

Approach to Noncardiac Surgery in Cardiac Patients: Feasibility of Simultaneous Cardiac and Noncardiac Surgery

Lutphun Nahar¹, Raghu Bheemaiah²

Received on: 04 January 2024; Accepted on: 22 February 2024; Published on: xxxx

ABSTRACT

The study aimed to investigate the feasibility of simultaneous cardiac and noncardiac surgery at a tertiary care high-volume center. The clinical records of all patients who underwent simultaneous cardiac and noncardiac surgery between July 2017 and July 2022 were reviewed. Preoperative, intraoperative, and postoperative clinical data were collected and analyzed. Patients were followed up to hospital discharge. Fourteen patients underwent simultaneous cardiac and noncardiac surgery. Patients were hemodynamically stable throughout the follow-up. Postoperative elective intermittent positive pressure ventilation (IPPV) duration was 4–8 hours (mean 5.4 ± 1.1 hours). The intensive care unit (ICU) stay varied between 3 and 22 (mean of 7.9 ± 6.4) days, and the total hospital stay varied from 8 to 30 (mean of 13.8 ± 6.8) days. None of the patients developed postoperative complications, namely bleeding needing re-exploration, pulmonary infection with hypoxemia, acute renal failure, or wound infection. There were no perioperative major adverse cardiac events such as myocardial infarction, heart failure, significant life-threatening arrhythmia, cardiac arrest, or acute ischemic stroke during the index hospital stay. There was no mortality in this cohort. Simultaneous cardiac and noncardiac surgery in patients who are suffering from heart disease is safe and feasible with a satisfactory postoperative outcome when stepwise stratification and evaluation during the preoperative period and efficient and expert management during the perioperative period have been executed.

Keywords: Cardiac surgery, Coronary artery bypass grafting, Noncardiac surgery, Simultaneous surgery.

Journal of Acute Care (2024): 10.5005/jp-journals-10089-0099

INTRODUCTION AND BACKGROUND

Currently, the incidence of cardiac diseases is on the rise due to demographic, epidemiological, social, nutritional, environmental, and economic transitions that have taken place worldwide. As a result, cardiac patients requiring noncardiac surgery are expected to increase. The situation becomes challenging when patients suffer from both cardiac and noncardiac diseases, which warrant surgical treatment. In the past, cardiac patients were deferred for noncardiac surgery if they suffered from acute cardiac conditions like angina, severe aortic/mitral stenosis, or life-threatening arrhythmia. However, with the advancement of medical sciences, both cardiac and noncardiac surgeries may be offered in the same setting in selected cases, especially if both conditions need immediate attention. Simultaneous surgeries in patients suffering from both cardiac and noncardiac benign or malignant diseases are safe and possible with satisfactory short-term and long-term survival.¹ A multidisciplinary constructive approach is needed for the management of concomitant/simultaneous cardiac and noncardiac surgery in the same setting that aims to improve the outcome of such a complex situation. In this study, we will analyze the preoperative, intraoperative, and postoperative data to figure out a stepwise management.

METHODS

After obtaining approval from the ethical committee, in a retrospective observational study design, the clinical records of all patients who underwent simultaneous cardiac and noncardiac surgery between July 2017 and July 2022 were reviewed. Patient consent for the study was waived because of the retrospective nature of the study. All patients had general anesthesia with endotracheal intubation and controlled mechanical ventilation. A

¹Department of Anaesthesiology, Combined Military Hospital, Dhaka Cantonment, Dhaka, Bangladesh

²Department of Cardiac Anaesthesiology, Narayana Institute of Cardiac Sciences, Bengaluru, Karnataka, India

Corresponding Author: Lutphun Nahar, Department of Anaesthesiology, Combined Military Hospital, Dhaka Cantonment, Dhaka, Bangladesh, Phone: +8801769198842, e-mail: nahar484@gmail.com

How to cite this article: Nahar L, Bheemaiah R. Approach to Noncardiac Surgery in Cardiac Patients: Feasibility of Simultaneous Cardiac and Noncardiac Surgery. *J Acute Care* 2024; <https://doi.org/10.5005/jp-journals-10089-0099>.

