RESEARCH PAPER

Comparison of short-term outcome between awake (epidural) and general endotracheal anesthesia in patients undergoing off-pump coronary artery bypass grafting

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Abstract

Background: Off-pump coronary artery bypass grafting (OPCABG) helps cut down on complications related to cardiopulmonary bypass. The type of anesthesia used can also play a role in how patients do after surgery. Some suggest that awake OPCABG with thoracic epidural anesthesia could be a better option than the usual general endotracheal anesthesia, possibly leading to better breathing and quicker recovery.

Objective: To compare short- term outcomes between awake (epidural) anesthesia and general endotracheal anesthesia in patients undergoing OPCABG.

Methods: This prospective observational study was conducted at BSMMU, Dhaka, from March 2017 to February 2019. We enrolled 30 patients, scheduled for elective OPCABG, and split them into two groups. Group A had their surgery with awake thoracic epidural anesthesia, while Group B was given general endotracheal anesthesia. Data were analyzed by SPSS version 23.0.

Results: After looking into the postoperative lung function measured by FEV1 and PEFR at 24, 48, and 72 hours, we found that the awake epidural group performed significantly better ($p<0.05$). Patients in this group also had shorter stays in the ICU ($p=0.004$) and in the hospital ($p=0.003$). As for hemodynamic stability and complication rates, they were similar across both groups, which suggests that awake anesthesia is both safe and effective.

Conclusion: Awake thoracic epidural anesthesia in OPCABG was associated with improved postoperative pulmonary function and reduced ICU and hospital stay compared with general endotracheal anesthesia, without increasing perioperative complications.

Keywords: Anesthesia, Coronary Artery bypass grafting, Pulmonary function, Short-term outcome, Thoracic epidural anesthesia

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Introduction

Coronary artery disease (CAD) is still a major cause of illness and death around the globe, and it's becoming more of an issue in low- and middle-income countries like Bangladesh [1]. Coronary artery bypass grafting, or CABG, remains a well-accepted and successful option for treating patients with multivessel coronary artery disease, issues with the left main artery, and complicated coronary structures [2]. In the past twenty years, there's been a big focus on improving surgical methods to cut down on complications during and after surgery. One notable development is off-pump coronary artery bypass grafting (OPCABG), which avoids the use of cardiopulmonary bypass. This was a game-changer since it helps prevent issues that can come from using external circulation, like inflammatory responses, blood clotting problems, brain dysfunction, and kidney issues [3,4]. A bunch

of research has shown that OPCABG can lower complications after surgery, shorten the time spent in the ICU, and lead to better early results, especially for patients at higher risk [5]. Even with all the improvements in surgical methods, how we manage anesthesia is still really important for keeping patients stable during surgery and ensuring good short-term results. For CABG, general endotracheal anesthesia has been the go-to method because it allows for controlled breathing, significant pain relief, and keeps patients still [6]. Still, using general anesthesia and putting patients on mechanical ventilation can lead to issues after surgery, like lung problems, delays in removing the breathing tube, longer stays in the ICU, and higher healthcare costs [7]. These worries have sparked interest in different anesthesia methods that could improve recovery after surgery. One option that's gaining traction is awake coronary artery bypass grafting using thoracic epidural anesthesia (TEA), which seems to work well for certain patients having OPCABG [8]. Thoracic epidural anesthesia does a great job at relieving pain, blocking the heart's sympathetic response effectively, and keeping your breathing natural. This can help with the oxygen levels in the heart and improve how the lungs function [9]. Plus, steering clear of endotracheal intubation and mechanical ventilation seems to help lower atelectasis, boost lung function after surgery, and get patients moving again sooner [10]. Earlier studies have shown that using TEA during heart surgery can lead to better blood flow stability and less stress response [11]. Moreover, awake OPCABG has been shown to reduce postoperative pain, facilitate earlier oral intake, and shorten ICU and hospital stay without increasing perioperative complications [12]. However, concerns remain regarding patient tolerance, technical expertise, and the potential risk of epidural- related complications, particularly in patients receiving antiplatelet therapy [13]. Even though there's more international experience now, there isn't much data comparing awake epidural anesthesia and general endotracheal anesthesia specifically for OPCABG in South Asian populations. It's crucial to have local evidence since factors like patient characteristics, perioperative practices, and available resources can really vary from those seen in wealthier countries. That's why we set out to look at the short-term outcomes of awake (epidural) anesthesia versus general endotracheal anesthesia for patients having OPCABG. We paid particular attention to things like respiratory and hemodynamic parameters during the operation, any complications afterward, and how long patients stayed in the ICU and the hospital.

