

Requirement of Postoperative Ventilation and analgesics during Off-Pump Coronary Artery Bypass (OPCAB) surgery – A Comparison between Combined High Thoracic Epidural Anaesthesia (HTEA) with GA and GA Alone

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Abstract :

Background: This is often difficult to achieve optimal pain relief after coronary artery bypass surgery and also great challenge to choose appropriate analgesics with minimize the duration of mechanical ventilation. In the postoperative period inadequate analgesia may increase morbidity by causing adverse haemodynamic, metabolic, immunologic and haemostatic attentions and prolong mechanical ventilation with more ICU stay. High Thoracic Epidural Anaesthesia (HTEA) as an adjunct to general anaesthesia has been shown to be potentially beneficial in postoperative pain relief and the requirement of mechanical ventilation in patients with off-pump coronary artery bypass surgery (OPCAB). HTEA provides good protection from stress response, ensures hemodynamic stability, improves distribution of coronary blood flow with reducing demand of oxygen, less requirement of postoperative analgesia, mechanical ventilation and ICU stay.

Objective: This study has been undertaken with a view to compare requirement of postoperative mechanical ventilation and analgesics in OPCAB surgery between HTEA with GA and GA alone.

Methods: This prospective, randomized case control comparative study was carried out in sixty patients without having left main coronary artery disease, left ventricular ejection fraction <30% or contraindication of regional anaesthesia scheduled for OPCAB. They were divided into two groups, thirty in each group. Group A received GA alone and group B received high thoracic epidural anaesthesia with GA. Requirement of

postoperative analgesics, pain score, consciousness score, sedation score, satisfaction level and duration of ventilation with length of stay in intensive care unit were recorded in the post-operative period.

Results: Rescue analgesics received and found 16(53.3%) and 6(20.0%) needed analgesia in group A and group B respectively and the difference was statistically significant ($p<0.05$). Regarding the pain score (VAS) during maintenance with ventilator with awareness at first fourth hour significant ($p<0.05$) change between two groups. After extubation at rest in different time interval and found significant ($p<0.05$) change between two groups in all follow-up times. Post-operative pain score (VAS) after extubation at movement in different time interval and found significant ($p<0.05$) change between two groups. Post-operative pain score (VAS) after extubation at during coughing in different time interval and found significant ($p<0.05$) change between two groups. Post-operative sedation score at first six hour (hourly) and found significant ($p<0.05$) change between two groups except 1st hour, which was not significant ($p>0.05$). The mean extubation hours were 7.4 ± 1.09 hours in group A and 5.3 ± 0.81 hours in group B. The mean ICU stay was 72.9 ± 9.2 hours in group A and 57.1 ± 12.0 hours in group B and the difference was statistically significant ($p<0.05$) in unpaired t-test. No post-operative complication was observed in both groups.

Conclusion: HTEA with GA appeared to be most reliable postoperative pain relief, shorter mechanical ventilation, ICU stay in OPCAB surgery

Key word: pain, ventilation, analgesics, OPCAB, post-operative, epidural, HTEA, General anaesthesia.

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Introduction:

Pain control with thoracic epidural is probably the most easily documented benefit. All studies examining the use of thoracic epidurals for cardiac surgery have documented superior pain relief when compared to all other modalities, including intrathecal opiate analgesia.

It is important to use TEA to its maximum capacity to benefit from its full potential: outstanding analgesia, excellent protection against stress hormone surge after surgery, reduction of postoperative ventilation period, fast recovery and better pulmonary recovery outcome. It seems imperative to begin its use before surgery starts, continue its infusion at a constant rate during surgery, and carry on for at least 2 days if possible. One study has shown that the maximum pain after surgery occurs within the first 48 hours, after which pain subsides significantly. In addition, use of TEA for longer than 3 days carries the risk of losing the control over its use and increase the likelihood of human error due to miscommunication. The safest duration of TEA in cardiac surgery is a maximum of 3 days; exceptionally longer use should be justified on a patient-by-patient basis. In the postoperative period inadequate analgesia may increase morbidity by causing adverse haemodynamic, metabolic, immunologic and haemostatic attentions (Chancy, 2006; Weissman, 1990; Kehlet, 1989; Roizen, 1988). This is often difficult to achieve optimal pain relief.

