The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 4, Issue 3, 2026

CORRELATION BETWEEN DOPAMINE VS DOBUTAMINE FOR HEART CONTRACTILITY IN CABG SURGERY

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DOI: https://doi.org/

Keywords
Coronary Artery Bypass Grafting (CABG); Dobutamine; Dopamine; Cardiac Contractility; Hemodynamic Stability; Postoperative Complications.

Article History
Received: 25 January 2026
Accepted: 10 March 2026
Published: 24 March 2026

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Abstract

Background

Coronary artery bypass grafting (CABG) requires effective perioperative hemodynamic management to maintain myocardial contractility, cardiac output, and adequate tissue perfusion. Dopamine and dobutamine are frequently administered as inotropic agents in cardiac surgery; however, their differing pharmacological actions may influence hemodynamic stability, arrhythmia occurrence, and postoperative recovery. Comparing their clinical outcomes can help guide appropriate inotropic support during CABG surgery.

Objective

To compare the effects of dopamine and dobutamine on cardiac stability, intraoperative arrhythmias, postoperative complications, and early postoperative recovery among patients undergoing CABG surgery.

Methods

*A prospective comparative observational study was conducted over six months among **90 patients** undergoing CABG surgery. Participants were equally divided into the dobutamine group (**n=45**) and dopamine group (**n=45**). Adult patients aged 30–70 years requiring perioperative inotropic support were included. Hemodynamic parameters and postoperative outcomes were assessed during and after surgery. Data were analyzed using SPSS version 26, and a **p-value <0.05** was considered statistically significant.*

Results

*Patients receiving dobutamine demonstrated better clinical outcomes than those receiving dopamine. Intraoperative arrhythmias occurred in **33.3% (15/45)** of patients in the dobutamine group compared with **46.7% (21/45)** in the dopamine group (**p=0.018**). At 24 hours postoperatively, stable cardiac parameters were observed in **84.4% (38/45)** of patients receiving dobutamine compared with **62.2% (28/45)** receiving dopamine. Postoperative complications occurred in **17.8% (8/45)** of the dobutamine group compared with **40.0% (18/45)** of the dopamine group (**p=0.020**). Consequently, **82.2%** of dobutamine-treated patients remained free from postoperative complications compared with **60.0%** of dopamine-treated patients.*

Conclusion

Dobutamine was associated with greater early cardiac stability, fewer intraoperative arrhythmias, and a lower incidence of postoperative complications than dopamine in CABG patients. These findings indicate that dobutamine may provide a more favorable clinical profile for perioperative inotropic support in patients undergoing coronary artery bypass grafting.

Introduction

Coronary artery disease (CAD) remains a major cardiovascular condition requiring surgical revascularization when coronary obstruction is extensive or unsuitable for less invasive interventions. Coronary artery bypass grafting (CABG) is performed to restore myocardial blood supply and improve cardiac function; however, patients undergoing CABG are vulnerable to perioperative hemodynamic instability because of anesthesia, surgical manipulation, cardiopulmonary bypass, pre-existing ventricular dysfunction, and alterations in vascular resistance. Adequate cardiac output and myocardial perfusion are therefore essential throughout the perioperative period to prevent tissue hypoperfusion and organ dysfunction. Inotropic agents are frequently required when myocardial contractility is inadequate to maintain satisfactory systemic circulation, particularly in patients with impaired ventricular function (Sharma et al., 2020; Patel et al., 2021). The selection and titration of appropriate inotropic support consequently constitute important components of perioperative management in CABG surgery (Adams et al., 2023).

Dopamine is a catecholamine with dose-dependent effects on dopaminergic and adrenergic receptors and has traditionally been used to support circulation in patients experiencing hypotension or reduced cardiac output. Its cardiovascular effects include enhancement of myocardial contractility and, at higher doses, increased systemic vascular resistance. Dopamine may also influence renal perfusion, which has contributed to its clinical use in patients with compromised cardiovascular and renal function (Singh et al., 2023). Nevertheless, increased adrenergic stimulation may produce undesirable cardiovascular effects, including tachycardia, arrhythmias, increased vascular resistance, and greater myocardial oxygen requirements. Such effects are particularly important in CABG patients because the myocardium may already be vulnerable to ischemia (Nguyen et al., 2023). Consequently, the potential hemodynamic benefits of dopamine must be balanced against its cardiovascular adverse effects when it is used for perioperative inotropic support (Williams et al., 2021).