Objective

The main objective was to compare short- term outcomes between awake (epidural) anesthesia and general endotracheal anesthesia in patients undergoing OPCABG.

Methodology

This observational study was conducted in the Department of Cardiac Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, over a period of two years from March 2017 to February 2019. A total of 30 patients undergoing elective off-pump coronary artery bypass grafting (OPCABG) were enrolled and divided equally into two groups: Group A, receiving awake epidural anesthesia, and Group B, receiving general endotracheal anesthesia. Patients were allocated into the two groups based on the anesthetic technique used during surgery. Written informed consent was obtained from all participants before inclusion in the study.

Selection Criteria:

a. Inclusion Criteria

- Patients scheduled for elective off-pump coronary artery bypass grafting (OPCABG).
- Patients eligible for either awake epidural anesthesia or general endotracheal anesthesia.
- Patients who provided informed written consent for participation in the study.

b. Exclusion Criteria

- Patients who did not provide informed consent.
- Patients with contraindications to epidural anesthesia.
- Patients requiring emergency coronary artery bypass surgery.
- Patients with significant coagulopathy or bleeding disorders.
- Patients with major neurological disorders.
- Patients were converted to on-pump coronary artery bypass grafting intraoperatively.

After enrollment, detailed preoperative clinical data were collected using a structured case record form. Patients in Group A received thoracic epidural anesthesia using bupivacaine combined with dexmedetomidine sedation, allowing spontaneous ventilation throughout the procedure. In contrast, patients in Group B received standard general

endotracheal anesthesia using a combination of fentanyl, midazolam, vecuronium, and isoflurane with controlled mechanical ventilation. All surgical procedures were performed under standardized OPCABG protocols. Intraoperative and postoperative parameters, including hemodynamic stability, respiratory function, pulmonary function, and cardiac performance, were recorded at predefined time intervals. Postoperative outcomes, including duration of mechanical ventilation, length of intensive care unit (ICU) stay, and total hospital stay, were also documented and compared between the two groups.

Statistical Analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS). Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test, while categorical variables were analyzed using Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

Result

Figure 1: Distribution of the site of distal anastomosis in both groups

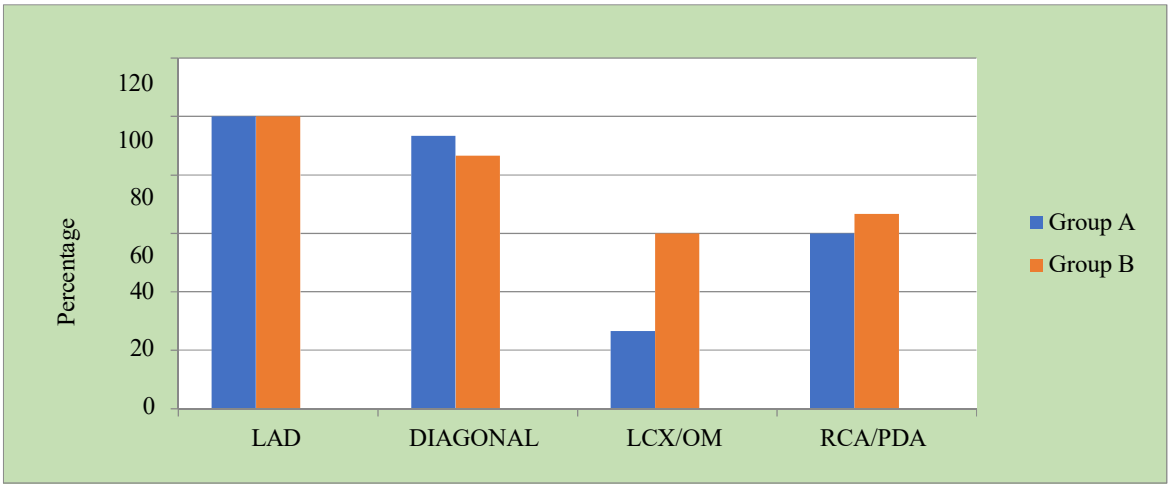

Figure 1 shows the distribution of distal anastomosis sites in the two groups. LAD grafting was performed in all patients (100%) in both groups. Diagonal artery grafting was slightly more common in Group A (95%) than in Group B (88%). In contrast, LCX/OM and RCA/PDA grafting were more frequent in Group B (60% and 66%, respectively) compared with Group A (23% and 60%, respectively).

