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ORIGINAL ARTICLE

COMPARISON OF EPIDURAL ANESTHESIA AND POSTOPERATIVE ANALGESIA WITH ROPIVACAINE AND FENTANYL IN OFF-PUMP CORONARY ARTERY BYPASS GRAFTING: A RANDOMIZED, CONTROLLED STUDY

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ABSTRACT: BACKGROUND: Our aim was to assess the efficacy of thoracic epidural anesthesia followed by postoperative epidural infusion with ropivacaine and Fentanyl in off-pump coronary bypass grafting. **INTRODUCTION:** In cardiosurgical patients, high thoracic epidural anesthesia (EA) with local anesthetics and opioids can provide effective analgesia and reduce the number of perioperative complications. However, the use of EA in coronary surgery is controversial, and it is still unclear whether EA influences lung fluid balance, cardiopulmonary function and clinical outcome in OPCAB. Thus, the method requires further evaluation and its potential benefits in coronary patients should be weighed against its risks. **MATERIALS AND METHODS:** A prospective study was performed in 40 patients undergoing coronary artery bypass surgery who received high thoracic epidural analgesia. Group 1 received thoracic epidural 0.2% ropivacaine (bolus 10 ml, 10 min before starting surgery) while group 2 pts. received Fentanyl 2 mcg/ml (bolus 10 ml, 10 min before starting surgery), then rate of epidural infusion adjusted between 3-8 ml/hr. of the same concentration according to response. The Regimens aimed at a visual analog scale (VAS) score < or = 4/10. Hemodynamic parameters and blood gases were measured from extubation till 24 h after OPCAB. **RESULTS:** Outcome measures included the incidence of Visual Analogue Score (VAS) < or =4/10, infusion rate adjustments and side-effects. Patients receiving ropivacaine were less likely to experience pain < or =4/10 (P' = 0.002); the infusion rate was lower (P' = 0.024); required less rate adjustments (P' = 0.001); a less need for noradrenaline (P' = 0.001) and antiemetic drugs (P' = 0.001). There were no significant differences between the groups for sedation scores or the incidence of respiratory depression. **CONCLUSION:** This study suggests that ropivacaine 0.2% may be superior to fentanyl 2 microg/ml. We found a reduced number of infusion interventions and less inadequate patient analgesia but more volume expander needed. Postoperative thoracic epidural infusion with Fentanyl and ropivacaine reduced the time to extubation.

INTRODUCTION: Coronary artery bypass grafting (CABG) is one of the most common cardiovascular interventions. In many institutions, CABG is performed without cardiopulmonary bypass (CPB), a modification which is commonly referred to as off-pump coronary artery bypass grafting (OPCAB) [1-4]. The off-pump technique enables coronary revascularization on the beating heart, thereby reducing the risk of complications associated with CPB. However, OPCAB can be accompanied by hemodynamic alterations, postoperative pain, and respiratory dysfunction, requiring thorough monitoring and perioperative and Postoperative care [3-6].

In cardiac patients, high thoracic epidural anaesthesia (EA) with local anesthetics and opioids can provide effective analgesia and reduce the number of perioperative and postoperative

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complications [6-8]. However, the use of EA in coronary surgery is controversial, and it is still unclear whether EA influences lung fluid balance, cardiopulmonary function and clinical outcome in OPCAB. Thus, the method requires further evaluation and its potential benefits in coronary patients should be weighed against its risks [8, 9].

We hypothesized that after OPCAB, thoracic epidural analgesia with Ropivacaine and Fentanyl aiming at a visual analogue scale (VAS) score < or =4/10 will be associated with improved cardiopulmonary parameters in comparison with intravenously administered analgesia. If the hypothesis is confirmed, we expect that epidural administration of Ropivacaine and Fentanyl might reduce the duration of mechanical ventilation. The aim of our study was to assess the influence of Epidural Anesthesia followed by postoperative Epidural Analgesia with Ropivacaine/Fentanyl in the perioperative and postoperative management of OPCAB patients. HTEA may offer distinct advantage beyond its beneficial effects on hemodynamics, like pain control without sedation, reduction in stress response, early recovery of consciousness and spontaneous ventilation [10], faster extubation and mobilization, decrease incidence of DVT and good patient acceptance.