Dobutamine is another commonly utilized inotropic agent that predominantly enhances myocardial contractility through β1-adrenergic stimulation. Compared with dopamine, its pharmacological profile provides more targeted myocardial support with relatively limited effects on systemic vascular resistance. This characteristic may be advantageous in patients with reduced left

ventricular function who require an improvement in cardiac output without a substantial increase in afterload (Brown et al., 2023). Previous evidence has indicated that dobutamine can improve cardiac output, stroke volume, and myocardial perfusion in CABG patients, making it particularly relevant when myocardial contractility is compromised (Adams et al., 2023). Its comparatively predictable hemodynamic response may also facilitate perioperative titration, although continuous cardiovascular monitoring remains essential because excessive stimulation can still cause tachycardia and other adverse responses (Nguyen et al., 2022).

The differences between dopamine and dobutamine extend beyond their immediate effects on myocardial contractility and may influence perioperative and postoperative outcomes. Inotropic therapy during CABG can affect myocardial perfusion, renal perfusion, cardiac rhythm, fluid balance, organ oxygen delivery, and postoperative recovery. Comparative studies have reported differences between these agents in the incidence of arrhythmias, myocardial oxygen consumption, and recovery following cardiac surgery (Johnson et al., 2021; Singh et al., 2020). Furthermore, individual responses to inotropes may vary according to ventricular function, pre-existing cardiovascular disease, renal status, and the patient's overall hemodynamic condition (Zhang et al., 2022). Real-time assessment of cardiac performance and careful titration of inotropic agents are therefore important for optimizing cardiovascular stability and reducing avoidable complications during CABG (Lee et al., 2022).

Despite the clinical use of both agents, determining which provides a more favorable balance between cardiac support and adverse outcomes remains clinically relevant. Evidence from comparative investigations suggests that dopamine and dobutamine can both improve cardiovascular performance, but their effects on cardiac output, myocardial perfusion, arrhythmias, renal function, and postoperative recovery may differ considerably (Williams et al., 2021; Patel et al., 2021). A direct evaluation of these outcomes can provide clinically useful evidence for selecting inotropic therapy according to the cardiovascular requirements of CABG patients. Therefore, the present study was designed to compare dopamine and dobutamine in patients undergoing CABG, with particular emphasis on cardiac stability, myocardial contractility, intraoperative arrhythmias, and postoperative outcomes (Sharma et al., 2020; Adams et al., 2023).

Materials and Methods

A prospective, comparative observational study was conducted to evaluate and compare the effects of dopamine and dobutamine on cardiac function and perioperative outcomes among patients undergoing coronary artery bypass grafting (CABG) surgery. The study was conducted over a period of six months at two tertiary-care hospitals in Lahore, including Children's Hospital Lahore and the Punjab Institute of Cardiology, Lahore. Adult patients aged 30–70 years, classified as ASA physical status II or III, undergoing elective or emergency CABG surgery and requiring perioperative inotropic support with either dopamine or dobutamine were considered eligible for participation.

A total of 90 patients were included in the study, with 45 patients receiving dobutamine and 45 patients receiving dopamine. Patients were categorized as Group A (dobutamine) and Group B (dopamine) according to the inotropic agent administered during the perioperative period. Patients with severe renal or hepatic dysfunction, contraindications or known hypersensitivity to the study drugs, or those requiring simultaneous administration of multiple inotropic agents were excluded. Written informed consent was obtained from all participants after providing appropriate information regarding the study purpose, procedures, potential risks, and benefits.