Figure 2: Line graph comparing perioperative changes in FEV1 between Group A and B

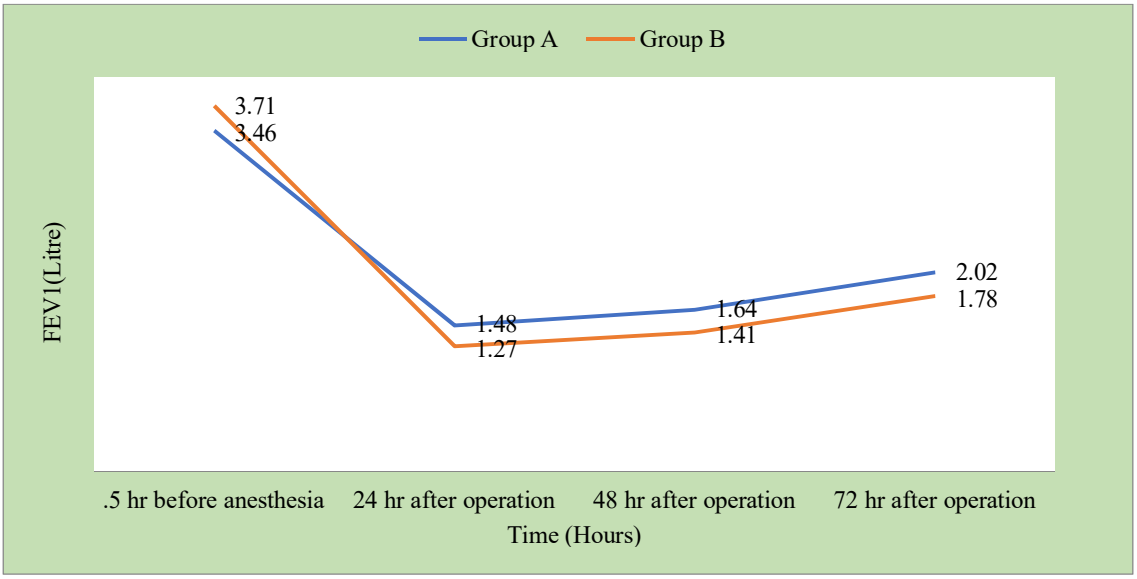

Figure 2 demonstrates that FEV_1 decreased markedly in both groups at 24 hours after surgery, followed by gradual recovery at 48 and 72 hours. Although Group B had a slightly higher preoperative FEV_1, Group A showed consistently higher postoperative FEV_1 values, indicating better recovery of pulmonary function.

Figure 3: Line graph comparing perioperative changes in PEFR (Liter/Minute) in both groups of patients

