RESEARCH PAPER

Perioperative Outcomes of Concomitant Cardiac and Non-Cardiac Surgery: A Nine-Year Single-Centre Retrospective Study

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ABSTRACT

Introduction: Evidence about doing concomitant cardiac and non-cardiac surgery is limited and decisions in choosing simultaneous versus staged surgery remain personalised. We described the procedural short term clinical outcomes and characteristics of the patients who underwent concomitant surgeries.

Methods: The study included 33 patients who underwent concomitant Cardiac and Non-Cardiac Surgery procedures during the same anesthetic episode between January 2015 and December 2023. Patients were categorized into two groups based on the primary indication of the surgery as Group 1 (Primary Cardiac Group) and Group 2 (Primary Non-cardiac Group). Primary outcome was in-hospital mortality and secondary outcome included post operative complication, left ventricular ejection fraction, ICU stay and hospital length of stay.

Results: Total of thirty-three patients were included, 69.7% (23) were males with mean age of total patients were 57.3 +/- 12.3 years. Among thirty-three patients, sixteen patients (Group 1), while seventeen patients (Group 2). Twenty-nine patients underwent cardiac surgery before the non-cardiac surgery and four patients underwent non-cardiac surgery first. The post operative complications included low cardiac output syndrome, pneumonia, multiorgan dysfunction, mesenteric ischemia, acute kidney injury, pleural effusion requiring drainage and blood transfusion. Two patients died (6.1%) during hospitalization. The remaining thirty one patients were discharged uneventfully. Patients in both groups had an average hospital stay of 7.97 ± 9.455 days. Group I had a mean hospital stay of 6.00 ± 1.000 days, whereas Group 2 had 9.76 ± 13.07 days; This difference was not statistically significant ($p>0.05$). The mean values of mechanical ventilation duration, inotrope use, and ICU stay were also not statistically significant among groups 1 and 2 ($p>0.05$ for all). Left ventricular ejection fraction was significantly lower in group 1 than in group 2 ($p<0.05$).

Conclusion: Concomitant cardiac and non-cardiac surgery was technically feasible and associated with satisfactory short-term outcomes in this highly selected cohort, despite occasional clinically important morbidity and mortality. Larger comparative studies are needed to confirm its safety relative to staged approaches.

Keywords: Cardiac surgery; non-cardiac surgery; perioperative outcomes; Concomitant surgeries; Concomitant cardiac and non-cardiac surgery.

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INTRODUCTION

As the general population's life expectancy increases, there will be an increased number of individuals with significant coronary artery disease (CAD) who also have non-cardiac pathologies that require surgical treatment [1]. Deciding on the appropriate treatment for cardiac patients requiring Non-cardiac surgery (NCS) can be challenging, particularly for those with high-risk NCS and severe CAD. This is because both cardiac surgery and Non-cardiac surgery often pose contraindications for each other. Recent advancements in surgical technology and expertise have enabled patients to undergo simultaneous surgeries. However, the safety and feasibility of performing simultaneous cardiac and non-cardiac surgery have long been a subject of debate. Existing literature suggests that doing cardiac surgery prior to non-cardiac surgery may provide protection against cardiac morbidity and mortality. Performing concomitant surgery may provide considerable benefits to the patient by eliminating the need for two separate hospital exposure of two different operative fields, anaesthesia, post-operative care, pain management and cardio-pulmonary rehabilitation. Furthermore, it prevents the discontinuation of anti-platelet medication for the second Non-Cardiac Surgery (NCS), which could result in fatal cardiovascular events. In situations such as malignancy, it is crucial to promptly address the disease to prevent any unnecessary delays in treatment. This approach also offers substantial cost savings in terms of healthcare expenses [2]. Managing patients who have both cardiac and non-cardiac surgical diseases is rarely straightforward. A staged approach is more conventional strategy with more practical setbacks such as repeated exposure to anaesthesia, multiple hospital admissions, delays in treating time-sensitive conditions such as malignancy, and the added complexity of managing antiplatelet therapy after coronary intervention. Combining the two procedures avoids these issues, but introduces its own risks longer operative times, greater blood loss, higher infection risk, a more pronounced inflammatory response, and a greater chance of postoperative organ dysfunction. Ultimately, the decision to stage or combine surgery has to be individualized, weighing the urgency and severity of each condition against factors like the likely need for cardiopulmonary bypass, the contamination risk posed by the non-cardiac procedure, and how much physiological reserve the patient must begin with. Current perioperative guidelines call for multidisciplinary, patient-centred decision-making in these situations [3], yet they offer little specific direction when it comes to performing major cardiac and non-cardiac surgery simultaneously. Most of the available evidence comes from small, retrospective series involving a narrow range of procedural combinations, so questions around patient selection, procedural sequencing, and expected outcomes remain largely unresolved. With this gap in mind, we reviewed our institution's nine-year experience with combined cardiac and non-cardiac surgery. This approach has the potential to benefit two distinct patient groups. Group 1 (Primary Cardiac Group): patients with known cardiac disease on regular medical management who later developed a non-cardiac surgery condition requiring surgical intervention and underwent Concomitant Cardiac and Non-Cardiac Surgery during the same operative and aesthetic episode. Group 2 (Primary Non-cardiac Group): Patients with a primary non-cardiac surgical condition who were diagnosed with cardiac disease during preoperative cardiovascular evaluation and underwent Concomitant Cardiac and Non-Cardiac Surgery during the same operative and anesthetic episode. Therefore, a retrospective analysis was conducted on these two patient groups who underwent concomitant surgical procedures for both cardiac and non-cardiac conditions. Our aim was to assess the safety and feasibility of these procedures and to analyse the short-term (30-day) mortality outcomes in these patients. This report presents a comprehensive study conducted at a prominent center in the southern states of India.