Source of support: Nil

Conflict of interest: None

standard anesthetic and surgical technique was used; anesthesia was induced with a combination of fentanyl, midazolam, and etomidate in adult patients and sevoflurane in oxygen in children. However, the choice of induction agent and muscle relaxant was dictated by the pathophysiology of the cardiac lesion, and the management of different surgeries was noted. Muscle relaxation was achieved with the use of rocuronium/vecuronium bromide or atracurium. Isoflurane or sevoflurane at an end-tidal concentration of 1 MAC was used for the maintenance of anesthesia. Monitoring included direct arterial pressure, central venous pressure, nasopharyngeal temperature, urine output, and arterial blood gases. Activated clotting time was monitored to assess the level of anticoagulation during cardiac surgery. The cardiac lesion was fixed either using extracorporeal circulation (ECC) or was done without the aid of ECC, namely "off-pump" coronary artery bypass grafting (OP-CABG). In both, the

cardiac surgery was performed after a median sternotomy and anticoagulation with heparin. For those requiring ECC, the standard technique of cardiopulmonary bypass (CPB) was used. In those who had the off-pump technique, the distal coronary anastomosis was done on the beating heart using the “octopus” (Medtronic Inc, Minneapolis, United States of America) suction device tissue stabilizer for immobilization of the local heart muscle. Hemodynamic management included a targeted mean arterial pressure of at least 65 mm Hg, central venous pressure of 8–12 mm Hg, and pulse pressure variation (PPV) of $\leq 12\%$. Epinephrine at 0.01–0.05 $\mu\text{g}/\text{kg}/\text{minute}$ and nitroglycerine at 0.05–0.1 $\mu\text{g}/\text{kg}/\text{minute}$ were used as inotrope/vasodilator at the discretion of the anesthesiologist. The noncardiac surgery was done after the reversal of heparin anticoagulation with protamine and achieving hemostasis. The patients were electively ventilated postoperatively, and tracheal extubation was performed in the intensive care unit after satisfying the criteria for separation from mechanical ventilation. The patients were followed up till the hospital discharge.

RESULTS

There was a total of 14 cases in which simultaneous cardiac and noncardiac surgery was performed during the study period. Among them, 11 were adults, and three were from the pediatric age group; 12 were male, and two were female. Cardiac diseases include triple vessel coronary artery disease (CAD) in four, valvular heart disease in two, congenital heart disease in four, cardiac tumor in three, and hypertrophic obstructive cardiomyopathy in one. Noncardiac diseases included chest diseases (three diaphragmatic herniae, one left upper lobe mass), abdominal diseases (four chronic cholecystitis, one hepatocellular carcinoma, one renal carcinoma, one suprarenal tumor, one lower segment cesarean section (LSCS), one meatal stenosis, one obstructed inguinal hernia). Left ventricular ejection fraction (LVEF) was 50–60%, and five out of 14 patients were diabetic, and two patients had a history of unstable angina. The simultaneous heart and lung operations were CABG with left upper lobe resection in one case. The simultaneous heart and diaphragmatic operation were ventricular septal defect (VSD) repair with diaphragmatic hernia (three cases). The simultaneous heart and obstetric operation was mitral valve repair with an LSCS. The simultaneous cardiac operations and laparoscopic cholecystectomy were performed in three, simultaneous cardiac and urethral surgery in one, cardiac surgery with inguinal hernioplasty in one, cardiac surgery with supra renal tumor in one, and cardiac surgery with hepatic resection in one. Among the 14 cases, 13 cases were first operated on for cardiac diseases, and one case first operated for noncardiac disease. Among the 14 cases, 10 cases were done on the pump, and four cases were done off-pump. Postoperative intermittent positive pressure ventilation (IPPV) duration was 4–8 (mean 5.38 ± 1.1) hours. There were no postoperative complications namely postoperative bleeding, pulmonary infection with hypoxemia, incisional wound infection, or postoperative acute renal failure. The ICU stay varies from 3 to 22 (mean 7.9 ± 6.4) days and total hospital stay 8–30 (mean 13.84 ± 6.4) days. The patients were followed up to 30 postoperative days. There were no significant perioperative adverse events like myocardial infarction, heart failure, significant life-threatening arrhythmia, cardiac arrest, or acute ischemic stroke till the 30th postoperative day. The mortality rate in these 14 cases was 0%. The details of patients who underwent simultaneous cardiac and noncardiac surgery are shown in [Table 1](#).