Aim:

- To assess postoperative pain score, consciousness score and sedation score between HTEA with GA and GA alone.
- To observe duration of ventilation and length of stay in intensive care unit between HTEA with GA and GA alone.
- To observe the requirement of post-operative rescue analgesia.

Methodology:

After selection of patients according to the inclusion and exclusion criteria, and after obtaining informed consent, a total of 60 adult patients with coronary artery diseases were prospectively enrolled in this study. All patients were undergone elective CABG on the beating heart with complete median sternotomy either using General

Anaesthesia alone (group A) or combined High Thoracic Epidural Anaesthesia with General Anaesthesia (group B). All patients were premedicated Tab. Midazolam 7.5 mg received at bed time day before operation. On the arrival in the operation theater, patients were pre oxygenated and after stablist ECG monitor with all aseptic precaution intravenous cannulation, radial arterial cannulation and central venous catheterization was established in both groups. In the group B (study group), with all aseptic precaution a side holed multiport epidural catheter was inserted through 18G Touhy needle at the level of T1-2 or T2-3 interspaces in the morning on the day of surgery under local anaesthesia using midline approach at lateral decubitus position with the loss of resistance or hanging drop technique. The catheter was directed cephalic and advance 3-4 cm into the epidural space. Continuous epidural infusion with 0.25% bupivacaine was maintained after operation @ 4-5 ml/hr up to 48 hours. Sensory block was determined bilaterally using loss of warm- cold sensation as well pinprick discrimination.

In both groups general anaesthesia was induced with fentanyl 10 µg/kg IV and with propofol 1 mg/kg IV. Tracheal intubation was facilitated by pancuronium bromide 0.1 mg/kg. Anaesthesia was maintained with propofol infusion @ 3-6 mg/kg/hr (50-100µg/kg/min) and fentanyl infusion @ 1-2 µg/kg/hr, neuromuscular blocking agent pancuronium bromide 1/3rd dose of induction dose was given at one hour interval through iv route. The lungs were ventilated mechanically at normocapnia in an air and Oxygen mixture.

The parameters including heart rate (HR), arterial blood pressure (ABP), ECG, SPO₂, CVP, ABG analysis, Urine output were monitored during operation. Ephedrine 5-10 mg iv bolus or repeated was given if hypotension associated with epidural anaesthesia, dopamine 1-20 µg/kg/min was the first choice to maintain MAP above 70 mmHg if not corrected then adrenaline 0.05-0.2 µg/kg/min, dobutamine 2-20 µg/kg/min was added accordingly.

On the arrival at ICU from Operation Theater the patient, ventilation was maintained by mechanical ventilator. Mechanical ventilation was started in assist control mode with a respiratory rate 10-12 breath / min, Tidal volume 10ml/kg, FiO₂: 0.7 and was adjusted to maintain O₂ saturation by pulse oxymetry >95% and PEEP was set at

5 cm H₂O .Tidal volume was adjusted to maintain partial pressure of arterial CO₂ between 35 and 40 mm Hg. When patient is haemodynamically stable and arousal, ventilation mode was changed to SIMV then Spontaneous ventilation mode. When there were accepted criteria for tracheal extubation then the patient was extubated and postoperative mechanical ventilation hour was recorded. Postoperative analgesia was performed by the epidural infusion 0.25% bupivacaine 3-4 ml/hour in patients group B and both groups of the patients were received injection ketorolac 30 mg iv 8 hourly.

Pain exceeding a visual analog score (VAS 0-100) of 50 or whenever were requested by the patients or deemed necessary by the nurse in case the patients are not fully awake and able to respond sufficiently, the hourly epidural rate was increased by 1 ml and intravenous Ketorolac 30 mg was administered simultaneously for instant pain relief. Morphine 1-2 mg IV as needed was used if ketorolac were insufficient. These rescue analgesics need were recorded. The epidural catheter was removed after 48 hours of post-operative period with normal coagulation profile.After extubation the level of consciousness (LOC) was hourly assessed for 6 hours using 5-point LOC scale. A higher score on the LOC were indicated a poorer LOC. After awareness postoperative pain scores were assessed and recorded of all patients at rest, exercise (e.g. Movement, coughing and so on) using a 100-mm visual analog scale, with ends marked as 0 (no pain) and 100 mm (worst imaginable pain) every four hour interval for 48 hours postoperatively. Sedation score was assessed and recorded by using a 3- point scale (1, completely awake and open eyes; 2, asleep but responds to verbal commands and/or touch; 3, does not respond) every hourly for first six hour of postoperative period. On the 3rdpost-operative day all patients were questioned as to satisfaction and whether they would choose the anaesthetic technique again and ask to other patients to receive this anaesthetic technique. After accepted criteria for discharge from the intensive care unite (ICU) patient was shifted to the post-operative care unit and the duration of ICU stay was recorded. Following post-operative complications were recorded in this study.

