve replacement (MVR). More complex procedures included: valve procedures done at the same time as other surgery, CABG combined with valve replacement surgery, tricuspid valve annuloplasty, and aortic replacement.All procedures were performed using conventional open surgical methods on cardiopulmonary bypass. Surgical strategy and extent of surgery were decided by the operating cardiac surgeon, based on anatomic findings and clinical presentation.

Data Collection

The demographic parameters, surgical procedures, and early postoperative data were collected from the medical records. The parameters included were age, sex, type of surgery, left ventricular ejection fraction, length of stay in the hospital, and mortality. However, given that the study had a retrospective approach and that the patient population was relatively old, it was not possible to have a full frailty assessment or a reliable surgical risk assessment tool such as EuroSCORE II or Society of Thoracic Surgeons (STS) risk score.

Outcome Measures

The major study endpoint was in-hospital death post-open heart surgery. The secondary endpoints included the length of hospital stay and the distribution of deaths according to type of surgery and complexity of surgery. In descriptive analysis, surgery was divided as isolated and combined.

Statistical Analysis

The analyses were done using Python version 3.9 and related scientific libraries. Continuous data is presented as mean ± standard deviation or as median and range, as applicable. Categorical data is presented as absolute frequencies and percentages.For comparison between groups, the independent samples t-test or the Mann-Whitney U test, depending on whether the data are normally distributed, was used. The chi-squared test or Fisher's exact test, depending on the number of observations, was used to compare categorical data. The correlation between various clinical variables was explored using correlation analysis.

Because of the small number of patients and few individuals in several procedural groups, statistical inferences were made with considerable reservation, and data relating to individual surgical procedures are mainly descriptive.

Ethical Approval

The study was approved by the institutional ethics committee on 07 January 2025 (IRB No: E-60116787-020-636202) and was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Patient Characteristics

Sixty-six patients aged 80 years and above who underwent open heart surgery were studied. There were 37 (56.1%) men and 29 (43.9%) women. The mean and median ages of the subjects were 83.0 and 82.0 years, respectively (range 80-89 years).In-hospital survival rate was 44 patients (66.7%), while 22 patients (33.3%) died during the initial hospitalization. The preoperative LVEF was 49.6% with a median of 50.0% (25.0% to 60.0%). The average length of hospital stay was 18.3 days with a median of 14.0 days (0 to 82 days). The demographic data, initial hospital course, and survival rate for the patients are shown in Table 1.

Distribution of Surgical Procedures

The distribution of surgical procedures in the study group is shown in Table 2. The commonest surgical procedure done in this group is the four-vessel coronary artery bypass grafting, contributing 25.8% (n = 17). Isolated coronary revascularization procedures are the following: CABG ×5 in 7.6% (n = 5), CABG ×1 in 6.1% (n = 4), and CABG ×3 in 4.5% (n = 3).Isolated valve surgeries included valve replacement of the mitral valve in 12.1% (n = 8) and isolated aortic valve replacement in 10.6% (n = 7) of the surgeries. The remaining surgeries included combined surgeries such as aortic and mitral valve replacement in n = 3, CABG x4 with aortic valve replacement in n = 2, CABG x1 with tricuspid annuloplasty in n = 1, and ascending aortic replacement in n = 2.

Procedure-Specific Early Mortality

Early in-hospital mortalities depended on the type and complexity of surgical procedure. Isolated CABG surgeries had favorable early results in general. No in-hospital mortalities occurred in CABG ×1, CABG ×2, and CABG ×3. However, CABG ×4 had a higher early death rate with a total of five deaths out of 17 patients (29.4%).

There were no deaths within the hospital for patients receiving CABG × 5; however, this group represented a small, selectively treated population.Isolated aortic valve replacement showed relatively favorable early results, as shown by only one in-hospital death in seven patients (14.3 percent). However, combined valve surgery showed a relatively high mortality rate. In particular, combined aortic and mitral valve replacement showed two in-hospital deaths in three patients (66.7 percent).

Procedures involving the ascending aorta had the highest observed early in-hospital mortality rate. All patients who underwent surgery that involved ascending aortic replacement died during the initial hospitalization. Because the numbers are small, these data are presented descriptively. The in-hospital mortality rate for isolated versus combined surgical procedures can be seen in Table 3.

Length of Hospital Stay and Clinical Associations

The mean duration of hospital stay was 18.3 days. Prolonged hospital stay was more frequent in survivors, while the shorter stay was more common in patients who died in the early postoperative period.Results from the exploratory correlation analysis showed weak correlation for age, left ventricular ejection fraction, and length of hospital stay. In the same manner, the three factors showed weak correlation for in-hospital deaths. This indicated that the postoperative factors for octogenarians were not primarily based on isolated demographic and physiological factors.

Summary of Key Findings

Isolated surgical procedures were found to have a favorable prognosis, while the risk of inhospital death for the group that underwent combined or complex procedures was significantly increased. This variability in surgical outcomes points out the diversity of surgical risk for patients who are octogenarians.

DISCUSSIONS

The current research provides a practical evaluation of early outcomes after open-heart surgery for patients aged 80 years and older, emphasizing the great significance of the complexity of the procedure for early in-hospital mortality. The major finding of this research indicates that isolated surgeries result in favorable early outcomes compared to complex surgeries, while the risk of early mortality is much greater.The in-hospital mortality rate in this study, at 33.3%, is a reflection of the patients' age and comorbidities. While the in-hospital mortality rate in this study is certainly higher than in some contemporary studies, it is important to recognize that the patients in this study were not selected for low risk [5, 6]. The patients in this study underwent aortic and/or valve operations, as well as operations on the ascending aorta, all of which have been shown to be at higher risk for operative mortality. Analysis of procedure-specific data showed great variability in early in-hospital mortality. Isolated coronary artery bypass grafting and isolated aortic valve replacement showed relatively better outcomes, consistent with previous literature that octogenarians can benefit from isolated cardiac surgery [9,11]. However, combined procedures, especially those requiring replacement of aortic and mitral valves, had a much higher mortality rate. Our findings are consistent with previous literature, which showed the cumulative physiological stress of prolonged CPB times, surgical trauma, and reduced physiological reserves in very elderly patients undergoing complex surgery [5,6].