Patients and Methods

The study was reviewed and approved by the institutional ethics committee (Ref No.: IHEC-II/0651/24). We conducted the study according to the principles outlined in the Declaration of Helsinki. We conducted a thorough analysis of the medical records of patients who had received both cardiac and non-cardiac surgeries. We gathered comprehensive data on patient characteristics, clinical information, reasons for opting for concomitant surgery, and the resulting outcomes. The surgeries were performed on the patients from January 2015 to December 2023. A total of 33 patients were included in the study (figure-1). A total of 33 individuals participated in the study, comprising 23 (69.7%) males and 10 (30.3%) females. The age range of the participants was 18 to 74 years, with a mean age of 57.27 ± 12.251 years. Table 1 provides an overview of the demographic and clinical characteristics of the patients. Gathered data were categorized into Group I and 2. Group 1 comprised individuals with a primary cardiac condition associated with known Non cardiac surgery conditions, whereas Group 2 had patients who were diagnosed with high-risk cardiac disease during their preoperative assessment of the NCS conditions. Group I consisted of 16 patients with primary cardiac diseases. Among them, 12 cases had CAD, 1 had CAD along with aortic disease, and 1 had CAD along with mitral diseases. Additionally, there was 1 case of double valve disease and 1 case of mitral valve disease. The total of 16 patients in Group I had 16 non-cardiac diseases, including 11 cases of general surgery, 1 case of gynaecology, 1 case of urology, and 3 cases of

vascular pathologies (Table 1). Group 2 consists of total 17 non-cardiac conditions, including 3 breast lump excisions, 7 general surgeries, 1 neurology case, 4 orthopaedic cases, 1 urology case, and 1 ENT case. The total of 17 patients in Group 2 had 17 cardiac conditions, consisting of 13 cases of CAD, 2 cases of aortic valve replacement (AVR), 1 case of atrial septal defect (ASD), and 1 case of double valve replacement (DVR), were shown in Table 2. Among total of 33 patients, 29 patients underwent CABG first and then followed by non-cardiac surgery. Remaining 4 patients had NCS was performed first, followed by the correction of their cardiac lesion. All patients underwent a standard sternotomy. The only exception was an 18-year-old female patient who had atrial septal defect closure performed through a right anterior thoracotomy. Every patient who received isolated coronary artery surgery underwent an OPCAB procedure. We performed standard cardiopulmonary bypass on patients undergoing surgery for valve and for concomitant coronary and valve surgery. The ASD patient received femoral cannulation and underwent a minimally invasive procedure. All patients were transferred to the intensive care unit and received ventilation. They were closely monitored for complications for at least 6 hours before extubation.

Statistical Analysis

Statistical analyses were accomplished using SPSS (V-27; IBM Corp., Armonk, NY). Normality of continuous variables was determined prior to analysis. Descriptive statistics were used to calculate the mean and standard deviation for continuous variables, and frequencies and percentages were used for categorical variables. The independent samples t-test was used to compare continuous variables between Group 1 and Group 2, and the chi-square test was used to compare categorical variables between the group 1 and group 2. A two-tailed P value less than 0.05 was considered statistically significant. Given the wide variability observed in some continuous variables (e.g., length of ICU and hospital stay), these findings should be interpreted with appropriate caution given the sample size.

