Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2023i1.534
*Biol. Clin. Sci. Res. J., Volume, **2023**: 534*
Original research article

THE IMPACT OF AGE ON OUTCOMES OF CORONARY ARTERY BYPASS GRAFTING

SALEEM M[1*], SAEED MA[2], IQBAL H[3]

[1]Department of Cardiac Surgery (Assist. Professor), Punjab Institute of Cardiology Lahore, Pakistan
[2]Department of Cardiac Surgery (CPT), Punjab Institute of Cardiology Lahore, Pakistan
[3]Department of Cardiac Surgery (Cardiac Perfusionist), Punjab Institute of Cardiology Lahore, Pakistan
**Correspondence author email address:* drsaleem6001@hotmail.com

(Received, 27th June 2023, Revised 20th September 2023, Published 09th November 2023)

Abstract: *As people live longer, the number of individuals aged 75 and above is increasing. This makes it crucial to provide careful medical care for elderly cardiac patients. Our study was conducted at the Punjab Institute of Cardiology and involved 300 patients divided into three age groups: those under 60, those between 60-75, and those over 75. Participants had no history of cardiac surgery. We documented preoperative demographics and other relevant variables and then analyzed post-operative data concerning complications and other variables separately for each age group. Our research revealed a significant association between age and 30-day mortality ($p < 0.001$), with a 2.5% incidence of 30-day mortality observed among those over 75 years old. We also found that re-intubation, dialysis, extended ICU stays, and atrial fibrillation occurred more frequently in the over-75 age group compared to other age groups ($P < 0.001$). Our findings highlight the significant impact of age on mortality after cardiac surgery, as well as the heightened likelihood of complications in elderly individuals. Therefore, it is essential to carefully consider age-related organ abnormalities and the increasing burden of age-related health problems when managing elderly patients who undergo cardiac surgery. These insights suggest a need for personalized strategies to address the unique challenges posed by advanced age in the context of cardiac surgical procedures.*

Keywords: Elderly, Cardiac Surgery, Mortality, Complications, Age-Related Health Problems

Introduction

A growing demographic shift and advancements in medical technology have led to an increasing number of elderly patients seeking cardiac surgery interventions, particularly for coronary artery bypass grafting (CABG) to address cardiovascular issues (Alexander et al., 2000; Peterson et al., 1995). Among this demographic, octogenarians stand out as the segment experiencing the most rapid growth and exhibiting the highest prevalence of coronary artery disease (CAD), necessitating frequent referrals to cardiothoracic surgeons for surgical revascularization (Raja et al., 2013).
Concerns often arise when considering surgical interventions in the elderly, primarily centered on the potential for suboptimal outcomes. Age-related factors, such as compromised tissue integrity and diminished healing capacity, raise apprehensions regarding the efficacy of surgical interventions in older individuals. Cardiologists, cognizant of the higher frequency of comorbidities and reduced cardiac function in older patients, express reservations about the likelihood of procedural complications in percutaneous coronary interventions (PCI) (De Gregorio et al., 1998; DeGeare et al., 2000).
Despite the notion that older patients undergoing CABG may not achieve outcomes comparable to their younger counterparts, evidence suggests that their results still surpass those from PCI or pharmacological treatments alone (Graham et al., 2002). Previous observational studies have indicated that even after adjusting for comorbidities, older patients undergoing CABG exhibit an increased risk of post-operative mortality (Zingone et al., 2009).

In this study, we systematically investigated the influence of age on both mortality rates and the incidence of post-operative complications in a substantial patient population undergoing solitary coronary artery bypass grafting (CABG) at our institution. Our analysis aimed to contribute nuanced insights into the outcomes of CABG in the elderly, taking into account the multifaceted considerations associated with advanced age in the context of cardiac surgical procedures.

