Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2023i1.422
*Biol. Clin. Sci. Res. J., Volume, **2023**: 422*
Original Research Article

RELATIONSHIP OF POST-OPERATIVE INOTROPIC USE AND MORTALITY IN CABG PATIENTS WITH RADIAL GRAFTS

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(Received, 15th February 2023, Revised 04th June 2023, Published 27th September 2023)

Abstract: *This retrospective analysis aimed to assess the effect of post-operative use of inotropic support on the long-term mortality rates of coronary artery bypass graft (CABG) patients who had undergone radial grafts. Inotropic drugs are frequently administered to improve heart function after surgery, but their impact on long-term survival is still controversial. The primary objective was to compare the 10-year mortality rates between patients who received post-operative inotropic support (Group A) and those who did not (Group B). We also sought to determine whether inotropic infusion correlated with improved or worsened long-term survival. A total of 80 participants were retrospectively analyzed, with Group A consisting of 18 individuals who received inotropic support and Group B comprising 62 individuals without such support. Demographic and clinical characteristics, including age, gender, comorbidities, clinical parameters, ejection fraction, New York Heart Association (NYHA) functional class, and 10-year mortality rates, were assessed and compared between the two groups. Kaplan-Meier survival analysis was done to assess the survival benefits. The analysis revealed no significant difference in 10-year mortality rates between Group A and Group B, with an insignificant p-value of 0.61. The Kaplan-Meier survival analysis and log-rank test further supported this finding, indicating no significant relationship between the absence of inotropic infusion and increased survival chances (p=0.987). These results suggest that post-operative inotropic support may not significantly influence long-term survival. Inotropic infusion may not be necessary for improving or worsening 10-year survival rates in surgical patients. While this retrospective analysis provides valuable insights, further research, particularly larger prospective studies, and randomized controlled trials, is needed to validate these findings and offer more conclusive guidance regarding the use of inotropic agents in post-operative care.*

Keywords: Coronary Artery Bypass Grafting (CABG), Radial Artery Grafts, Cardiac Surgery, Cardiac Function, Cardiac Arrest

Introduction

Coronary artery bypass grafting (CABG) surgery is a well-established and widely performed procedure for the treatment of coronary artery disease (CAD) (Giambruno et al., 2018). Over the years, various surgical techniques and strategies have been developed to enhance the outcomes of CABG, with a primary focus on improving graft patency and reducing post-operative complications. Among these strategies, radial artery grafts have gained prominence due to their favorable long-term patency rates and potential to improve patient outcomes compared to traditional saphenous vein grafts (Zukowska et al., 2023).

One crucial aspect of post-CABG care is the management of hemodynamic stability in the immediate post-operative period (Bhutiani, 2021). This often necessitates using inotropic agents, such as dopamine, dobutamine, or epinephrine, to support cardiac function and maintain adequate perfusion. Inotropic agents increase the heart's contractility, helping improve cardiac output (Arfaras-Melainis et al., 2023). However, their use is not without potential risks and adverse effects, including arrhythmias, increased myocardial oxygen consumption, and the potential for increased mortality (Edinoff et al., 2022). The decision to administer inotropic support in post-CABG patients, particularly those with radial artery grafts, remains a topic of debate and investigation.

The choice of graft material in CABG surgery has significant implications for patient outcomes, and recent studies have shown that the use of radial artery grafts is associated with improved long-term graft patency and reduced rates of revascularization when compared to saphenous vein grafts (Ruttmann et al., 2019). Radial artery grafts offer a higher resistance to atherosclerosis and may result in better long-term survival and freedom from cardiac events. However, the impact of post-operative inotropic support on patients with radial grafts remains a matter of concern (Nakamura et al., 2022).

While inotropic agents are essential for managing hemodynamic instability following CABG, there is a lack of consensus on their optimal use in patients with radial artery grafts (Hollenberg et al., 2019). The rationale for investigating the relationship between post-operative inotropic use and mortality in this subgroup of CABG patients is multi-fold.

Understanding the association between inotropic use and mortality in patients with radial artery grafts can have significant clinical implications. It may help healthcare providers make informed decisions regarding post-operative care and inotropic administration, potentially leading to improved patient outcomes.

Inotropic agents are not without risks. Their use can lead to adverse effects such as arrhythmias and increased

myocardial oxygen consumption, which may be particularly relevant in patients with radial grafts, where optimizing graft function is paramount.