RESULT

The study's findings revealed that all patients underwent a planned concomitant procedure intraoperatively. However postoperative complications occurred in few patients, including two (6.1%); the first patient had coronary artery bypass and popliteal revascularization and died on the seventh postoperative day due to low cardiac output, aspiration pneumonia, and mesenteric ischemia; the second patient died on the third postoperative day from severe vasoplegia and multiple organ dysfunction following a concomitant orthopaedic procedure and coronary artery bypass grafting. Two patients experienced significant complications during their extended hospital stay. One patient who underwent a gastrectomy needed multiple transfusions and received parenteral nutrition. The other patient, who had a liver transplant, had to undergo several intercostal drainage procedures to address pleural effusion. One patient had an acute kidney injury that resolved before being discharged. The mean length of hospital stay for group 1 and group 2 was 6.00 ± 1.000 days and 9.76 ± 13.07 days, with an overall mean of 7.97 ± 9.455 days across both groups (Table 1, Figure 2). Although Group 2 had a longer average hospital stay, the difference between groups was not statistically significant ($p > 0.05$). Whereas, Left ventricular ejection fraction was significantly lower (50.50 ± 9.606%) in Group 1 than in Group 2 (57.35 ± 6.585%; $p<0.05$). No statistically significant differences were seen between the two groups in age, gender distribution, diabetes mellitus, hypertension, duration of mechanical ventilation, length of ICU stay, or in-hospital mortality (all $p>0.05$; Table 1).

DISCUSSION

In this single-center retrospective study, 33 selected patients underwent concomitant cardiac and non-cardiac surgery over a nine-year period. This is consistent with a broader shift happening across India, where a growing burden of cardiovascular disease and increasing aging population may result with more patients with both cardiac and non-cardiac ailments that need to be addressed surgically [4-7]. Coronary artery bypass grafting (CABG) reported for most of the cardiac procedures, and in most cases the cardiac surgery was executed first. Two patients died during their hospital stay, and several others experienced clinically significant postoperative complications. Taken together, these findings show that a combined approach was technically achievable at our center, but they also make clear that the perioperative risk involved is far from negligible. The rationale for performing the cardiac procedure first is safe because vascularizing the myocardium or correcting valvular pathology before proceeding to the non-cardiac operation appears to protect against intraoperative myocardial ischemia and improves a patient's tolerance of the subsequent procedure [8, 9]. This is consistent with reports that surgical revascularization, performed ahead of major NCS, may offer better protection against perioperative cardiac events than a percutaneous approach [10, 11]. This sequencing logic is held in our cohort as well, and it is consistent with why surgical revascularization, rather than percutaneous intervention, is often favoured when the interval before non-cardiac surgery is short discontinuing antiplatelet therapy too early after PCI carries a real risk of stent thrombosis [12]. Similarly, uncorrected obstructive valve lesions, such as severe aortic or mitral stenosis, are recognized to carry substantial risk if left unaddressed before major NCS [13,14], supporting the justification for correcting valvular pathology as part of a combined strategy where feasible.

Patient selection is likely the single most important determining factor of outcome in this setting, and our findings need to be considered with that in mind. Our findings align with other observational case series, which have stated that concomitant surgery can be performed safely when patients are carefully chosen [1,15], and also combining the surgery, anaesthesia, and hospitalization

into a single episode of care event may offer both clinical and financial advantages over a staged surgery [10]. Concomitant surgery is more justified when delaying either condition includes substantial risk on its own. For example, postponing definitive cancer treatment for patients diagnosed with cancer is often not an option and staged surgery can also lead to difficulty in antiplatelet management or logistical issues. On other hand, patients with severe ventricular dysfunction, a high risk of contamination from the non-cardiac procedure which is expected due to long cardiopulmonary bypass run associated with significant frailty, or existing multi organ dysfunction are usually better attended by a staged surgery or alternative approach. Hence, we could not formally test these selection criteria against outcomes in this cohort, but they show the reasoning that guided how cases were selected at our center.