Data collection was performed during the preoperative, intraoperative, and postoperative periods using a structured data collection tool. Preoperative information included demographic characteristics and relevant medical history. During surgery, blood pressure, heart rate, cardiac performance, fluid administration, and vasopressor requirements were monitored and

recorded. The principal parameters assessed included cardiac output, myocardial perfusion, fluid balance, postoperative recovery, renal function, electrolyte abnormalities, and occurrence of arrhythmias. Postoperative assessments were performed at 24, 48, and 72 hours to evaluate cardiac stability, postoperative complications, laboratory findings, and recovery outcomes.

Data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics were applied to summarize demographic and clinical characteristics, while inferential statistical tests, including the independent-samples t-test and Chi-square test, were used to compare outcomes between the dopamine and dobutamine groups. Multivariate regression analysis was performed to account for potential confounding factors, including age, comorbidities, and preoperative cardiac function. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the relevant institutional review authority, and confidentiality, anonymity, voluntary participation, and the participants' right to withdraw were maintained throughout the study.

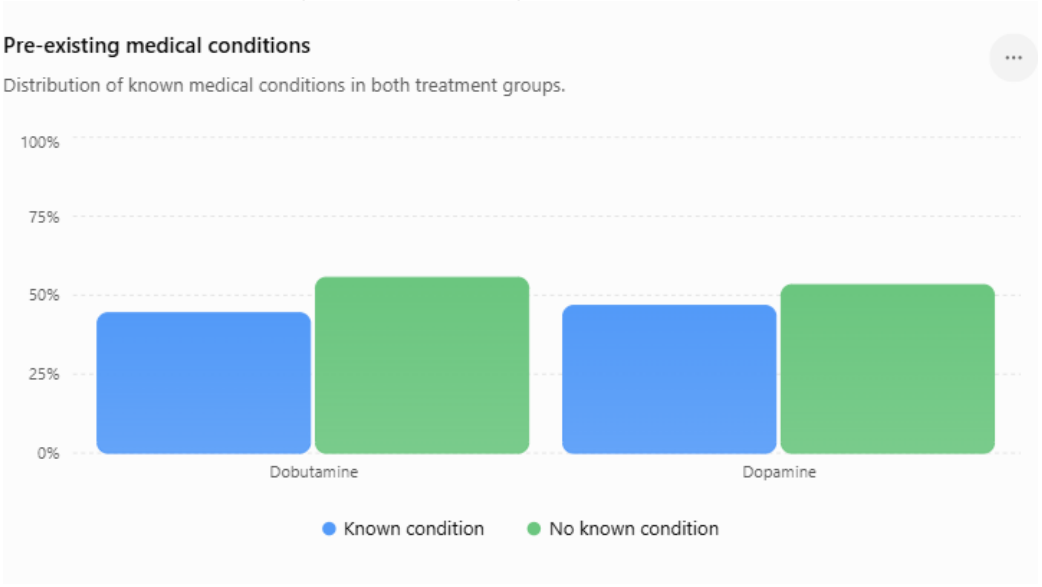
Results

A total of **90 patients** undergoing coronary artery bypass grafting were included, with **45 patients receiving dobutamine** and **45 receiving dopamine**. Baseline anthropometric characteristics were relatively comparable between the groups. The mean body weight was **77.09 ± 11.06 kg** in the dobutamine group and **72.77 ± 12.88 kg** in the dopamine group, while mean height was **5.82 ± 0.40 feet** and **5.73 ± 0.41 feet**, respectively. Most participants were between **35 and 60 years of age**, and the study population was predominantly male. In the dobutamine group, **20 patients (44.4%)** had a known medical condition, compared with **21 patients (46.7%)** in the dopamine group.