Pneumothorax: Evidenced on chest x-ray for consecutive post-operative 3 days.Prolong mechanical ventilation: Tracheal intubation for more than 24 hours, tracheal reintubation after initial extubation.Neurologic complication: Assessed with sensory, motor or reflex

abnormalities any time after surgery; global abnormalities within two days operation.Acute infection: Patients were defined as confused when, after extubation they were unable either to cooperate or communicate with the nurses and were disoriented in time and place for 8 hours or more.Epidural haematoma: Suspected if patients had radicular pain on the back, sensory, motor deficits, and urinary retention diagnosed was confirm with immediate MRI.

Results:

The mean (±SD) age of the study patients were 49.9±7.1 years in group A and 49.3±7.2 years in group B. The mean (±SD) body surface area (BSA) of the study patients were 1.6±0.11 m² in group A and 1.7±0.15 m² in group B. No significant (p>0.05) mean age and body surface area (BSA) differences were found between two groups in unpaired t-test .

During postoperative ventilation with awareness at first fourth hour and after extubation from ventilator at rest and during movement in different time interval significant (p<0.05) change found regarding pain score (VAS) between two groups.

Table-I

Post-operative pain score (VAS) during maintenance with ventilator with awareness at different times of the study patients (n=60)

	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
1 st fourth hour	53.4±9.4	26.0±8.7	0.001

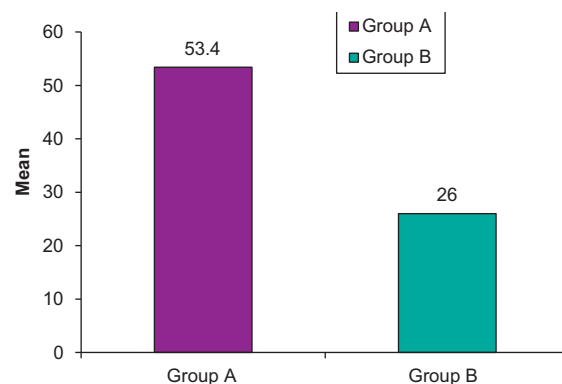


Fig.-1: Bar diagram showing post-operative pain score (VAS) during maintenance with ventilator with awareness at different times of the study patients.

Table-II

Post-operative pain score (VAS) after extubation at rest in different time interval of the study patients (n=60)

Four hours time interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8 th hour	47.5±9.6	23.3±5.0	0.001
12 th hour	47.5±8.8	23.3±5.8	0.001
16 th hour	45.3±5.1	22.3±5.3	0.001
20 th hour	42.1±6.1	21.9±5.3	0.001
24 th hour	42.5±6.2	21.5±4.3	0.001
28 th hour	41.7±5.9	21.5±4.3	0.001
32 nd hour	40.5±4.6	21.5±4.3	0.001
36 th hour	40.7±4.7	21.5±4.3	0.001
40 th hour	40.2±5.7	21.2±4.2	0.001
44 th hour	39.5±5.1	21.5±5.2	0.001
48 th hour	37.8±4.6	21.3±4.3	0.001

Table-III

Post-operative pain score (VAS) after extubation at movement in different time interval of the study patients (n=60)

Four hours time interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8 th hour	51.2±7.5	25.0±6.1	0.001
12 th hour	52.5±8.6	24.8±6.9	0.001
16 th hour	48.5±4.8	23.8±5.8	0.001
20 th hour	47.1±5.1	22.9±5.5	0.001
24 th hour	47.0±9.5	22.9±5.7	0.001
28 th hour	44.2±5.7	22.3±6.2	0.001
32 nd hour	41.7±4.9	22.5±5.3	0.001
36 th hour	43.0±4.7	22.3±4.4	0.001
40 th hour	43.5±5.4	22.5±6.4	0.001
44 th hour	41.7±6.5	21.7±4.3	0.001
48 th hour	40.6±4.8	21.7±5.3	0.001

