**DOI:** https://doi.org/10.54393/pjhs.v4i09.986

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 9 September 2023)

**Original Article**

# Concomitant CABG vs. CABG Alone - A Comparative Analysis of Early Outcomes

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## ARTICLE INFO

***Key Words:***

Coronary Artery Bypass Graft Surgery, Concomitant CABG, Mortality, Outcomes

***How to Cite:***

Muhammad Wasim Sajjad, Sarmad Saeed khattak, Saif Ullah, Azam Jan, Muhammad Salman Farsi, Rashid Qayyum, & Marghalara Bangash. (2023). Concomitant CABG vs. CABG Alone - A Comparative Analysis of Early Outcomes: Concomitant CABG vs. CABG Alone. Pakistan Journal of Health Sciences, 4(09). https://doi.org/10.54393/pjhs.v4i09.986

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Received Date: 16th August, 2023

Acceptance Date: 20th September, 2023

Published Date: 30th September, 2023

## ABSTRACT

Concomitant CABG is performed in combination with other cardiac procedures (VHD, CHD) while CABG is performed exclusively for CAD. **Objective:** To compare the mortality and perioperative outcomes between CABG and concomitant CABG for proper quoting of risk & optimizing the treatment decision for improved patient outcomes. **Methods:** The observational study on retrospective data was conducted at Rehman Medical Institute from December 2020 to December 2022. A total of 169 patients were included, with 89 in the CABG and 80 in the concomitant CABG group. Ethical approval was granted and inclusion criteria were met. Data were analyzed using SPSS 25. **Results:** A total of 169 patients were included with a mean age of 57.72±10.65 & the majority of the male population (77.5%). Most of the patients had NYHA III (56.1%) & CCS III (43.9%) class symptoms. Hypertension was our most common co-morbidity (58.0%), followed by dyslipidemia (52.3%) & DM (47.3%). Concomitant CABG has the worst parameters in terms of intraoperative characteristics such as a statistically significant higher rate of intraoperative transfusion ($p<0.001$), prolonged perfusion ($p<0.001$) & cross-clamp time ($p<0.001$). Similarly, concomitant CABG patients have the worst postoperative outcomes with a significantly higher incidence of mortality ($p<0.001$), post-operative transfusion requirement (p 0.008), increased duration of mechanical ventilation hours (p 0.005), extended hours of ICU stay (p 0.02) & higher rates of re-intubation (p 0.03). **Conclusions:** Concomitant CABG is no doubt a high-risk procedure as signified by its worst outcomes.

## INTRODUCTION

CABG stands for "coronary artery bypass graft surgery," performed to bypass blocked coronary arteries, relieving symptoms like chest pain and breathlessness. It's a common cardiac surgery with a mortality rate under 1% [1]. The nature of both CABG & valve surgery has changed over time with increased complexity in both surgery being performed [2]. A "risk index" for short-term mortality linked to CABG surgery has been published in much research and some of these studies also allows the user to calculate the risk for patients undergoing cardiac surgery [3]. Significant risk factors for short-term mortality among patients undergoing heart valve surgery have been reported in other research [4]. However, only a small number of studies have created risk indices based on statistical models to forecast patient outcomes for cardiac valve replacement [5]. Operative mortality has traditionally served as the benchmark for assessing the caliber of surgical outcomes [6]. Patients undergoing concomitant CABG exhibit higher-risk clinical traits compared to isolated CABG patients, including older age, more CVD risk factors, and increased burden of symptomatic NYHA class III–IV heart failure [7]. Major morbidity following CABG is more prevalent than mortality and is more significant economically since it necessitates a longer hospital stay and higher resource use [8]. Cardiac surgery carries higher perioperative risk than many other surgeries. Crude mortality rates indicate care quality, but are limited without patient risk profiles [9]. Risk factors for short-term

DOI: https://doi.org/10.54393/pjhs.v4i09.986

mortality following valve procedures with or without CABG have received less attention and are less well established than risk factors for CABG only procedures [10]. VHD burden rises globally due to aging and degenerative valve issues. Estimated VHD prevalence is ~2.5% in industrialized nations. Global VHD epidemiology varies; rheumatic heart disease leads in developing countries, while developed countries have degenerative valvular diseases as the main cause [11]. In the last decade, concomitant CABG surgeries in the USA have almost doubled from 16,000 to 25,000, while isolated CABG procedures have declining trend. With an aging population and rising coronary and valvular disease, concomitant CABG surgeries are expected to increase [12]. Elderly valve replacement patients might have coexisting coronary artery disease (CAD). Studies have shown 20-40% CAD prevalence in such cases. Untreated CAD in valve replacement patients reduces survival [13]. Compared to CABG, valve surgery historically showed twice higher mortality for aortic valve replacement (AVR) and thrice higher for mitral valve replacement (MVR). However, recent case series report significantly lower mortality rates compared to earlier eras [14]. We sought to study early outcomes associated with concomitant CABG procedures when compared to CABG performed alone. By analyzing this comparison, surgeons can better modify treatment strategies based on patient requirements, thereby enhancing patient care and optimizing surgical interventions. The study aims to compare the perioperative outcomes, including mortality & morbidity.