Methodology

The study examined individuals who had their first coronary artery bypass graft (CABG) surgery at the Punjab Institute of Cardiology, Lahore, between June 15, 2022 to December 15, 2022. A total of 300 patients were included in the study and were divided into three age groups, each containing 100 individuals, as shown in Table 1. Only individuals who had not previously undergone cardiac surgery were included in the study after obtaining informed consent from them and approval from the hospital's ethics committee.
Patient medical history and other parameters were obtained from hospital records, and the 30-day mortality and incidence of surgical complications were calculated for each age group. Statistical analysis using the analysis of variance (ANOVA) and Pearson's chi-squared test was performed to determine the impact of age. The threshold for statistical significance was set at $p < 0.05$. Additionally, the prevalence of diabetes mellitus, atrial fibrillation (AF), and arterial hypertension was determined across all age groups under investigation.

[Citation: Saleem, M., Saeed M.A., Iqbal H. (2023). The impact of age on outcomes of coronary artery bypass grafting *Biol. Clin. Sci. Res. J.*, **2023***: 534*. doi: https://doi.org/10.54112/bcsrj.v2023i1.534]

Results

Table 1 displays the preoperative parameters of individuals in different age groups as well as the prevalence of three concomitant disorders. The analysis revealed significant differences influenced by age in the following variables: female gender, low left ventricular ejection fraction (30-50%), arterial hypertension, diabetes, unstable angina, non-cardiac atherosclerosis, increased serum creatinine levels, and atrial fibrillation. The table presents the preoperative characteristics of patients. Table 2 presents a detailed examination of post-operative outcomes and complications in a cohort of 300 patients undergoing solitary coronary artery bypass grafting (CABG), categorized into three age groups: those under 60 years, those between 60 and 75 years, and those aged 75 years and above.

The first row highlights the distribution of patients in each age group, with 100 patients in each category. Moving to the subsequent rows, the mean duration of Intensive Care Unit (ICU) stay is provided for each age group, demonstrating a significant increase with age. The associated 95% confidence limits further underscore the reliability of these findings.

The following rows outline the occurrence of various post-operative complications. Pneumonia, atrial fibrillation, perioperative myocardial infarction, unstable sternum, significant pleural effusion, and pericardial effusion are presented as percentages for each age group. Notably, the prevalence of atrial fibrillation and pneumonia substantially increases with advancing age.

Other complications, including cerebral vascular events, confusion, re-thoracotomy, reintubation, resuscitation, intra-aortic balloon pump (IABP) utilization, dialysis requirement, and laparotomy, are detailed in subsequent rows. The percentages reflect the varying degrees of occurrence in each age group.

The mean units of packed red blood cells transfused are presented alongside their 95% confidence limits, indicating a notable increase with age. Finally, the table concludes with the percentage of patients experiencing 30-day mortality, revealing a considerable rise in mortality rates among patients aged 75 years and above..

Table 1: Demographics of study population before operation:

Variable	< 60 years	60−75 years	≥ 75 years	*P*-Value
No. of patients	100	100	100	
Female	12.9%	23.5%	41.8%	< 0.001
COPD	2.1%	4.7%	4.1%	0.017
Extracardiac arteriopathy	11.3%	17.4%	20.4%	< 0.001
Neurological dysfunction	2.5%	3.7%	4.3%	0.097
Serum creatinine > 200 µmol·L^{-1}	1.2%	1.7%	2.2%	0.047
Critical preoperative state	0.5%	0.3%	0.6%	0.845
Unstable angina	10.6%	14.6%	19.5%	< 0.001
LV ejection fraction 30%−50%	28.9%	32.4%	32.9%	0.003
LV ejection fraction < 30%	3.3%	5.9%	4.9%	0.303
Recent myocardial infarction	13.8%	11.7%	9.8%	0.067
Pulmonary hypertension	2.1%	2.4%	2.8%	0.271
Emergency	1.3%	1.4%	1.9%	0.178
Arterial hypertension	67.3%	74.1%	76.2%	< 0.001
Diabetes mellitus	23.8%	30.7%	31.7%	< 0.001
Atrial fibrillation	0.5%	4.2%	5.3%	< 0.001