The procedures that involve the ascending aorta showed the highest mortality rates. Although the number of cases was not many, this finding underlines the technical difficulty of aortic surgery in patients who are octogenarians. Hence, patient selection is of utmost importance for this group of patients. Alternative methods of management also need to be considered. Left ventricular ejection fraction has long been considered one of the main factors that influence surgical risk. In the current study, there was a tendency toward lower ejection fraction in nonsurvivors; in contrast, there were only slight correlations between ejection fraction, age, hospital stay, and in-hospital mortality. The data suggest that isolated biological variables might have little predictive power in patients who are very old and that the evaluation of patients should not be limited to their age [12,13].One area that has emerged as a prominent predictor of poor outcome in elderly patients undergoing cardiac surgical procedures is that of frailty. Various studies have shown that patients who are frail have higher mortality rates, longer durations of hospital stay, and a higher probability of institutionalization following cardiac surgical procedures [13-15]. Although the current study did not evaluate patients for the presence of frailty, its known prognostic value may help to explain the discrepancies in patient outcome based on chronological age.

The duration of hospital stay in this population of patients represents the variable nature of postoperative recovery in octogenarians who undergo major cardiac surgery. Longer hospital stays were more common among survivors, and smaller hospital stay times were more often associated with early postoperative mortality. This suggests a need for postoperative care and support among patients who recover.While there has been an expansion in the management of older patients through the use of transcatheter therapies, there are still indications for open heart surgery in cases of complex anatomy or coexisting diseases that cannot be managed percutaneously [7, 11]. The results of the present study are in support of a multi-disciplinary approach in decision-making in octogenarians considered for surgical management.

LIMITATIONS

The study has a number of limitations. The study being retrospective and conducted at a single institution limits its generalizability and may be prone to certain biases. The study has a small sample size, and this may affect the power of certain comparisons and may require that certain outcomes be interpreted cautiously. The study did not utilize standardized measures of frailty and standardized risk scores for surgery. The study focused only on short-term in-hospital outcomes and did not include long-term survival and recovery.

CONCLUSION

In patients 80 years and older, open heart surgery can provide acceptable postoperative results if strict patient selection and individualized surgical strategies are employed. Stand-alone operations, and in particular coronary artery bypass grafting and aortic valve replacement, appear to provide a more favorable postoperative course, while the risk of in-hospital death is significantly increased in more complex operations. This study clearly underscores the importance of procedural complexity rather than the number 80 as the determinant for the evaluation of patients for open heart surgery.

Declarations

Data Availability Statement: All data supporting the findings of this study are available without restriction. The data are stored in the university hospital patient database and can be provided by the corresponding authors upon reasonable request.

Declaration of Conflicting Interests: The authors declare that there are no conflicts of interest related to the authorship or publication of this study.

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Ethics Committee Approval: The study was approved by the Institutional Medical Ethics Committee of Pamukkale University Faculty of Medicine - Denizli / Turkey (Approval No: E-60116787-020-636202) and

conducted in accordance with the principles of the Declaration of Helsinki. The Institutional Review Board (IRB) waived the requirement for informed consent due to the retrospective nature of the study.

Author Contribution

writerdata collectoranalyzercorresponding author
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Tables

Table 1. Baseline Demographic and Clinical Characteristics of Octogenarian Patients Undergoing Open-Heart Surgery

Variable	Value
Number of patients	66
Male sex, n (%)	37 (56.1)
Female sex, n (%)	29 (43.9)
Age, mean ± SD (years)	83.0 ± 2.4
Age, median (range)	82 (80–89)
Preoperative ejection fraction, mean ± SD (%)	49.6 ± 7.8
Preoperative ejection fraction, median (range)	50 (25–60)
Length of hospital stay, mean ± SD (days)	18.3 ± 14.9
Length of hospital stay, median (range)	14 (0–82)
In-hospital mortality, n (%)	22 (33.3)
In-hospital survival, n (%)	44 (66.7)

Table 2. Distribution of Surgical Procedures Performed in Patients Aged ≥80 Years

Surgical procedure	n	%
CABG ×4	17	25.8
CABG ×5	5	7.6
CABG ×1	4	6.1
CABG ×3	3	4.5
CABG ×2	2	3.0
Isolated mitral valve replacement (MVR)	8	12.1
Isolated aortic valve replacement (AVR)	7	10.6
AVR + MVR	3	4.5
CABG ×4 + AVR	2	3.0
CABG ×1 + tricuspid annuloplasty	1	1.5
Procedures involving ascending aortic replacement	2	3.0

Table 3. In-Hospital Mortality According to Surgical Procedure Complexity

Surgical procedure	Deaths (n)	Total cases (n)	Mortality (%)
CABG ×1	**0**	**4**	**0**
CABG ×2	**0**	**2**	**0**
CABG ×3	**0**	**3**	**0**
CABG ×4	**5**	**17**	**29.4**
CABG ×5	**0**	**5**	**0**
Isolated AVR	**1**	**7**	**14.3**
Isolated MVR	**0**	**8**	**0**
AVR + MVR	**2**	**3**	**66.7**
CABG ×4 + AVR	**1**	**2**	**50.0**
Procedures involving ascending aortic replacement	**2**	**2**	**100**