## METHODS

The observational study on retrospective data were conducted at Rehman Medical Institute, Peshawar from December 2020 to December 2022 by reviewing the database of the cardiac surgery department over two years. A total of 169 patients were included in the study, with 89 patients in the CABG group and 80 patients in the concomitant CABG group. A convenient non-probability sampling technique was employed to select patients for inclusion in the study. Patients aged 18 years or older who underwent concomitant CABG or CABG alone with complete medical records are included. Patients who underwent emergency CABG and those with incomplete medical records were excluded. The study protocol was approved by the ethical review board of Rehman Medical Institute, and informed consent was obtained from all patients included in the study. Data were collected on pre-designed Pro forma for peri-operative characteristics. Patients were then categorized into 2 groups, Concomitant CABG & CABG. Data analysis was done on SPSS version 25.0. Frequencies and percentages were calculated for qualitative variables. Mean and standard deviation was calculated for quantitative variables. For statistical analysis, the Chi-square & independent t-test was employed. A p-value of ≤0.05 was considered statistically significant. The term concomitant CABG refers to CABG performed in conjunction with other cardiac surgeries, such as valve repair or replacement, and ASD/VSD closure. In-hospital Mortality was considered as the primary outcome and secondary outcomes included perioperative outcomes. The term "in-hospital mortality" refers to fatalities that occurred during the patient's hospital stay following the surgery within the same hospital admission. The parameters for prolonged ventilation were lasting more than 24 hours and prolonged ICU stay as extending beyond 48 hours. Data were shown in tables.

## RESULTS

Baseline characteristics, co-morbidities, and pre, intra, and post-operative parameters have been represented in tables. Table 1 shows the difference between demographic & pre-operative parameters of CABG and concomitant groups along the consistent total and p-values i.e. our study included a total of 169 patients, amongst them 80 were in the concomitant CABG group & 89 in CABG group. The mean age was 57.72±10.65. The majority were male (77.5%). Most of the patients had NYHA III (56.1%) & CCS III (43.9%) functional class symptoms. Hypertension was our most common co-morbidity (58.0%), followed by dyslipidemia (52.3%) & DM (47.3%). In the CABG group, 73 patients (43.2%) were males and 16(9.5%) were females, while in the concomitant CABG group, 58(34.3%) were males, with a p-value of 0.1, suggesting no significant difference between both groups in terms of gender. Moreover, as far as the usage of tobacco is concerned amongst the total patients 10 (5.9%) in the CABG group and 6 (3.6%) in the concomitant CABG group reported tobacco use. The total number of patients reporting tobacco use was 16 (9.5%), with a p-value of 0.4. In terms of co-morbidity CABG patients were significantly more likely to have HTN (p 0.04), DM (p 0.006) & dyslipidemia (p <0.001). Similarly are more likely to have a history of myocardial infarction MI (p=0.06) & cerebrovascular accident CVA (p=0.3) however not significant. In the CABG group, 1.2% had a family history of CAD, while no patients in the concomitant CABG group had a family history of CAD. The total number of patients with a family history of CAD was 2, with a p-value of 0.1, suggesting no significance. In terms of presenting complaints, concomitant CABG patients have a significantly higher proportion of patients with NYHA I (p 0.01) & CCS IV (p 0.003) functional class symptoms whereas CABG patients have significantly more CCS III functional class symptoms (p 0.02). More than half of our patients have preserved EF (59.3%) & most of them were in CABG (30.5%)

DOI: https://doi.org/10.54393/pjhs.v4i09.986

group however it is not statistically significant. There is no statistical difference between the two groups in terms of gender, history of tobacco smoking, family history of CAD, previous PCI, & MI.