Table-IV

Post-operative pain score (VAS) after extubation at during coughing in different time interval of the study patients (n=60)

Four hours time interval	Group Ax (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8 th hour	53.7±7.5	28.3±8.3	0.001
12 th hour	56.7±8.2	28.7±9.5	0.001
16 th hour	50.8±6.1	25.8±7.5	0.001
20 th hour	50.2±7.2	24.6±6.6	0.001
24 th hour	48.5±9.3	23.7±6.6	0.001
28 th hour	45.7±5.4	22.9±6.4	0.001
32 nd hour	45.0±4.3	23.1±5.5	0.001
36 th hour	45.2±6.8	22.9±4.6	0.001
40 th hour	45.0±5.4	23.1±7.6	0.001
44 th hour	43.2±6.5	21.7±4.3	0.001
48 th hour	42.8±3.5	22.4±5.6	0.001

The following table showed mean distribution of post-operative sedation score at first six hour (hourly) and found significant ($p < 0.05$) change between two groups except 1st hour, which was not significant ($p > 0.05$) (Table V).

Table-V

Mean distribution of post-operative sedation score at first six hour (hourly) of the study patients (n=60)

One hour interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
1 st hour	2.9±0.3	2.8±0.5	0.352 NS
2 nd hour	2.8±0.5	2.1±0.6	0.001
3 rd hour	2.4±0.7	1.4±0.5	0.001
4 th hour	2.1±0.5	1.1±0.3	0.001
5 th hour	1.4±0.5	1.0±0.0	-
6 th hour	1.15±0.4	1.0±0.0	-

The following table showed Status of rescue analgesics received and found 16(53.3%) and 6(20.0%) needed analgesia in group A and group B respectively and the difference was statistically significant ($p < 0.05$) in chi square test (Table VI).

Table-VI
Status of rescue analgesics received by the study patients (n=60)

Rescue analgesics	Group A (n=30)		Group B (n=30)		p value
	N	%	n	%	
Received	16	53.3	6	20.0	0.015
Not received	14	46.7	24	80.0	

The following table showed the requirement of postoperative mechanical ventilation i.e. The mean extubation hours were 7.4±1.09 hours in group A and 5.3±0.81 hours in group B. The mean ICU stay was 72.9±9.2 hours in group A and 57.1±12.0 hours in group B and the difference was statistically significant (p<0.05) in unpaired t-test (Table VII).

Table-VII
Mean distribution of extubation hour and duration of ICU stay of the study patients (n=60)

	Group A (n=30)	Group B (n=30)	p value
	Mean±SD	Mean±SD	
Extubation hours	7.4±1.09	5.3±0.81	0.001
ICU stay	72.9±9.2	57.1±12.0	0.001

No post-operative complication was observed in both groups.

Discussion:

This prospective, randomized observational comparative study was carried out with an aim to compare, which one more efficient for short duration of postoperative ventilation with the length of stay in intensive care unit and optimal pain relief after off pump coronary artery bypass surgery (OPCAB) between combined High Thoracic Epidural anaesthesia (HTEA) with General anaesthesia (GA) and general anaesthesia (GA) alone.

A total of 60 patients undergo elective CABG on off pump having ASA grade I, II, III and IV and NYHA class I, II, III and IV were included in the study at the National Institute of Cardiovascular Diseases and Hospital, Sher-E-Bangla Nagar, Dhaka and they were randomly allocated by lottery methods in two groups; group A: using GA alone and group B: using HTEA+ GA.

Regarding the mean pain score during maintenance with ventilator with awareness in this study at first fourth hour was significantly (p<0.05) higher in group A, which was 53.4±9.4 and 26.0±8.7 in group A and group B respectively.