DISCUSSION

The strategy for dealing with cardiac patients undergoing noncardiac surgery has been well described, and an algorithmic approach for such patients is widely followed.² However, a patient with cardiac and noncardiac disease may require both cardiac and noncardiac surgery on a semi-urgent basis. Here, it is a challenge to decide if both cardiac and noncardiac surgical conditions can be tackled simultaneously or concomitantly and which surgical condition should be treated first. When a decision is taken to tackle both cardiac and noncardiac surgical conditions in one sitting, the factors that can influence cardiac surgery on the noncardiac operation and vice versa, both physiologically and pathologically, must be considered. In pregnant patients, consideration of cardiac surgery on the fetus and the influence of circulatory changes of pregnancy on cardiac disease must be borne in mind. Simultaneous cardiac operation and lung resection were not associated with increased early or late morbidity or mortality.³ In patients suffering from carcinoma, simultaneous operations increase resectability, radicality, and functional operability and, therefore, promise improvement of follow-up results.⁴ The following facts must be considered when making the decision: (1) incidence of noncardiac surgery in patients with known cardiovascular risk factors is on the rise, (2) treatment may be completed in a single setting without the need to stop the antiplatelet/coagulation therapy postcardiac surgery for noncardiac surgery, (3) reduction readmissions rate and hospital-acquired infections, (4) reductions in the final cost of treatment, (5) extensive monitoring used in cardiac surgery will benefit simultaneous noncardiac surgery at no additional cost, and (6) presence of a trained cardiac anesthesiologist attending the cardiac surgery adds value to the patient’s anesthetic management for noncardiac surgery.

Disadvantages of the Two-staged Procedure

It may be possible to arrange two-staged surgeries, that is, one surgery followed by the other after a gap of a few days or weeks, but disadvantages of two-stage techniques—two anesthetic procedures, twice surgical trauma, long-stay in hospital, delay in tumor resection in case of malignancy, double the operation stress, increased postoperative pain, and high cost of treatment.

Disadvantages of Simultaneous/Concomitant Surgery

Some disadvantages of one-stage, that is, simultaneous/concomitant cardiac and noncardiac surgery, include possible increased bleeding and increased trauma due to two simultaneous surgeries; noncardiac cases may include gastrointestinal surgeries, debridement, abscess drainage; these cases are potentially infective and contaminate the operation room if cardiac surgery is to be performed simultaneously. This may add to the risk of infections, use of higher antibiotics, and adverse drug reactions and drug interactions during the postoperative period.

Advantages of Off-pump Technique for Cardiac Surgery

The advantages of off-pump CABG in preference to “on-pump” CABG is that less heparin is needed for off-pump procedures, and less bleeding is anticipated. During the off-pump process, hemodynamic stability is more predicted. Furthermore, unlike the on-pump method, the off-pump technique does not cause an inflammatory reaction. Off-pump coronary surgery avoids the risks of CPB, reduces systemic inflammatory response, and does not affect the immune system.⁵ A combined off-pump CABG and

Table 1: The details of patients who underwent simultaneous cardiac and noncardiac surgery