MATERIAL AND METHOD: After approval from the institutional ethics committee, written informed consent from all patients was taken. A prospective randomized study was conducted in 40 patients (45 – 70 yrs.) of ASA grade II and III scheduled for elective surgery. The patients were randomized in two groups using envelope method. The patients in both the groups were induced with I/V Fentanyl 2-3 mcg/kg body wt., I/V Thiopentone 3-5 mg/kg body wt. and I/V Vecuronium 0.1-0.15 mg/kg BW and maintained on O2/N2O 50:50 and Sevoflurane 1-5 MAC. Group 1 received thoracic epidural Ropivacaine 0.2% (bolus 10 ml, 10 min before starting surgery) while group 2 pts. received Fentanyl 2 mcg/ml (bolus 10 ml, 10 min before starting surgery), then rate of epidural infusion adjusted between 3-8 ml/hr. of the same concentration according to response. The Regimens aimed at a visual analogue scale (VAS) score < or =4/10. Hemodynamic parameters and blood gases were measured from start of surgery till 24 h after OPCAB.

In both groups Patient was given continuous infusion of drugs immediately after surgery as soon as patient was shifted to PACU to maintain analgesia. Infusion rate in group I patient is maintained 3.5-4.5 ml /hr. and in group 2 patient 6-8 ml/hr. Exclusion Criteria were Left coronary artery involved, Preoperative hemodynamic instability, Congestive heart failure, Recent (<1 week) MI, Associated valvular disease, Previous cardiac surgery, and transfer to CPB during surgery.

RESULTS: Outcome measures included the incidence of Visual Analogue Score (VAS) < or =4/10, infusion rate adjustments and side-effects. The results in both the groups were compared using ‘p’ value. Patients receiving Ropivacaine were less likely to experience pain < or =4/10 (P' = 0.002); the infusion rate was lower (P' = 0.024); required less rate adjustments (P' = 0.001); a less need for noradrenaline (P' = 0.001) and antiemetic drugs (P' = 0.001). There were no significant differences between the groups for sedation scores or the incidence of respiratory depression.

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Parameters	Group 1(R) (n = 20)	Group 2(F) (n = 20)
Age (yrs.)	58.2 ± 8.0	58.87 ± 0.34
Sex (M/F)	18/2	17/3
Weight (kg)	56.89 ± 4.5	59.12 ± 9.6
LVEF (%)	48.87 ± 6.0	48.50 ± 7.8
Hypertension	12	14
Diabetes	12	10
NYHA	I & II	I & II
ASA	I & II	I & II

Table 1: Demographic data and clinical information

As shown in Table 1, we found no significant differences among the groups concerning demographic data, including co-morbidities and preoperative ejection fraction. Two patients (one patient in each group) who became hemodynamically unstable during CABG were transferred to CPB and excluded from further analysis. THE DURATION OF SURGERY WAS NOT TAKEN INTO ACCOUNT.

	Group 1 R (n = 20)	Group 2 F (n = 20)	p value
Pre-Extubation	77.24 ± 8.6	83.48 ± 9.2	0.0328
Post – Extubation	78.04 ± 10.8	85.03 ± 9.7	0.0377
6 hrs.	74.26 ± 6.8	80.04 ± 8.8	0.0256
12 hrs.	70.86 ± 8.8	82.42 ± 7.6	0.0001
18 hrs.	70.26 ± 4.6	80.36 ± 6.8	0.0001
24 hrs.	68.89 ± 5.8	78.26 ± 6.2	0.0001

Table 2: Hemodynamic Parameters Heart Rate (beats / min)

	Group 1(R) (n = 20)	Group 2(F) (n = 20)	p value
Pre-Extubation	134.02 ± 8.4	142.92 ± 14.6	0.0233
Post – Extubation	127.95 ± 9.6	136.50 ± 7.9	0.0039

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6 hrs.	120.86 ± 8.6	128.56 ± 9.2	0.0094
12 hrs.	115.28 ± 6.4	120.82 ± 6.8	0.0116
18 hrs.	112.74 ± 9.6	118.46 ± 7.8	0.0455
24 hrs.	112.68 ± 6.4	120.48 ± 6.8	0.0006