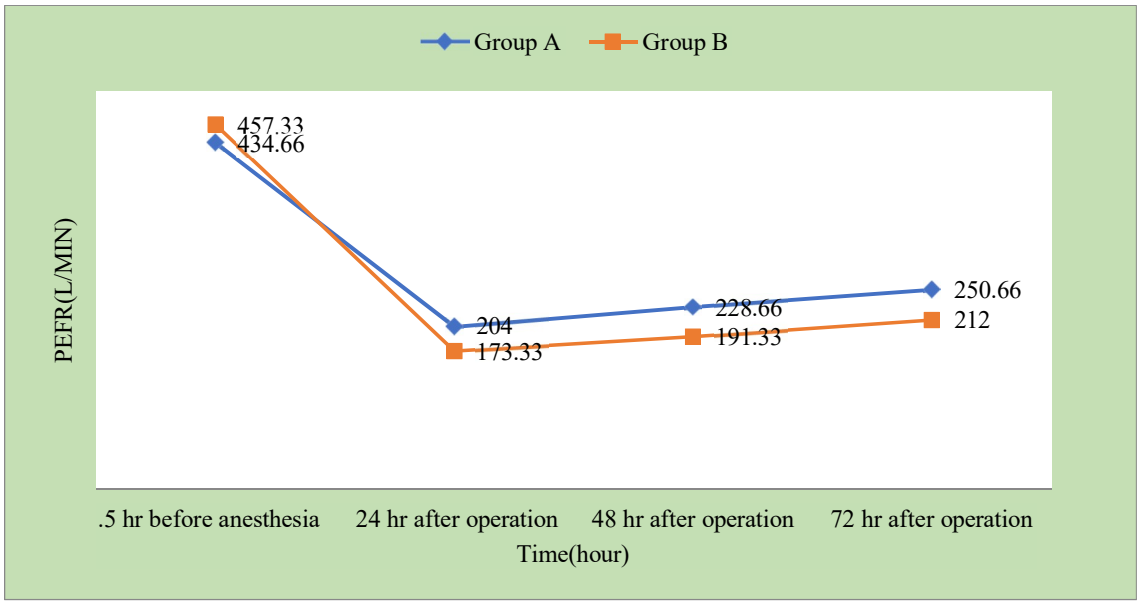

Figure 3 illustrates a significant reduction in PEFR in both groups at 24 hours postoperatively, followed by progressive improvement over the next 72 hours. Group A maintained higher PEFR values than Group B throughout the postoperative period, suggesting better preservation and recovery of expiratory airflow.

Table 1: Comparison of demographic variables between groups

Variable	Group A (n=15)	Group B (n=15)	p-value
Age (years), mean ± SD	52.33 ± 4.65	51.88 ± 5.39	0.802
Male sex, n (%)	13 (86.66)	14 (93.33)	1.000
BSA (m^2), mean ± SD	1.74 ± 0.12	1.80 ± 0.09	0.161

Unpaired Student's t-test and Chi-square test

Table 1 compares demographic variables between the two groups. The mean age was similar (52.33 ± 4.65 years in Group A vs. 51.88 ± 5.39 years in Group B; p=0.802). Male predominance was observed in both groups (86.66% vs. 93.33%; p=1.000). Body surface area was also comparable (1.74 ± 0.12 vs. 1.80 ± 0.09; p=0.161).

Table 2: Distribution of presenting symptoms and clinical findings

Parameter	Group A n (%)	Group B n (%)	p-value
Chest pain	14 (93.33)	15 (100)	0.309
Palpitation	8 (53.33)	12 (80.00)	0.121

Dyspnea	3 (20.00)	7 (44.66)	0.245

Chi-square test and Fisher's exact test

Table 2 describes presenting symptoms and clinical findings. Chest pain was nearly universal in both groups (93.33% vs. 100%; p=0.309). Palpitation (53.33% vs. 80.00%; p=0.121) and dyspnea (20.00% vs. 44.66%; p=0.245) were more frequent in Group B, but differences were not statistically significant.

Table 3: Distribution of cardiovascular risk factors

Risk factor	Group A	Group B	p-value
	n (%)	n (%)	
Diabetes mellitus	4 (26.66)	5 (33.33)	0.690
Smoking	9 (60.00)	11 (73.33)	0.439
Hypertension	11 (73.33)	11 (73.33)	1.000
Dyslipidemia	12 (80.00)	11 (73.33)	0.666

Table 3 shows cardiovascular risk factors. Diabetes mellitus (26.66% vs. 33.33%; p=0.690), smoking (60.00% vs. 73.33%; p=0.439), hypertension (73.33% in both groups; p=1.000), and dyslipidemia (80.00% vs. 73.33%; p=0.666) were evenly distributed, indicating well-matched baseline risk profiles.

Table 4: Duration of ICU stay and hospital stay

Outcome	Group A	Group B	p-value
	Mean ± SD	Mean ± SD	
ICU stay (hours)	34.50 ± 0.59	38.09 ± 0.86	0.004
Hospital stays (days)	6.06 ± 0.70	8.66 ± 0.97	0.003

Statistical analysis: Unpaired Student's t-test

Table 4 compares ICU and hospital stay duration. Group A had significantly shorter ICU stay (34.50 ± 0.59 hours vs. 38.09 ± 0.86 hours; p=0.004) and reduced hospital stay (6.06 ± 0.70 days vs. 8.66 ± 0.97 days; p=0.003), indicating faster postoperative recovery in the awake epidural anesthesia group.