Research in this area can contribute to quality improvement initiatives in cardiac surgery units by identifying best practices and areas for improvement in post-operative care for CABG patients with radial grafts.

Investigating the relationship between post-operative inotropic use and mortality in CABG patients with radial grafts is paramount, as it addresses a clinically relevant question with potential implications for patient care and outcomes. This research seeks to provide valuable insights into the optimal management of this patient population, ultimately improving the quality of care provided to CABG patients undergoing surgery with radial artery grafts.

Methodology

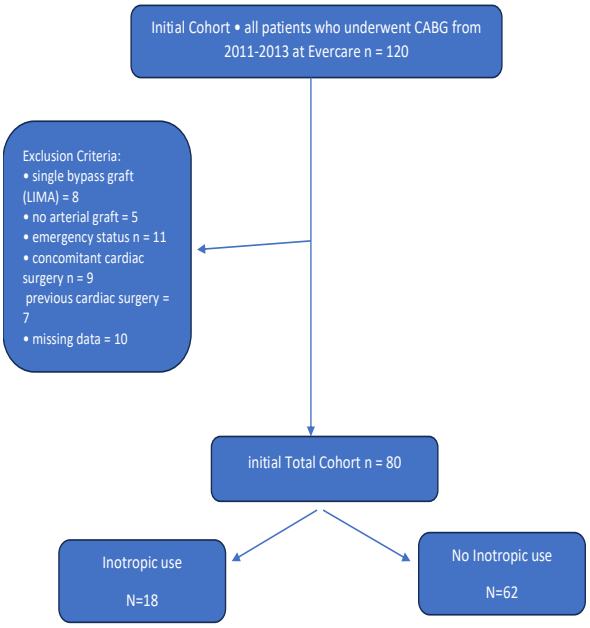

Figure 1: Consort type diagram showing the selection of study population

This retrospective cohort analysis compared the mortality of patients with radial artery Grafts receiving inotropic support to those who did not receive the inotropic support between January 2012 and December 2013, Evercare Hospital, Lahore.

The study was approved by institutional review boards at the Evercare Hospital, Department of Cardiac Thoracic Surgery. The baseline clinical characteristics and demographics were collected from the patient's medical records. Telephone calls to the patients noted the 10-year mortality rate. Those who did not attend to the calls or whose numbers were changed were followed at their postal address. 120 patient records were seen, and 80 participants were selected for further analysis (Figure 1). They were further divided into two groups. Group A, comprising individuals who received post-operative inotropic support following coronary artery bypass grafting (CABG) with radial artery grafts, and Group B, consisting of patients who did not receive inotropic support under similar surgical conditions patients who had undergone open heart surgery with total atrial graft (2 to 3 grafts), including radial artery graft, was recruited in the study. The study included patients aged between 30 and 60 years. Those with previous cardiac surgery, hemodynamic instability, or who required inotropes were excluded. Emergency cases and those without arterial conduit use were also excluded. Patients with missing personnel or surgeon identifiers and those from out of state were excluded to ensure complete follow-up. The same surgeon and team performed the surgeries to eliminate any confounding factors.

The study's primary endpoint was all-cause mortality, with the last follow-up conducted on December 31, 2022. However, the last follow-up for cardiac catheterizations was December 31, 2014. Secondary outcomes included stroke, myocardial infarction, repeat revascularization, and graft patency. Stroke was defined as a permanent neurological deficit due to a cerebrovascular event. Repeat revascularization was defined as a post-operative redo CABG or percutaneous coronary intervention (PCI). The patency of native vessels and bypass conduits was determined by identifying patients with stenosis >50% in any post-operative coronary angiography.

Continuous variables were expressed as mean ± SD, while categorical variables were expressed as proportions. Student's T-test, Wilcoxon's rank sum test, and Pearson's chi-square test were used to compare baseline characteristics. Kaplan-Meier analysis was used to estimate the probability of survival, and comparisons were performed with the log-rank test. The statistical software used was SPSS version 25.0, with p-values less than 0.05 considered statistically significant.

Results

The retrospective analysis included a total of 80 participants who were divided into two groups. Group A comprised 18 participants who received post-operative inotropic support, while Group B comprised 62 participants who did not receive any inotropic support after surgery. You can find the demographic details of these groups in Table 1.