Serial number	Age	Sex	Cardiac disease	Noncardiac disease	METS	ASA	LVEF%	Surgical procedure	Duration of IPPV	Event	ICU stay	Hospital stays	Outcome
1	5 months 13 days	Male	Laevocardia, atrioventricular discordance, DORV, ASD, muscular VSD	Diaphragmatic palsy	-	III	60	Left bidirectional Glenn shunt, atrial septectomy, diaphragmatic plication	3 hours	Uneventful	4	11	Favorable
2	1 year 6 months	Male	Perimembranous VSD with pulmonary HTN	Diaphragmatic hernia	-	III	60	VSD closure, subaortic membrane excision, diaphragmatic plication	3 hours	Uneventful	22	30	Favorable
3	2 years 5 months	Male	TOF with hypoplastic pulmonary annulus	Diaphragmatic hernia	-	III	60	ICR with diaphragmatic hernia repair	2 hours	Uneventful	21	26	Favorable
4	25 year	Male	TOF	Left adrenal pheochromocytoma	3	III	55	ICR with excision of left adrenal mass	8 hours	Uneventful	9	14	Favorable
5	29 years	Female	Left atrial myxoma	G2P1L1 with 29weeks of pregnancy	3	III	55	Excision of Left atrial myxoma, ASD closure, LSCS	3 hours 20 minutes	Uneventful	4	9	Favorable
6	40 years	Male	TVCAD	Left upper lobe mass	3	III	55	CABG with left upper lobe wedge resection	6 hours	Uneventful	4	9	Favorable
7	46 years	Male	TVCAD	Cholecystitis	3	III	60	CABG with lap cholecystectomy	6 hours	Uneventful	5	11	Favorable
8	46 years	Female	Severe AS	Cholecystitis	3	III	60	AVR with lap cholecystectomy	6 hours	Uneventful	3	8	Favorable
9	49 years	Male	Hepatocellular carcinoma with tumor and thrombus extending to right atrium	Hepatocellular carcinoma	2	IV	55	RA tumor and thrombus resection with left hepatectomy	10 hours	Uneventful	11	17	Favorable
10	49 years	Male	RHD with severe MS with moderate MR	Cholecystitis	3	III	54	MVR with lap cholecystectomy	2 hours	Uneventful	5	10	Favorable
11	55 years	Male	HOCM, left ventricular outflow obstruction	Cholecystitis	3	III	55	SAM excision, septal myectomy, lap cholecystectomy	4 hours	Uneventful	5	9	Favorable
12	56 years	Male	Rt renal carcinoma with tumor thrombus in IVC extending into RA, RV	Rt renal carcinoma	2	IV	56	RPLND with IVC thrombectomy, Rt radical nephrectomy	10 hours	Uneventful	11	17	Favorable
13	63 years	Male	TVCAD	Urethral meatal stenosis	3	III	55	CABG with meatotomy	6 hours	Uneventful	4	12	Favorable
14	70 years	Male	TVCAD	Left inguinal hernia	3	III	50	CABG with left inguinal hernioplasty	5 hours	Uneventful	6	14	Favorable

AS, aortic stenosis, ASD, atrial septal defect; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; HTN, hypertension; HOCM, hypertrophic cardiomyopathy; ICR, intracardiac repair; IVC, inferior vena cava; Lap, laparoscopic; LSCS, lower segment Cesarean section; MR, mitral regurgitation; MS, mitral stenosis; MVR, mitral valve replacement; RA, right atrial; RHD, rheumatic heart disease; RPLND, retroperitoneal lymph node resection; Rt, right; SAM, systolic anterior motion; TOF, tetralogy of Fallot; TVCAD, triple vessel coronary artery disease; VSD, ventricular septal defect

pulmonary resection is a safe approach in patients diagnosed with concomitant coronary artery and pulmonary disease. Avoidance of CPB may decrease the incidence of postoperative complications.⁶ Dyszkiewicz et al. demonstrated the safety and efficacy of simultaneous lung resection with off-pump CABG for the treatment of lung cancer and CAD with no mortality.⁷

Problems of Cardiac Surgery Using ECC that Might Affect Noncardiac Surgery

The disadvantages of CPB are (1) increased risk of bleeding due to anticoagulation, (2) activation of systemic inflammatory response syndrome, (3) tissue oedema due to hemodilution and increased tissue water content, and (4) disseminating malignant cells in patients with carcinoma. Inflammatory phenomena and immunologic changes secondary to ECC use can increase tumor recurrence.⁸

Why Should We Opt for Concomitant/Simultaneous Cardiac and Noncardiac Surgery?

Simultaneous surgery is indicated when there are unstable cardiac disease and semi-urgent noncardiac conditions, especially if malignant. In general, cardiac conditions must be tackled first—(1) with improved myocardial blood supply or valve function, the patient is likely to tolerate noncardiac surgery better; (2) cardiac surgery is invariably clean and nonseptic, whereas noncardiac may not be so.