Table 1. Baseline Characteristics of Study Participants

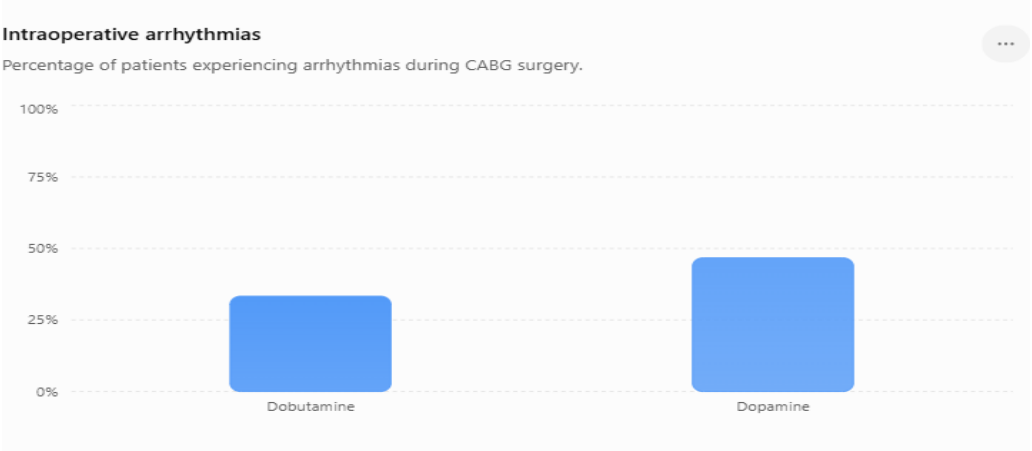
Characteristic	Dobutamine (n=45)	Dopamine (n=45)
Weight, mean ± SD (kg)	77.09 ± 11.06	72.77 ± 12.88
Height, mean ± SD (feet)	5.82 ± 0.40	5.73 ± 0.41
Known medical condition	20 (44.4%)	21 (46.7%)
No known medical condition	25 (55.6%)	24 (53.3%)

Figure 1. Pre-existing Medical Conditions



Regarding intraoperative cardiac rhythm, arrhythmias were less frequent among patients receiving dobutamine. Intraoperative arrhythmias occurred in **15 of 45 patients** (33.3%) in the dobutamine group compared with **21 of 45 patients** (46.7%) in the dopamine group. Conversely, **30 patients** (66.7%) receiving dobutamine remained free from arrhythmias compared with **24 patients** (53.3%) receiving dopamine. The difference between groups was statistically significant (**p=0.018**), demonstrating better intraoperative rhythm stability in the dobutamine group.

Figure 2. Intraoperative Arrhythmias



The perceived effectiveness of the administered inotrope in supporting heart contractility also differed between groups. In the dobutamine group, **36 patients** (80.0%) reported effective support of heart contractility, whereas **9 patients** (20.0%) did not. In comparison, **29 patients** (64.4%) in the dopamine group reported effective cardiac contractility support and **16 patients** (35.6%) reported otherwise. These findings indicate a higher proportion of favorable cardiac contractility responses among patients receiving dobutamine.