Table 2: Post-operative data of patients after

Variable	< 60 years	60-75 years	≥75 years	*p*-Value
No. of patients	100	100	100	
ICU stay (days)	2.4 ± 0.08	3.5 ± 0.15	4.7 ± 0.35	**< 0.001**
Pneumonia	7.6%	9.1%	9.9%	**0.005**
Atrial fibrillation	27.9%	44.8%	56.1%	**< 0.001**
Perioperative myocardial infarction	1.4%	1.6%	1.8%	**0.878**
Unstable sternum	0.4%	0.6%	1.3%	**0.245**
Significant pleural effusion	9.2%	11.4%	12.1%	**0.123**
Significant pericardial effusion	0.3%	0.4%	1.1%	**0.423**
Cerebral vascular event	1.2%	2.1%	2.6%	**0.0001**
Confusion	2.1%	5.4%	13.7%	**< 0.001**
Re-Thoracotomy	2.1%	2.4%	2.9%	**0.621**
Re-intubation	1.5%	3.7%	5.3%	**< 0.001**
Resuscitation	1.3%	2.2%	2.8%	**0.153**

[Citation: Saleem, M., Saeed M.A., Iqbal H. (2023). The impact of age on outcomes of coronary artery bypass grafting *Biol. Clin. Sci. Res. J.*, **2023***: 534*. doi: https://doi.org/10.54112/bcsrj.v2023i1.534]

IABP	0.6%	0.4%	0.8%	**0.550**
Dialysis	1.3%	2.3%	5.2%	**< 0.001**
Laparotomy	0.3%	0.3%	0.3%	**0.784**
Packed red blood cells (units)	0.6 ± 0.07	0.7 ± 0.09	1.4 ± 0.11	**< 0.001**
30-day mortality	0.4%	0.9%	2.5%	**< 0.001**