Discussion

In this study, we looked at the short-term results of using awake thoracic epidural anesthesia compared to general endotracheal anesthesia in patients who were undergoing off-pump coronary artery bypass grafting. The main takeaway was that patients who had the awake procedure with epidural anesthesia showed better postoperative lung function and spent less time in the ICU and hospital, all without any increase in serious complications or deaths. This backs up the idea that the choice of anesthesia can really affect recovery outcomes after heart surgery. We found that the basic demographic info, clinical signs, heart health risks, and the level of coronary artery disease were similar between both groups, which means we matched them up well. This similarity helps reduce any selection bias, making the comparison between the two groups more valid. Other studies have highlighted the importance of having similar baseline profiles when evaluating anesthetic methods in heart surgery [14]. A key takeaway from this study was that patients in the awake epidural group showed better lung function after surgery. We saw that their forced expiratory volume and peak expiratory flow rates at 24, 48, and 72 hours post-surgery were notably higher compared to Group A. These results align with previous findings that keeping natural breathing and steering clear of mechanical ventilation can help prevent atelectasis, diaphragm issues, and injuries related to ventilation [15,16]. Thoracic epidural anesthesia provides effective analgesia, allowing better coughing, deep breathing, and early mobilization, which together contribute to improved postoperative lung mechanics [17]. The arterial blood gas analysis done around the time of surgery showed some notable differences between the groups right after the sternotomy, during graft anastomosis, and upon arrival at the ICU.

Specifically, the group under general anesthesia had higher PaO_2 levels and better $PaCO_2$ levels during the surgery, which makes sense considering they had controlled ventilation and were getting more oxygen. But these differences didn't stick around; they faded within 24 hours after the surgery. This suggests that using awake epidural anesthesia doesn't really affect how well the body exchanges respiratory gases in the long run [18]. Keeping a stable blood flow is really important during OPCABG, especially for patients who are awake. In this study, we found that heart rates were considerably lower in the epidural group during sternotomy, after the graft connections were made, and upon ICU arrival. This suggests that the epidural successfully blocked the cardiac sympathetic response. We know that thoracic epidural anesthesia can help lower stress responses, reduce the heart's need for oxygen, and cut down on catecholamine release, which might be helpful for those dealing with ischemic heart disease [19]. Mean arterial pressure remained comparable between groups throughout the perioperative period, indicating that epidural anesthesia did not result in clinically significant hypotension, a finding consistent with previous reports [20]. After the surgery, we found that complications like atrial fibrillation, heart attacks, neurological issues, the need for re- exploration, blood loss, and even death were rare and similar across the groups. Notably, there weren't any cases of spinal hematoma or lasting neurological problems in the awake epidural group, which backs up the idea that thoracic epidural anesthesia can be safe when done right for certain heart surgery patients [21]. Similar safety profiles have been reported in recent systematic reviews and observational studies [22]. The most clinically relevant finding of this study was the significant reduction in ICU and hospital stay in patients undergoing awake OPCABG. Shorter ICU stay reduces healthcare costs, resource utilization, and the risk of ICU-related complications, while early hospital discharge improves patient satisfaction and overall recovery [23]. These findings align with previous studies that have shown enhanced recovery pathways with regional anesthesia techniques in cardiac surgery [24]. Even with these positive findings, doing awake OPCABG still needs careful patient selection and strong teamwork between surgeons and anesthesiologists, along with enough expertise at the institution. There are potential challenges like patient anxiety, accidental pleural openings, and possibly needing to switch to general anesthesia, which we also saw in one patient from our study. So, awake epidural anesthesia should be seen as a supplementary option rather than a complete replacement for general anesthesia. While this study's small size and single-center design limit its scope, it does show that using awake thoracic epidural anesthesia for OPCABG is generally safe and can lead to better lung function and quicker recovery. We definitely need bigger randomized controlled trials to better understand its role and set up standard protocols for broader clinical use [25].

Limitations

This study has some limitations, like the small number of participants, being conducted at just one center, and the observational approach, which might affect how broadly these findings can be applied. We didn't look at long- term results, and we can't rule out any selection bias linked to the choice of anesthetic technique.

Conclusion and Recommendation

Using awake thoracic epidural anesthesia for off-pump coronary artery bypass grafting seems to lead to better lung function after surgery. Plus, patients tend to spend less time in the ICU and hospital compared to those who received general endotracheal anesthesia. Both methods showed similar levels of stability in blood flow and rates of complications. So, for the right patients, awake epidural anesthesia could be a safe and effective option that helps speed up recovery after OPCABG.

Awake thoracic epidural anesthesia could be an option for certain patients getting OPCABG, especially in hospitals with a lot of experience. It would be great to see bigger, multicenter studies to really confirm these results and help create standard protocols that ensure safety and the best outcomes for patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee.

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