**Table1:** Pre-operative patients' parameter

| Parameters | CABG N=89 | Concomitant CABG N=80 | Total N=169 | p-value |
|---|---|---|---|---|
| Male | 73 (43.2%) | 58 (34.3%) | 131 (77.5%) | 0.1 |
| Female | 16 (9.5%) | 22 (13.0%) | 38 (22.5%) | |
| Tobacco Used | 10 (5.9%) | 6 (3.6%) | 16 (9.5%) | 0.4 |
| Family history of CAD | 2 (1.2%) | 0 (0.0%) | 2 (1.2%) | 0.1 |
| DM | 51 (30.2%) | 29 (17.2%) | 80 (47.3%) | 0.006 |
| Dyslipidemia | 42 (37.8%) | 16 (14.4%) | 58 (52.3%) | <0.001 |
| HTN | 58 (34.3%) | 40 (23.7%) | 98 (58.0%) | 0.04 |
| NYHA I | 0 (0.0%) | 5 (3.2%) | 5 (3.2%) | 0.01 |
| NYHA II | 19 (12.3%) | 14 (9.0%) | 33 (21.3%) | 0.5 |
| NHYA III | 51 (32.9%) | 36 (23.2%) | 87 (56.1%) | 0.1 |
| NYHA IV | 16 (10.3%) | 14 (9.0%) | 30 (19.4%) | 0.9 |
| CCS I | 8 (5.2%) | 7 (4.5%) | 15 (9.7%) | 0.9 |
| CCS II | 28 (18.1%) | 20 (12.9%) | 48 (31.0%) | 0.3 |
| CCS III | 43 (27.7%) | 25 (16.1%) | 68 (43.9%) | 0.02 |
| CCS IV | 6 (3.9%) | 18 (11.6%) | 24 (15.5%) | 0.003 |
| History of MI | 25 (14.8%) | 13 (7.7%) | 38 (22.5%) | 0.06 |
| EF<35 | 2 (1.2%) | 6 (3.6%) | 8 (4.8%) | 0.6 |
| EF 35-50 | 35 (21.0%) | 25 (15.0%) | 60 (25.9%) | 0.3 |
| EF>50 | 51 (30.5%) | 48 (28.7%) | 99 (59.3%) | 0.5 |

NYHA= New York Heart Association, CCS= Canadian cardiovascular score, EF=Ejection Fraction, MI=myocardial infarction, CAD= coronary artery disease, DM=diabetes mellitus, HTN=hypertension

In terms of intraoperative characteristics, concomitant CABG patients have statistically significant higher rates of intraoperative blood/ products transfusion (p <0.001), prolonged perfusion (p <0.001) & x clamp time (p <0.001). The IABP insertion is also higher in concomitant CABG, however, it is not significant (p 0.1) (Table 2). The mean perfusion time was 93.3±27.5 mins in the CABG group, while in the concomitant CABG group, the mean perfusion time was 132±41 mins with a significant p value of <0.001. As far as X-Clamp time is concerned the mean X-Clamp time was 52.8±16.6 in the CABG group, whereas in the concomitant CABG group, the mean X-Clamp time was 87.4±34.5 mins with a significant p value of <0.001.

**Table 2:** Intra-operative patients' parameter

| Parameters | CABG N=89 | Concomitant CABG N=80 | Total N=169 | p-value |
|---|---|---|---|---|
| IABP | 6 (3.6%) | 11 (6.5%) | 17 (10.1%) | 0.1 |
| Intra Op Blood/ products transfusion | 44 (26.0%) | 65 (38.5%) | 109 (64.5%) | <0.001 |
| Perfusion Time (Mean ± S.D) | 93.3±27.5 | 132±41 | - | <0.001 |
| X-Clamp (Mean ± S.D) | 52.8±16.6 | 87.4±34.5 | - | <0.001 |

X-clamp=Cross clamp time, IABP=Intra-Aortic Balloon Pump

Table 3 illustrates the outcomes & their comparison amongst CABG and concomitant CABG groups. It concludes that concomitant CABG patients have the worst outcomes with a significantly higher incidence of mortality (p <0.001), post-operative blood/products transfusion requirement (p 0.008), increased duration of initial mechanical ventilation hours (p 0.005), extended hours of ICU stay (p 0.02) & higher rates of re-intubation (p 0.03). There was no significant difference in the need for re-opening of the chest (p 0.4), the occurrence of postoperative stroke was similar, with a non-significant p-value of 0.2. There were no significant differences in the occurrence of cardiac arrest or atrial fibrillation (AF) between the two groups, with p-values of 0.1 and 0.7, respectively.

**Table 3:** Post-operative patients' parameter

| Parameters | CABG N=89 | Concomitant CABG N=80 | Total N=169 | p-value |
|---|---|---|---|---|
| Post-Op Blood/ Products transfusion | 33 (19.5%) | 46 (27.2%) | 79 (46.7%) | 0.008 |
| Initial Vent Hrs (mean± S.D) | 6.7±5.9 | 13.9±22.5 | - | 0.005 |
| ICU Hrs | 49±9.9 | 58±32 | - | 0.02 |
| Re-Intubated | 0 (0.0%) | 4 (2.4%) | 4 (2.4%) | 0.03 |
| Re-Opening | 6 (3.6%) | 8 (4.7%) | 14 (8.3%) | 0.4 |
| Post-op Stroke | 1 (0.6%) | 3 (1.8%) | 4 (2.4%) | 0.2 |
| Prolong Ventilator | 1 (0.6%) | 5 (3.0%) | 6 (3.6%) | 0.07 |
| Cardiac Arrest | 2 (1.2%) | 6 (3.6%) | 8 (4.7%) | 0.1 |
| Mortality | 2 (1.2%) | 18 (10.7%) | 20 (11.8%) | <0.001 |