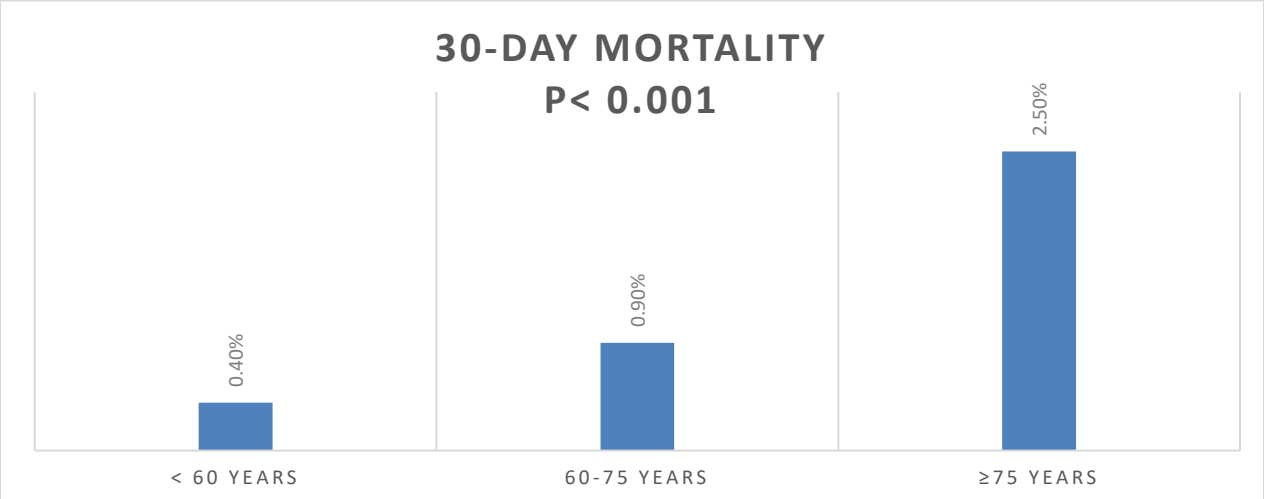

Figure 1: 30- Days Mortality between the different age groups

Discussion

The amount of older adults receiving heart surgery is steadily rising, which is one of the effects of population demographic shifts. (Mortasawi et al., 1999; Mortasawi et al., 2001) There isn't a national database of the related diseases' prevalence in Pakistan that we looked into in our patient group. There is less empirical support for the idea that age affects the post-operative outcome of CABG surgery. Age-specific studies are inconsistent and frequently concentrate on specific methods and procedures or the quality of life following surgery as opposed to post-operative mortality. Diastolic function is one of the cardiac parameters that our study did not consider, even though it should have a significant bearing on diagnosis and treatment, particularly in older people. (Kitzman, 2001)According to a 1998 study, 43% of patients who had heart failure as their primary diagnosis also had decent systolic function. (Senni et al., 1998) It has been determined by different entities that roughly 50% of older people with congestive heart failure had a diastolic failure (Cowie et al., 1999; Kitzman et al., 2001). This aspect is also hidden in our study.

In our study, post-op ICU stay was longest for the age group more significant than 75 years, followed by the age group between betwee60-75yrs and it was least for the age group less than 60 years. Similar to our research, Tuman et al. discovered that older age and emergency surgery were associated with longer ICU stays. (Tuman et al., 1992)

. In our study, 30-day mortality was higher among those aged≥ 75 years, which is 2.5%, per the previous research. Johnson et al. demonstrated that even after adjusting for sixteen likely confounding factors, octogenarian patients receiving heart surgery still had more excellent fatality rates than younger patients. (Johnson et al., 2005) In contrast, Barnett et al. did not identify any statistically significant differences in the adjusted odds ratios of death after surgery between octogenarians and others. On the other hand, notable variations in post-operative complications were discovered.(Barnett et al., 2003)

In general terms, rather than being tied explicitly to surgical problems, the increased mortality risk observed in the elderly population may be associated with the complete treatment process. Numerous studies show that compared to preoperative comorbidities and procedural factors, post-operative complications are a more excellent risk factor for hospital death. (Barnett et al., 2003; Zingone et al., 2009)

Older individuals do not recover from issues as quickly as younger people do. Because post-operative complications tend to lower the chance of more senior survival drastically, these patients will only recover successfully if the procedure is carefully executed and no complications are kept at a minimum. (Barnett et al., 2003; Scott et al., 2005; Zingone et al., 2009).

The study provides insights into cardiac surgery outcomes in elderly patients but has limitations due to the lack of comprehensive assessment of diastolic function and focus on short-term outcomes only. Inconsistencies in age-specific studies and the study's retrospective nature introduce the possibility of bias and incomplete data capture. Addressing these limitations is crucial for enhancing the study's generalizability and robustness.

Conclusion

Based on our analysis, it is evident that advanced age has a significant influence on the probability of experiencing

perioperative complications and mortality after undergoing heart surgery. Therefore, while treating elderly patients who require cardiac surgery, healthcare providers should consider the increased likelihood of age-related organ dysfunction and the presence of multiple comorbidities that may affect the patient's health outcome.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

Writers have affirmed they have no pending conflicts of interests

References

Alexander, K. P., Anstrom, K. J., Muhlbaier, L. H., Grosswald, R. D., Smith, P. K., Jones, R. H., and Peterson, E. D. (2000). Outcomes of cardiac surgery in patients age≥ 80 years: results from the National Cardiovascular Network. Journal of the American College of Cardiology **35,** 731-738.

Barnett, S. D., Halpin, L. S., Speir, A. M., Albus, R. A., Akl, B. F., Massimiano, P. S., Burton, N. A., Collazo, L. R., and Lefrak, E. A. (2003). Post-operative complications among octogenarians after cardiovascular surgery. The Annals of thoracic surgery **76,** 726-731.

Cowie, M. R., Wood, D. A., Coats, A. J., Thompson, S. G., Poole-Wilson, P. A., Suresh, V., and Sutton, G. C. (1999). Incidence and aetiology of heart failure; a population-based study. European heart journal **20**, 421-428.