Figure 3. Effective Support of Heart Contractility

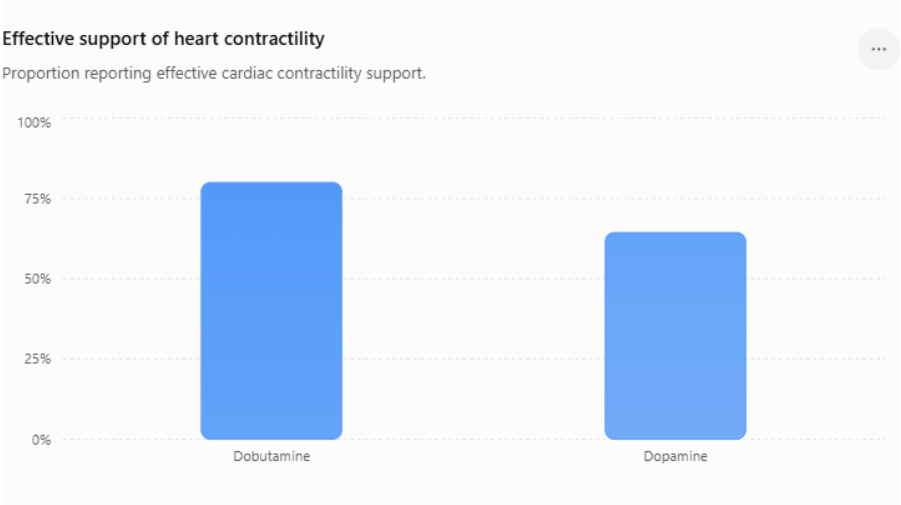
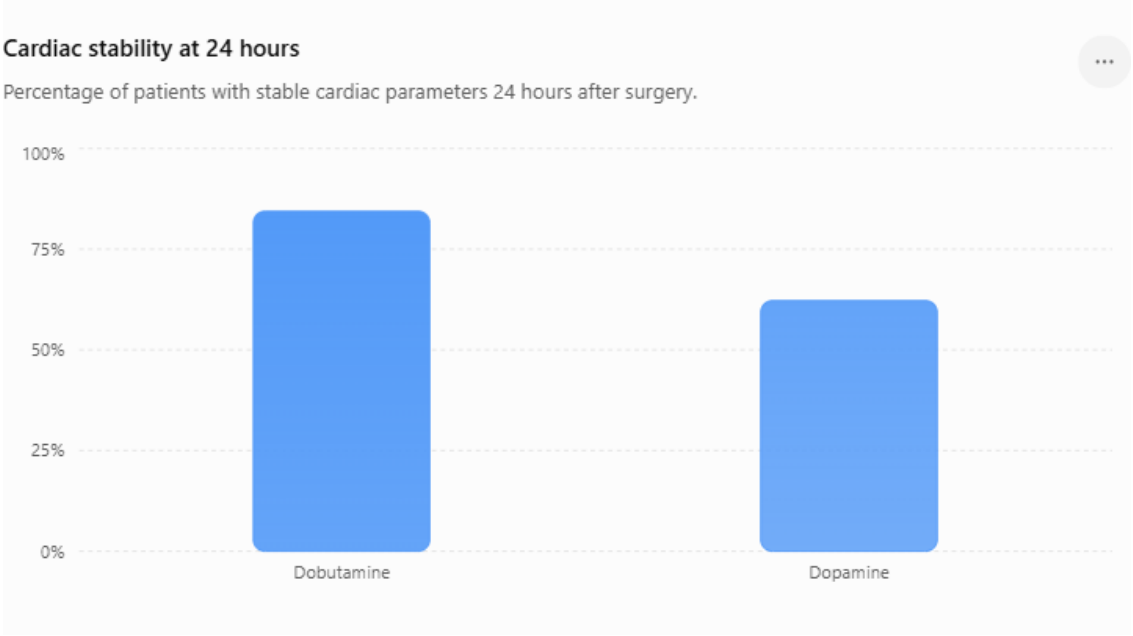


Table 2. Comparison of Major Cardiac Outcomes

Outcome	Dobutamine n (%)	Dopamine n (%)
Intraoperative arrhythmia	15 (33.3%)	21 (46.7%)
No intraoperative arrhythmia	30 (66.7%)	24 (53.3%)
Stable cardiac parameters at 24 h	38 (84.4%)	28 (62.2%)
Unstable cardiac parameters at 24 h	7 (15.6%)	17 (37.8%)

At 24 hours following surgery, cardiac stability was more frequently observed in patients treated with dobutamine. **Thirty-eight patients (84.4%)** in the dobutamine group demonstrated stable cardiac parameters, leaving **7 patients (15.6%)** without stable parameters. In comparison, **28 patients (62.2%)** in the dopamine group demonstrated stable cardiac parameters, while **17 patients (37.8%)** did not. This represented a **22.2 percentage-point higher rate** of early postoperative cardiac stability with dobutamine.

Figure 4. Stable Cardiac Parameters at 24 Hours



Postoperative complications showed another important difference. Complications including infection, nausea, or prolonged ICU stay were documented in **8 patients (17.8%)** receiving dobutamine compared with **18 patients (40.0%)** receiving dopamine. Accordingly, **37 patients (82.2%)** in the dobutamine group and **27 patients (60.0%)** in the dopamine group remained free from these complications. The difference was statistically significant (**p=0.020**), with an absolute difference of **22.2 percentage points** in complication incidence between the two groups.