Table 1 presents a comparison between two groups, Group A and Group B, with regard to various demographic and clinical characteristics. In terms of age, the mean age for Group A was 48.9 years with a standard deviation of 12.6, while Group B had a slightly higher mean age of 51.6 years with a standard deviation of 10.6. Both groups had a relatively balanced gender distribution, with Group A having 44.4% males and Group B having 46.8%. Group A had an average BMI of 29.5, similar to Group B's BMI of 29. The prevalence of comorbidities such as hypertension and diabetes mellitus was comparable between the groups, with 88.9% and 44.4% in Group A and 90.3% and 40.3% in Group B, respectively. Smoking habits were also similar, with 50% in Group A and 46.8% in Group B being smokers. Additionally, the table provides information on clinical parameters such as heart failure, previous myocardial infarction (MI), previous percutaneous coronary

intervention (PCI), cerebrovascular accident (CVA), chronic obstructive pulmonary disease (COPD), renal dysfunction, and cancer, showing varying prevalence rates between the two groups. The ejection fraction (EF) mean values were 48.9% for Group A and 51.6% for Group B, with distribution across different EF categories (<35%, 35-50%, and >50%). Lastly, the New York Heart Association (NYHA) functional class distribution demonstrates that both groups predominantly fell into Class II and III categories, indicating moderate levels of heart dysfunction. Overall, this table provides a comprehensive overview of the demographic and clinical characteristics of the two groups under study.

In Figure 3, the 10-year mortality rates of both groups are presented. The percentage reveals no significant difference in the 10-year mortality rates between the two groups. The p-value is also insignificant, indicating that the results of our study did not find a statistically significant difference in 10-year mortality between the two groups.

We used the Kaplan-Meier function in SPSS to analyze survival rates, a commonly used statistical software. The log-rank test was then conducted, and the resulting p-value was found to be 0.987, indicating no significant relationship between the non-use of inotropic infusion and an increase in survival chances. Therefore, it can be concluded that inotropic infusion is unnecessary for improving or worsening the survival rates. (Figure 3).