The surgical technique used for the cardiac component also matters. Off-pump coronary artery bypass (OPCAB) reduces bleeding, inflammation, and the overall physiological burden compared with conventional on-pump surgery [16]. Where feasible, this is likely to make OPCAB a better fit for combined procedures than routine use of cardiopulmonary bypass. Trans catheter valve therapies are also becoming more widely used because of their strong safety profile, and they may offer a less invasive option than open valve surgery in carefully selected patients undergoing combined surgery [17]. The surgical procedure used for the cardiac surgery also be important. Off-pump coronary artery bypass (OPCAB) has been shown to reduce the inflammatory response, bleeding, and systemic disadvantages related to conventional on-pump surgery [16], and where feasible, this likely makes it a more justified choice in the concomitant surgery setting rather than use of routine cardiopulmonary bypass. Similarly, the increasing use of trans catheter valve therapies promotes safety, and it may offer a less invasive alternative to open valve surgery in appropriately selected patients undergoing a concomitant surgery [17].

One specific concern raised in the literature is whether cardiopulmonary bypass might promote tumor dissemination in cancer patients, through bleeding or transient immunosuppression [18, 19]. The evidence on this remains mixed, and several studies suggest that CPB itself does not meaningfully influence tumor growth or spread, even in patients with active malignancy survival in these patients appears to be driven more by the underlying disease trajectory than by the surgical approach used [20,21]. Our data does not allow us to draw firm conclusions on this question, but they are at least consistent with the view that CPB was not an obvious driver of adverse outcomes in our cancer patients. The in-hospital mortality rate of 6.1% in our cohort should not be taken as evidence that concomitant surgery is safe in a consensus. We did not have a staged surgery comparison group, and without comparison group there is no possible to establish whether outcomes would have been better, equivalent or worse with a staged surgery. Selection bias is also a factor that these patients were previously judged to be suitable for concomitant surgery before the procedure, which limits how broadly our study findings can be applied. Additionally, our cohort included many different types of surgical procedures, and a single overall mortality rate may hide the real differences in risk between specific concomitant surgery combinations.

LIMITATIONS

This study has several limitations. First, study was retrospective, led at a single center, and involved a small diverse patient cohort. Second, no staged surgery control group. Hence, we don't have benchmarks against to compare outcomes, and the small number of adverse events ruled out risk adjustment or multivariable modelling. Third, Selection bias certainly influenced which patients were offered combined surgery in the first place. Perioperative practices and management patterns likely changed over the nine-year study period as well, adding a further source of variability we could not be able to account for. Finally, our follow-up was limited to the short-term postoperative period, and we did not systematically track long-term survival or disease-specific outcomes.

CONCLUSION

In this small, selected single-center cohort, the concomitant surgery was technically feasible, with most patients surviving to hospital discharge. However, post-operative morbidity and in-hospital mortality were observed. These findings offer useful preliminary insight into the feasibility of a concomitant cardiac and non-cardiac surgery. Multicenter comparative studies are required to define the appropriate selection criteria and determine which patients are most likely to benefit from a concomitant cardiac and non-cardiac surgery.

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Table 1. Descriptive characteristics and risk factors of the patients

Variable	Overall (n = 33)	Cardiac Surgery (n = 16)	Non-Cardiac Surgery (n = 17)	P value
Age, years (mean ± SD)	57.27 ± 12.251	55.50 ± 9.94	58.94 ± 14.19	>0.05
Gender, n (%)				
Male	23 (69.7)	11 (68.8)	12 (70.6)	>0.05

Female	10 (30.3)	5 (31.3)	5 (29.4)	>0.05
Diabetes mellitus, n (%)	18 (54.5)	8 (50.0)	10 (58.8)	>0.05
Hypertension, n (%)	23 (69.7)	10 (62.5)	13 (76.5)	>0.05
LVEF, % (mean ± SD)	54.03 ± 8.777	50.50 ± 9.606	57.35 ± 6.585	<0.05
Mechanical ventilation, days (mean ± SD)	1.21 ± 3.814	0.56 ± 1.031	1.82 ± 5.223	>0.05
Length of stay, ICU, days (mean ± SD)	4.24 ± 9.182	2.69 ± 1.302	5.71 ± 12.741	>0.05
Length of stay, hospital, days (mean ± SD)	7.97 ± 9.455	6.06 ± 0.998	9.76 ± 13.07	>0.05
Mortality, n (%)	2 (6.1)	1 (6.3)	1 (5.9)	>0.05

Baseline characteristics and outcomes of patients undergoing concomitant cardiac and non-cardiac surgery, by group. Data are presented as mean ± SD or n (%), left ventricular ejection fraction(LVEF); SD, standard deviation. $P < 0.05$ was considered statistically significant.