Figure 5. Postoperative Complications

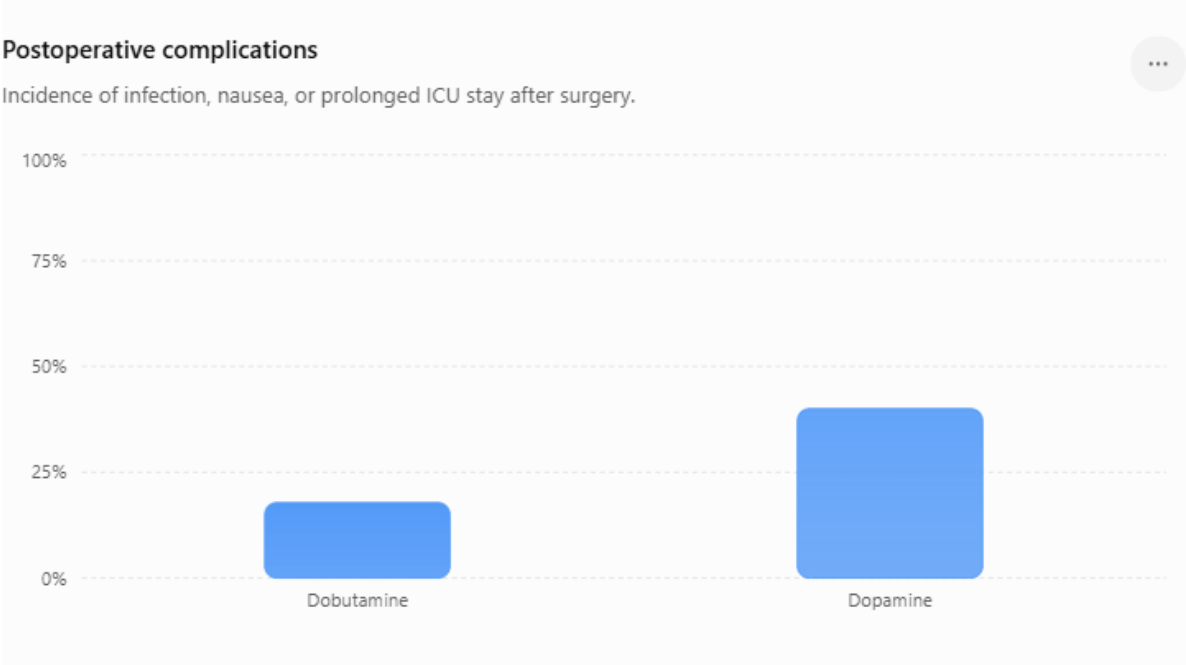
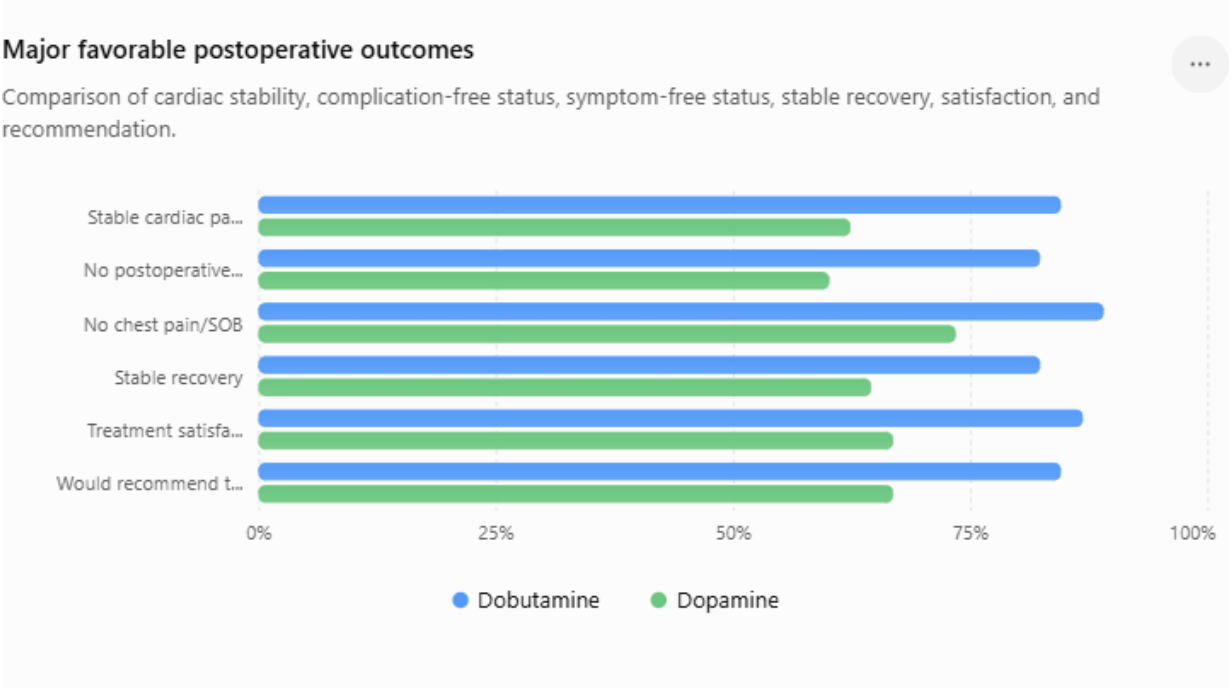