## DISCUSSION

Our findings regarding gender showed majority of the male population (77.5%), which is similar to the study conducted by Matyal *et al.*, revealed mostly male group (78.6%) demonstrating that it is more prevalent in the male gender leading to higher representation [15]. The mean age of patients undergoing concomitant CABG was 69 years in a study conducted by Ullah *et al.*, in contrast to our study's mean age of 57.72 years showing the early onset of disease in our part of the world. In terms of comorbidity, our study concludes HTN (58.0%) to be most common followed by dyslipidemia (52.3%) & DM (47.3%) which is somehow comparable with Ullah *et al.*, stating HTN (64.40%) & DM (55.0%) [16]. The functional class of most patients was NYHA III in a study conducted by Davarpasand *et al.*, which is consistent with our findings of most patients with the same class of symptoms [17]. Regarding intraoperative characteristics, our study illustrates that patients with concomitant CABG had a statistically higher percentage of intraoperative blood/product transfusion, a result consistent with the study, which also showed a significant difference, indicating that patients with concomitant CABG had an increased number of blood transfusions [18]. Our study illustrates significantly prolonged perfusion & cross-clamp time for concomitant CABG with more incidence of IABP insertion. The mean perfusion time was showing a significant difference of 93.3±27.5 vs. 132±41 in the CABG & concomitant CABG group respectively. The findings are consistent with the study, where the cross-clamp times (95.6 vs. 71.8 minutes, p = 0.0001) and perfusion

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times (121.8 vs. 92.7 minutes, p = 0.0001) were also longer in patients undergoing concomitant CABG [19]. Cross-clamp time (139 ± 40 mins) shown by Davarpasand *et al.*, was much higher than ours, showing the expertise & efficient surgical techniques of our team & could also be related to patient characteristics as well. Same study also states that Intra-aortic balloon pump insertion was 12% vs 6.5% of our study showing the efficiency of our team & selection of less complex patients. Intraoperative transfusion was 23% vs 38.5%, Postoperative transfusion was 23% vs 27.2% indicating that patients in our study were at more risk of bleeding due to complex surgical procedures, possibly revealing higher transfusion threshold in previous studies with varying transfusion triggers based on patients' characteristics and clinical judgment. Re-opening for bleeding or cardiac tamponade is 7% vs 4.7% in our study [17]. Similarly, another study conducted found that patients with concomitant CABG had significantly higher operative mortality as well as complications compared to the patients with CABG alone which correlates with our findings [20]. Another study revealed that the concomitant CABG group had an increased 5-year mortality rate than the isolated CABG group [21]. Our study concludes that concomitant CABG has profoundly higher in-hospital mortality when compared with CABG alone. The results are consistent with a study conducted at the Cleveland Clinic Foundation USA, which found the in-hospital mortality rate to be 1.2% among 12,114 patients who had isolated CABG and 1.9% among 1713 patients who had combined AVR/CABG [22]. On the other hand SA *et al.*, concluded no difference in terms of mortality of concomitant CABG (6.3%) compared with CABG alone (7.7%; p = 0.679) which is discrepant with our result showing concomitant CABG as having high in-hospital mortality (10.7%) (p<0.001) [23]. Concomitant CABG procedure was found to be an independent predictor of early mortality after MVR [24]. A study conducted at the University of Virginia also compared the outcomes of the concomitant CABG patients and isolated CABG patients, revealing that concomitant CABG had profoundly higher operative mortality rates, required significantly longer ventilatory support, and had longer ICU and hospital stays as compared to CABG alone. The present study showed that concomitant CABG patients had a longer ICU stay than CABG patients. The results were similar to the study that showed that patients with concomitant CABG had a longer postoperative hospital stay as compared to the patients with CABG (7 vs 5 days, p < 0.001) [19].

## CONCLUSIONS

Concomitant CABG is no doubt a high-risk procedure as signified by its worst perioperative outcomes such as worse in-hospital outcomes & increased mortality. Therefore careful risk-benefit assessment & vigilant approach to managing postoperative complications should be adopted to improve the outcomes and minimize the adverse effects.

## Authors Contribution

Conceptualization: MWS
Methodology: SSK, MB
Formal Analysis: RQ
Writing-review and editing: SSK, S, AJ, MSF

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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