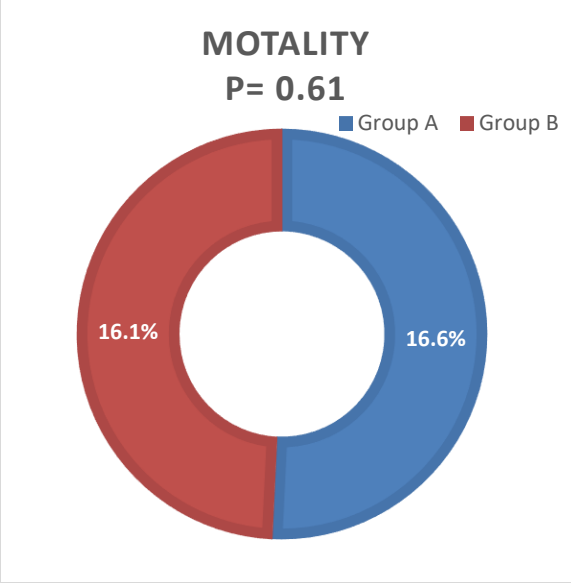

Figure 2: Mortality rate between the two groups

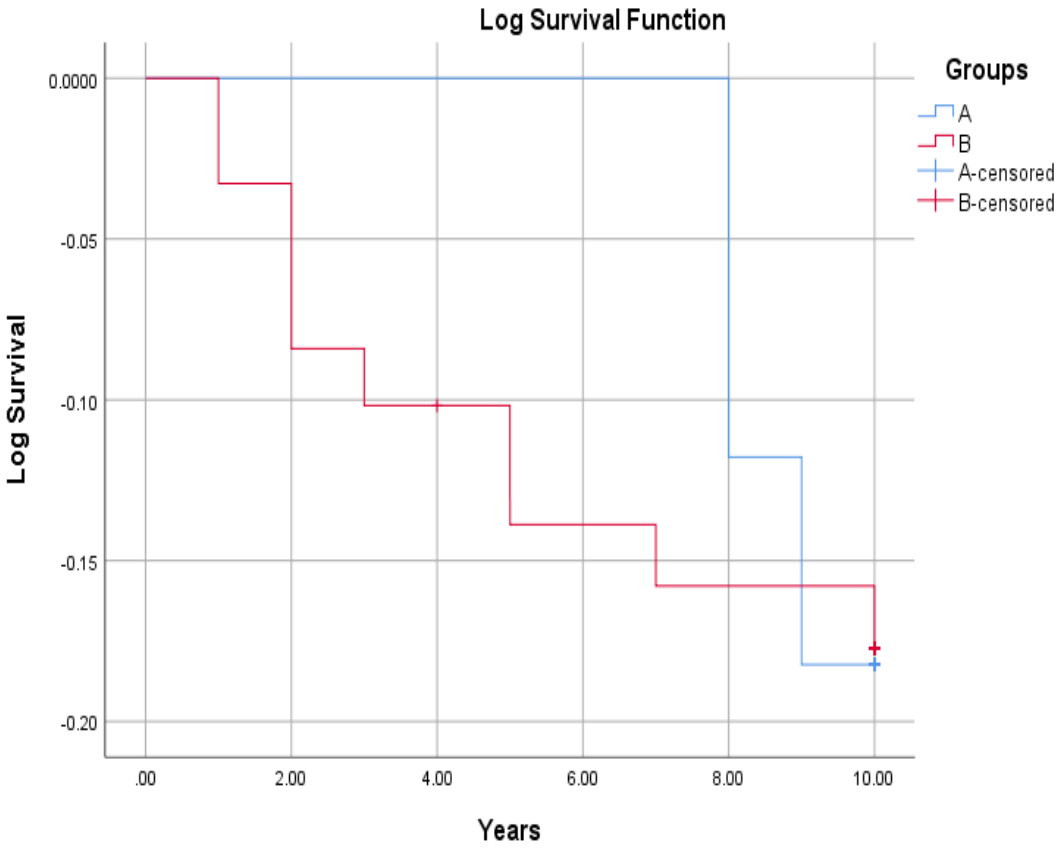

Figure 3: Kaplan-Meier analysis

[Citation Dar, F.N., Yunus, A., Niaz, M.N. (2023). Relationship of post-operative inotropic use and mortality in cabg patients with radial grafts. *Biol. Clin. Sci. Res. J.*, **2023***: 422*. doi: https://doi.org/10.54112/bcsrj.v2023i1.422]

Table 1 Demographics of both groups:

	Group A	Group B
Age		
Mean ± SD	48.9 ± 12.6	51.6 ± 10.6
Male	8 (44.4%)	29 (46.8%)
BMI	29.5 ± 2.6	29 ± 1.6
Hypertension	16 (88.9%)	56 (90.3%)
Diabetes Mellitus	8 (44.4%)	25 (40.3%)
Smokers	9 (50%)	29 (46.8%)
Heart Failure	3 (16.7%)	11 (17.7%
Previous MI	8 (44.4%)	27 (43.5%)
Previous PCI	4 (22.2%)	12 (19.4%)
CVA	1 (5.6%)	5 (8.1%)
COPD	4 (22.2%)	12 (19.4%)
Renal Dysfunction	1 (5.6%)	2 (3.2%)
Cancer	0 (0%)	1 (1.6%)
EF		
Mean ± SD	48.9 ± 12.6	51.6 ± 10.6
<35%	4 (22.2%)	4 (6.5%)
35-50%	8 (44.4%)	35 (56.5%)
> 50%	6 (33.3%)	23 (37.1%)
NYHA Functional Class		
Mean ± SD	2.5 ± 0.5	2.5 ± 0.8
I	1 (5.6%)	7 (11.3%)
II	11 (61.1%)	23 (37.1%)
III	7 (38.9%)	24 (38.7%
IV	3 (16.7%)	8 (12.9%)

Discussion

The study involved a retrospective analysis of 80 participants, categorized into Group A (18 participants) and Group B (62 participants), to investigate the impact of post-operative inotropic support on long-term mortality rates. The demographic details presented in Table 1 provided valuable insights into the characteristics of both groups. While Group A had a mean age of 48.9 years (SD 12.6), Group B had a slightly higher mean age of 51.6 years (SD 10.6). Both groups exhibited similar gender distributions, with approximately 44.4% males in Group A and 46.8% in Group B. Additionally, the groups displayed comparable profiles in terms of BMI, comorbidities like hypertension and diabetes mellitus, and smoking habits.