De Gregorio, J., Kobayashi, Y., Albiero, R., Reimers, B., Di Mario, C., Finci, L., and Colombo, A. (1998). Coronary artery stenting in the elderly: short-term outcome and long-term angiographic and clinical follow-up. Journal of the American College of Cardiology **32**, 577-583.

DeGeare, V. S., Stone, G. W., Grines, L., Brodie, B. R., Cox, D. A., Garcia, E., Wharton, T. P., Boura, J. A., O'Neill, W. W., and Grines, C. L. (2000). Angiographic and clinical characteristics associated with increased in-hospital mortality in elderly patients with acute myocardial infarction undergoing percutaneous intervention (a pooled analysis of the primary angioplasty in myocardial infarction trials). The American journal of cardiology **86**, 30-34.

Graham, M. M., Ghali, W. A., Faris, P. D., Galbraith, P. D., Norris, C. M., and Knudtson, M. L. (2002). Survival after coronary revascularization in the elderly. Circulation **105**, 2378-2384.

Johnson, W. M., Smith, J. M., Woods, S. E., Hendy, M. P., and Hiratzka, L. F. (2005). Cardiac surgery in octogenarians: does age alone influence outcomes? Archives of surgery **140**, 1089-1093.

Kitzman, D. W. (2001). Why is diastolic heart failure in older patients the cardiologist's enigma. Dialogues in Cardiovascular Medicine **6**, 95.

Kitzman, D. W., Gardin, J. M., Gottdiener, J. S., Arnold, A., Boineau, R., Aurigemma, G., Marino, E. K., Lyles, M., Cushman, M., and Enright, P. L. (2001). Importance of heart failure with preserved systolic function in patients≥ 65 years of age. The American journal of cardiology **87**, 413-419.

Mortasawi, A., Ennker, I. C., Albert, A., Rosendahl, U., Dalladaku, F., Alexander, T., and Ennker, J. (1999). Arterial myocardial revascularization in the 9th decade of life. Own results and literature review: Eigene Ergebnisse und Literaturübersicht. Herz **24**, 158-170.

Mortasawi, A., Gehle, S., Yaghmaie, M., Schröder, T., Ennker, I. C., Rosendahl, U., Albert, A., and Ennker, J. (2001). Short and long term results of aortic valve replacement in patients 80 years of age and older. Herz **26**, 140-148.

Peterson, E. D., Cowper, P. A., Jollis, J. G., Bebchuk, J. D., DeLong, E. R., Muhlbaier, L. H., Mark, D. B., and Pryor, D. B. (1995). Outcomes of coronary artery bypass graft surgery in 24 461 patients aged 80 years or older. Circulation **92**, 85-91.

Raja, S. G., Shah, J., Navaratnarajah, M., Amin, F., and Amrani, M. (2013). Outcomes and predictors of mortality and stroke after on-pump and off-pump coronary artery bypass surgery in octogenarians. Innovations **8,** 269-275.

Scott, B. H., Seifert, F. C., Grimson, R., and Glass, P. S. (2005). Octogenarians undergoing coronary artery bypass graft surgery: resource utilization, post-operative mortality, and morbidity. Journal of cardiothoracic and vascular anesthesia **19**, 583-588.

Senni, M., Tribouilloy, C. M., Rodeheffer, R. J., Jacobsen, S. J., Evans, J. M., Bailey, K. R., and Redfield, M. M. (1998). Congestive heart failure in the community: a study of all incident cases in Olmsted County, Minnesota, in 1991. Circulation **98**, 2282-2289.

Tuman, K. J., McCarthy, R. J., Najafi, H., and Ivankovich, A. D. (1992). Differential effects of advanced age on neurologic and cardiac risks of coronary artery operations. The Journal of thoracic and cardiovascular surgery **104**, 1510-1517.

Zingone, B., Gatti, G., Rauber, E., Tiziani, P., Dreas, L., Pappalardo, A., Benussi, B., and Spina, A. (2009). Early and late outcomes of cardiac surgery in octogenarians. The Annals of thoracic surgery **87,** 71-78.