Kessler et al. (2005) have assessed the VAS (0-100mm) at rest were subsequently higher in group A than group B at all times after surgery, always reaching significance level except at 48 hours. Similarly Salvi et al. (2004) assessed the VAS (0-10 mm) for the first 24 hour period were 0.9 at rest and 1.7 during coughing in each patients the VAS score always less than <2, which indicating that the post-operative pain relief was excellent in their study patients (group B). In the present study it was found that post-operative pain score VAS (0-100mm) was >40 in group A and <30 in group B after extubation at rest, movement and during coughing which were significantly (p<0.05) higher in group A in all the different follow-up times. The results obtained in the present study are comparable with the above studies.

In the current series it was observed that the status of rescues analgesics need 53.3% in group A and 20.0% group B and the difference was statistically significant (p<0.05).

In the present study post-operative sedation score at first hour was almost similar between two group, however the remaining times sedation score were significantly (p<0.05) higher in group A. Kessler et al. (2005) reported that sedation score were significantly higher at 6 hour post-operatively in group A.

Most of the patients in group B awareness were occurred at 2 hour after arrival at Intensive care unit but 4 hour later in group A. After 4 to 5 hour later after arrival at Intensive care unit it was observed that group B patients awake from sedation as like a normal healthy person with sound sleep, but in patients group A most of them looked anxious.

It was observed in the current study that post-operative level of consciousness score at different times almost similar between two groups. No significant (p>0.05) change was found between two groups.

A conscious and oriented patient will communicate their needs and cooperate with the medical staff providing post-operative care. The ability to concentric and learn instructions may facilitate tactual extubation, chest tube removal and cooperation with physiotherapist and moving staff.

In this study it was observed that the level of satisfaction with the anaesthetic technique was 36.7% and 83.3% mentioned good in group A and group B respectively, which was statistically significant (p<0.05). Kessler et al. (2005) found identical level of satisfaction with the anaesthetic technique.

Patients satisfaction is as much related to the comparison between anticipated and experienced pain

as it is to the actual level of pain experience. Satisfaction is achieved when a situation is better than expected and dissatisfaction when one is worse than expected. Patients undergoing cardiac surgery are very concerned regarding post-operative pain and tend to preoperatively expect more intense post-operative pain than that actually experienced. So in the present study patients who were received HTEA (group B) express very high satisfaction level than the groups A only. In the present study the patients in both groups were asked during 3rd postoperative day about their anesthetic technique and their feeling in comparison with the other patients who underwent OPCAB in the same day or next day at the same cardiac post anaesthesia care unit, a specialized unit caring a exclusively for open heart surgery patients. The patient group B, most of the patient expressed their feeling good and few of them expressed fair and none of them not fair. But in group A, 23.0% patients expressed their feeling not fair.

In this study no post-operative complication was found between two groups. In a study Scott (2001) done a study on 202 patients in group A and 206 in group B and found the incidence of postoperative confusion was 5.5% and 1.5% in group A and group B respectively. The incidence of CVA was 3.0% in group A and 1.0% in group B. Similar technique was used by Tuman et al. (1991) on outcome of major vascular surgery and found that prolong mechanical ventilation 12.5% in group A and 2.5% in group B, reintubation 2.5% in group A and none was found in group B, neurologic complications 7.5% in group A and none was found in group B.

In this study it was found that the mean ventilation hours was significantly ($p < 0.05$) higher in group A, which were 7.4 ± 1.09 in group A and 5.3 ± 0.81 hours in group B. Similarly, the mean ICU stay was also significantly ($p < 0.05$) higher in group A, which were 72.9 ± 9.2 hours in group A and 57.1 ± 12.0 hours in group B. Kessler et al. (2005) observed the higher mean ventilation hours in group A, which was 5.0 ± 2.6 hour in group A and 3.7 ± 2.4 hours in group B. The mean ICU stay was also higher in group A, which was 11.2 ± 7.9 hours and 9.2 ± 8.1 hours in group B. Salvi et al. (2004) observed the mean ventilation hour was 4.6 ± 2.9 in group B and the mean ICU stay was 36.0 ± 19.2 hours.

Conclusion:

Based on the present study shows that anaesthetic technique High Thoracic Epidural Anaesthesia with General Anaesthesia (HTEA with GA) during off pump coronary artery bypass surgery (OPCAB) shortens the post-operative requirement of mechanical ventilation with

the duration of ICU stay and optimize the pain relief with satisfaction than GA only.

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