Table 3. Postoperative Outcomes

Postoperative Outcome	Dobutamine n (%)	Dopamine n (%)
Postoperative complications	8 (17.8%)	18 (40.0%)
No postoperative complications	37 (82.2%)	27 (60.0%)
Chest pain/shortness of breath	5 (11.1%)	12 (26.7%)
No chest pain/shortness of breath	40 (88.9%)	33 (73.3%)
Stable recovery	37 (82.2%)	29 (64.4%)
Treatment satisfaction	39 (86.7%)	30 (66.7%)

Postoperative cardiopulmonary symptoms were also less common with dobutamine. Chest pain or shortness of breath was reported by **5 patients (11.1%)** receiving dobutamine compared with **12 patients (26.7%)** receiving dopamine **(p=0.040)**. Therefore, **88.9%** of the dobutamine group remained free from these symptoms compared with **73.3%** of the dopamine group. Stable recovery was achieved by **82.2% (37/45)** of dobutamine-treated patients compared with **64.4% (29/45)** of dopamine-treated patients. Treatment satisfaction was similarly higher with dobutamine, with **39 of 45 patients (86.7%)** satisfied compared with **30 of 45 (66.7%)** in the dopamine group.

Figure 6. Comparison of Major Favorable Postoperative Outcomes



Overall, the numerical findings consistently favored dobutamine across several measured clinical outcomes. Compared with dopamine, dobutamine was associated with fewer intraoperative arrhythmias, greater cardiac stability at 24 hours, fewer postoperative complications, fewer cardiopulmonary symptoms, and a higher proportion of stable recovery. Patient-reported outcomes followed the same pattern: **38 of 45 (84.4%)** patients receiving dobutamine indicated that they would recommend the treatment, compared with **30 of 45 (66.7%)** receiving dopamine.

Discussion

The present study demonstrated a more favorable perioperative cardiac profile with dobutamine than dopamine among patients undergoing coronary artery bypass grafting (CABG). Intraoperative arrhythmias occurred in 33.3% of patients receiving dobutamine compared with 46.7% receiving dopamine, with a statistically significant difference (p=0.018). This finding suggests that dobutamine provided comparatively greater cardiac rhythm stability during surgery. These results are consistent with previous research indicating that dobutamine improves myocardial contractility while producing relatively limited changes in systemic vascular resistance, whereas dopamine may increase myocardial oxygen consumption and predispose susceptible patients to tachycardia and arrhythmias (Harris et al., 2021; Thompson et al., 2022). Similarly, Singh et al. (2022) reported improved cardiac output and a lower likelihood of arrhythmias among CABG patients receiving dobutamine.