The clinical parameters examined in our study, including heart failure, previous myocardial infarction (MI), previous percutaneous coronary intervention (PCI), cerebrovascular accident (CVA), chronic obstructive pulmonary disease (COPD), renal dysfunction, cancer, ejection fraction (EF), and New York Heart Association (NYHA) functional class, offered a comprehensive overview of the participants' health status. Notably, the EF mean values were 48.9% for Group A and 51.6% for Group B, distributed across different EF categories. Both groups predominantly fell into Class II and III categories according to NYHA functional class, suggesting moderate levels of heart dysfunction.

Figure 1 presented the 10-year mortality rates for both groups, demonstrating no statistically significant difference between Group A and Group B. This observation was reinforced by the insignificant p-value, further confirmed by the Kaplan-Meier analysis and log-rank test with a p-value of 0.987. These findings collectively indicate that the use or non-use of inotropic infusion did not significantly impact long-term survival rates. In conclusion, the study suggests that inotropic infusion may not be necessary for improving or worsening long-term survival prospects in post-operative patients, highlighting the need to assess its utility in clinical practice carefully.

A separate study investigated the mortality rates following Coronary Artery Bypass Grafting (CABG) in patients who required inotropic support. The research conducted by J. Shahin et al. shed light on the association between inotropic support and patient survival. However, this study had some limitations that warrant further investigation and refinement. Specifically, it did not exclusively employ radial grafts in CABG procedures, which may impact outcomes. The study did not assess long-term mortality, focusing on shorter-term survival. To build upon this research and provide a more comprehensive understanding of the relationship between inotropic support and CABG

outcomes, future studies should consider refining the surgical techniques and extending the follow-up period to encompass long-term mortality data, potentially utilizing radial grafts exclusively to investigate their influence on patient survival. Such improvements could contribute to a more nuanced understanding of the role of inotropic support in CABG outcomes (Shahin et al., 2011).

Similarly, another study conducted by Baysal et al. highlighted the significance of various scoring systems in predicting combined morbidity and mortality among patients undergoing elective coronary artery bypass surgery (CABG). Specifically, this study emphasized the value of the Visual Analog Scale (VIS) as the most critical predictor, followed by the European System for Cardiac Operative Risk Evaluation (EuroSCORE) as the second most important scoring system. When considering the results of this study in the context of the findings presented above, it becomes evident that the assessment of risk factors and predictive models plays a crucial role in evaluating the outcomes of CABG procedures, including mortality rates. The utilization of robust scoring systems, such as VIS and EuroSCORE, can provide valuable insights into the overall morbidity and mortality risks associated with CABG surgeries. This study concluded that the independently predict combined morbidity and mortality in undergoing elective coronary artery bypass surgery (Baysal et al., 2021).

Another study conducted by Formica et al. showed results similar to ours in which the use of radial graft did not affect long-term mortality. However, this study did not mention the use of inotropic agents in patients during the post-operative period (Formica et al., 2019).

While providing valuable insights into the relationship between post-operative inotropic support and long-term mortality rates, this study is subject to several limitations. The relatively small sample size, retrospective design, and single-center data collection restrict the generalizability of the findings. Selection bias may be present due to categorizing participants into two groups based on inotropic support receipt, warranting consideration of randomized controlled trials or propensity score matching. The 10-year mortality focus, albeit informative, may not capture the full spectrum of long-term outcomes, and unaccounted confounding variables could influence mortality rates. Additionally, treatment variability, generalizability, and publication bias should be acknowledged. Nevertheless, this study contributes important insights to the field and underscores the need for more comprehensive and diverse research further to elucidate the impact of inotropic support on post-operative outcomes.

Further research, including larger studies and randomized trials, is recommended to validate findings and improve generalizability. Longer follow-up periods are advised to assess long-term outcomes. Collaboration with healthcare organizations and professional societies is necessary to refine clinical guidelines on inotropic support after surgery. Personalized and evidence-based decision-making should be prioritized, along with interdisciplinary collaboration, quality improvement initiatives, and patient counseling to optimize post-operative care.

Conclusion

This study found no significant difference in 10-year mortality rates between patients who received post-operative inotropic support and those who did not. While the results do not support the routine use of inotropic support after surgery, further research is needed to validate these findings and provide more definitive guidance.

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

The authors declared an absence of conflict of interest.

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