Table 2. Clinical data of combined cardiac and non-cardiac surgery

Non-Cardiac Surgery Type	ASD Closure	AVR	CABG	CABG + AVR	CABG X3 + MVR	DVR	MVR	Total
Breast lump excision	1	0	2	0	0	0	0	3
ENT	0	0	1	0	0	0	0	1
General surgery	0	0	14	1	1	2	0	18
Gynecology	0	0	0	0	0	0	1	1
Neurology	0	1	0	0	0	0	0	1
Orthopedics	0	1	3	0	0	0	0	4
Urology	0	0	2	0	0	0	0	2
Vascular	0	0	3	0	0	0	0	3
Total	1	2	25	1	1	2	1	33

Clinical data of concomitant cardiac and non-cardiac surgery, showing the distribution of non-cardiac surgical specialties against the cardiac procedure performed. ASD, atrial septal defect; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; DVR, double valve replacement; MVR, mitral valve replacement.

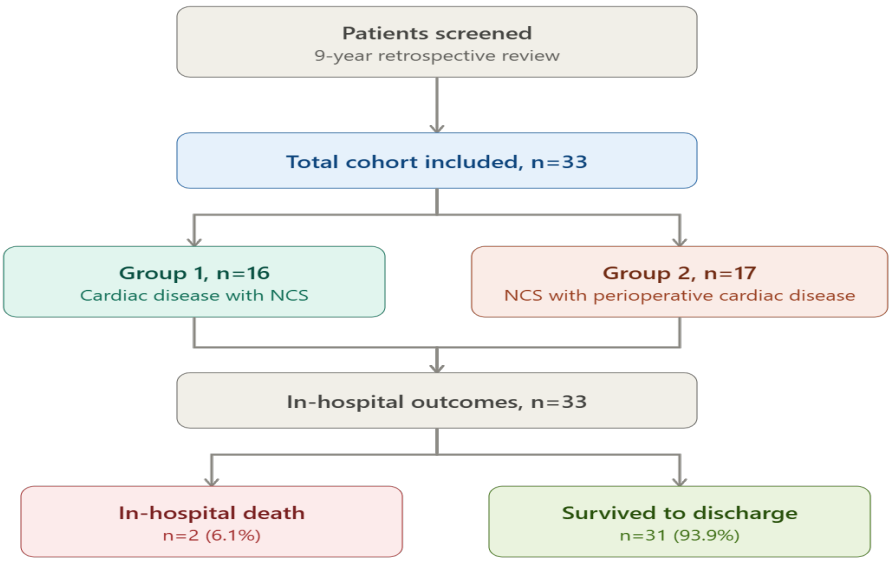


Figure 1. Study flow chart: patient enrollment and in-hospital outcomes in combined cardiac and non-cardiac surgery. NCS (non-cardiac surgery).

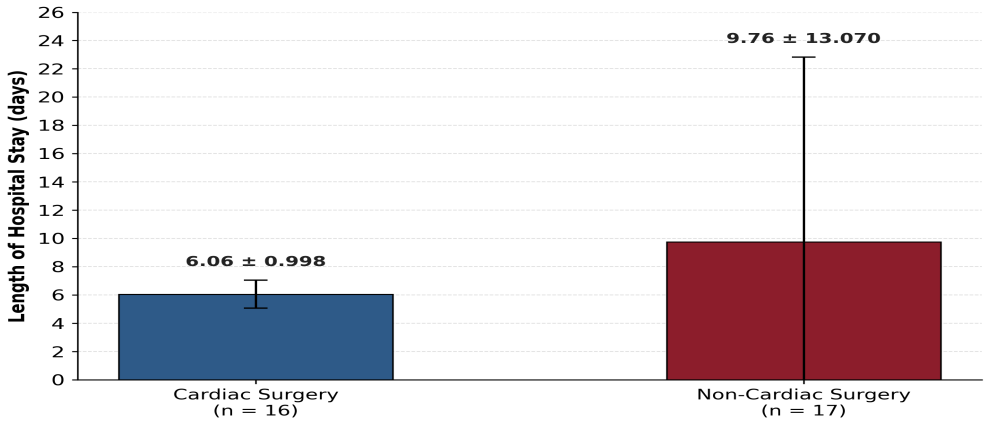


Figure 2: Length of hospital stay by surgical group, Patients who underwent cardiac surgery had a mean length of hospital stay of 6.06 ± 0.998 days, compared with 9.76 ± 13.07 days for patients who underwent non-cardiac surgery. Error bars represent one standard deviation.