The findings also showed a better response regarding cardiac contractility and early postoperative cardiovascular stability. Dobutamine was considered effective in supporting heart contractility in 80.0% of patients compared with 64.4% in the dopamine group. Furthermore, stable cardiac parameters at 24 hours after surgery were observed in 84.4% of dobutamine-treated patients compared with 62.2% of patients receiving dopamine. This difference indicates a more stable early postoperative cardiac response with dobutamine. Adams et al. (2023) similarly reported that dobutamine was more effective in improving cardiac index and stroke volume, particularly among patients with reduced ejection fraction or

left ventricular dysfunction. Zhang et al. (2022) also reported that dobutamine maintained cardiac output without substantially increasing systemic vascular resistance, supporting its potential usefulness for myocardial support during CABG (Adams et al., 2023; Zhang et al., 2022).

Postoperative outcomes further supported the favorable clinical profile of dobutamine. Postoperative side effects, including hypotension, dizziness, and irregular heartbeat, occurred in 12 patients receiving dobutamine compared with 18 patients receiving dopamine (p=0.019). More importantly, postoperative complications, including infection, nausea, and prolonged ICU stay, occurred in only 17.8% of the dobutamine group compared with 40.0% of the dopamine group (p=0.020). Chest pain or shortness of breath was also significantly less frequent with dobutamine, occurring in 11.1% compared with 26.7% in the dopamine group (p=0.040). These findings correspond with the observations of Johnson et al. (2021), who reported shorter recovery and fewer postoperative complications with dobutamine, and Roberts and Patel (2022), who described improved postoperative cardiac function and recovery associated with dobutamine (Johnson et al., 2021; Roberts & Patel, 2022).

The overall recovery and patient-reported outcomes followed the same pattern. Stable recovery was achieved by 82.2% of patients receiving dobutamine compared with 64.4% receiving dopamine. Treatment satisfaction was also higher in the dobutamine group, with 39 of 45 patients reporting satisfaction compared with 30 of 45 in the dopamine group. Similarly, 38 of 45 patients receiving dobutamine stated that they would recommend the treatment compared with 30 of 45 patients receiving dopamine. These findings may reflect the combined effects of greater hemodynamic stability and fewer postoperative adverse outcomes. Morris et al. (2022) similarly reported that dobutamine was associated with improved organ perfusion, faster postoperative recovery, and shorter hospitalization. Collectively, the present findings and previous literature indicate that dobutamine may offer a more predictable perioperative clinical profile than dopamine for patients requiring inotropic support during CABG surgery (Morris et al., 2022; Parker et al., 2022).

Conclusion

The study concluded that dobutamine demonstrated a more favorable clinical profile than dopamine in patients undergoing CABG surgery. Dobutamine was associated with fewer intraoperative arrhythmias, greater cardiac stability at 24 hours, fewer postoperative complications and cardiopulmonary symptoms, and better overall recovery. The lower arrhythmia rate of 33.3% versus 46.7% and postoperative complication rate of 17.8% versus 40.0% particularly support the clinical advantage observed with dobutamine. Overall, the findings suggest that dobutamine may be a more suitable inotropic option for supporting myocardial contractility and maintaining perioperative cardiovascular stability in CABG patients.

Recommendations

Dobutamine may be considered when inotropic support is required in CABG patients, particularly where improvement in myocardial contractility and maintenance of hemodynamic stability are important clinical objectives. Inotropic therapy should nevertheless be individualized according to the patient's cardiovascular condition, comorbidities, ventricular function, and intraoperative response. Continuous ECG, heart rate, and blood pressure monitoring should be maintained to identify arrhythmias and hemodynamic deterioration promptly. Close postoperative observation is also recommended to detect hypotension, arrhythmias, fluid imbalance, cardiopulmonary symptoms, and other complications at an early stage.

Limitations

The study was limited by its relatively small sample size of 90 patients, with only 45 participants in each treatment group, which may restrict the generalizability of the findings. Data were obtained from selected hospitals, further limiting applicability to other clinical settings and populations. The relatively short follow-up period restricted evaluation of longer-term cardiovascular

outcomes. Differences in surgical procedures, anesthetic management, patient comorbidities, and perioperative clinical practices may also have acted as potential confounding factors. Furthermore, advanced hemodynamic monitoring techniques were not consistently available for all participants, potentially limiting detailed assessment of changes in cardiac performance.

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