When considering the kind and severity of the diseases, as well as the hospital mortality of 0–6.5%, as reported by other researchers, it is both feasible and appropriate to do simultaneous surgeries on patients with both cardiac and noncardiac disorders.^{9,10} It is noteworthy that a 68-year-old woman with CAD, aortic valve stenosis, tricuspid valve regurgitation and pulmonary disease (malignant pathology) underwent combined heart and pulmonary surgery—left upper lobectomy, aortic valve replacement, tricuspid valve repair and coronary artery bypass surgery with successful outcome.¹¹

In a cohort of 43 patients, there was no significant difference in using an on-pump or off-pump technique to perform combined cardiac and lung surgery in relation to postoperative complications and hospital survival.¹⁰

However, the choice of patients and their general health should be considered by the anesthesiologists and surgeons when determining whether the patients can undergo combined cardiac and noncardiac surgery and if both surgeries are planned together, whether to use an off-pump or on-pump technique may further be discussed. A thorough preoperative assessment and a step-by-step approach are essential to determining the best surgical technique for each patient. Previously, stepwise management of a cardiac surgical patient for noncardiac surgery has been established and is being used worldwide.

Limitations of the Study

There are three major limitations of the study—firstly, because there are a small number of cases in the study cohort, meaningful conclusions cannot be drawn. Secondly, as a retrospective study,

whether the successful outcome can be guaranteed in a larger group undergoing varied cardiac and noncardiac procedures cannot be ascertained. Thirdly, concomitant/simultaneous cardiac and noncardiac surgery requires the availability of full-fledged cardiology, cardiac surgery, and intensive care teams for an interdisciplinary approach.

CONCLUSION

Simultaneous cardiac and noncardiac surgeries are feasible with an appropriate stepwise approach to cardiac surgical patients as it will lead to stratifying the decision of simultaneous operability as well as a good outcome.

REFERENCES

1. Yang Y, Xiao F, Wang J, et al. Simultaneous surgery in patients with both cardiac and non-cardiac diseases. *Patient Prefer Adher* 2016;10:1251–1258. DOI: 10.2147/PPA.S100588
2. Fleisher LA, Fleischmann KE, Auerbach AD, et al. American College of Cardiology. American Heart Association 2014 ACC/AHA Guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association task force on practice guidelines. *J Am Coll Cardiol* 2014;64(22):e77–e137. DOI: 10.1016/j.jacc.2014.07.944
3. Rao V, Todd TR, Weisel RD, et al. Results of combined pulmonary resection and cardiac operation. *Ann Thorac Surg* 1996;62(2):342–346. PMID: 8694588.
4. Davydov MI, Akchurin RS, Gerasimov SS, et al. Simultaneous operations in thoraco-abdominal clinical oncology. *Eur J Cardiothorac Surg* 2001;20(5):1020–1024. DOI: 10.1016/S1010-7940(01)00922-8
5. Mariani MA, Boven WJ, Duurkens VA, et al. Combined off-pump coronary surgery and right lung resections through midline sternotomy. *Ann Thorac Surg* 2001;71(4):1343–1344. DOI: 10.1016/S0003-4975(00)02355-9
6. Saxena P, Tam RK. Combined off-pump coronary artery bypass surgery and pulmonary resection. *Ann Thorac Surg* 2004;78(2):498–501. DOI: 10.1016/j.athoracsur.2004.02.026
7. Dyszkiewicz W, Jemielity MM, Piwkowski CT, et al. Simultaneous lung resection for cancer and myocardial revascularization without cardiopulmonary bypass (off-pump coronary artery bypass grafting). *Ann Thorac Surg* 2004;77(3):1023–1027. DOI: 10.1016/j.athoracsur.2003.07.041
8. Carrascal Y, Gualis J, Arevalo A, et al. Cardiac surgery with extracorporeal circulation in cancer patients: influence on surgical morbidity and mortality, and on survival. *Rev Esp Cardiol* 2008;61(4):369–375. PMID: 18405517.
9. Riviere AB, Knaepen P, Swieten HV, et al. Concomitant open-heart surgery and pulmonary resection for lung cancer. *Eur J Cardiothorac Surg* 1995;9(6):310–313. DOI: 10.1016/S1010-7940(05)80188-5
10. Schoenmakers MC, Boven WJ, Bosch J, et al. Comparison of on-pump or off-pump coronary artery revascularization with lung resection. *Ann Thorac Surg* 2007;84(2):504–509. DOI: 10.1016/j.athoracsur.2007.04.005
11. Sabol F, Toporcer T, Kolesár A, et al. Case report: surgical management of a patient with combined heart pathologies and lung cancer. A simultaneous coronary artery bypass surgery, aortic valve replacement, tricuspid valve repair and pulmonary resection. *Cor Vasa* 2014;56(1):e75–e79. DOI: 10.1016/j.crvasa.2013.07.007