Table 3: ABP Systolic (mmHg)

	Group 1(R) (n = 20)	**Group 2 (F) (n = 20)**	**p value**
Pre-Extubation	80.4 ± 7.0	87.50 ± 8.3	0.0058
Post – Extubation	80.10 ± 6.4	84.71 ± 7.2	0.0388
6 hrs.	77.26 ± 4.6	82.50 ± 8.6	0.0213
12 hrs.	74.81 ± 5.6	80.34 ± 7.2	0.0100
18 hrs.	70.42 ± 4.8	76.84 ± 6.2	0.0008
24 hrs.	70.16 ± 3.8	75.64 ± 8.6	0.0130

Table 4: ABP Diastolic (mmHg)

Table 2, 3 &4 displays changes in hemodynamics. In the groups I receiving Epidural Ropivacaine Heart rate and Systolic arterial pressure and diastolic blood pressure decreased significantly ($P < 0.05$) as compared to group 2.

Time	**Group 1(R) (n = 20)**	**Group 2(F) (n = 20)**	**p value**
Post Extubation	4.3 ± 1.34	5.6 ± 1.16	0.0027
6 hrs.	4.8 ± 1.24	5.32 ± 0.92	0.0021
12 hrs.	4.13 ± 1.04	5.12 ± 0.88	0.0024
18 hrs.	4.06 ± 1.02	4.98 ± 0.78	0.0027
24 hrs.	4.02 ± 0.98	4.92 ± 0.76	0.0024

Table 5: VAS Score **At Rest**

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Time	Group 1(R) (n = 20)	Group 2(F) (n = 20)	p value
Extubation	6.16 ± 1.62	6.48 ± 0.82	0.0024
6 hrs.	5.06 ± 1.36	6.26 ± 0.89	0.0021
12 hrs.	4.82 ± 1.12	5.89 ± 0.92	0.0021
18 hrs.	4.46 ± 1.02	5.48 ± 0.94	0.0022
24 hrs.	4.23 ± 1.12	5.30 ± 0.96	0.0025

Table 6: Vas Score On Coughing

Table 5 and 6 shows that The VAS scores were within <or =4/10 mm at rest and during coughing in all groups without intergroup differences excluding 24 h when VAS score was significantly lower in the group 1 as compared to group II. The level of postoperative sedation did not differ among the groups.

Time	Group 1(R) (n = 20)	Group 2(F) (n = 20)	p value
Post Extubation	3.92 ± 0.28	6.98 ± 0.69	<0.005
6 hrs.	3.76 ± 0.26	7.02 ± 0.52	<0.005
12 hrs.	3.84 ± 0.64	6.53 ±0 .59	<0.005
18 hrs.	4.38 ± .42	7.44 ± 0.39	<0.005
24 hrs.	3.68 ± 0.86	6.24+0.48	<0.005

Table 7: Requirements of infusion rate adjustment of epidural ropivacaine and fentanyl in patients undergoing OPCAB, Infusion Rate/Mean Rate (ml/hr.)

Time	Group 1(R) (n = 20)	Group 2(F) (n = 20)	p value
Shifting to Extubation	541.75 ± 56.83	401.60 ± 45	0.0001
6hr	525 ± 31.54	450 ± 25.75	0.0001
12hr	473 ± 38.13	433.50 ± 29.96	0.0007
18hr	485 ± 20.46	457.50 ± 21.49	0.0001
24hr	427.50 ± 32.10	402.50 ± 27.31	0.0116

Table 8: Need for Colloids

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Side effect	Group 1(R) (n = 20)	Group 2 (F) (n = 20)
Nausea	3(15%)	4(20%)
Pruritus	2(10%)	5(25%)
Epidural Hematoma	0(0%)	0(0%)
Hypotension	5(25%)	3(15%)
Respiratory depression	3(15%)	4(20%)

Table 9: Side effect

RESULTS: Outcome measures included the incidence of Visual Analogue Score (VAS) < or =4/10; infusion rate adjustments; and side-effects. Patients receiving Ropivacaine were less likely to experience pain < or =4/10 (P'=0.002); the infusion rate was lower (P'=0.024); required less rate adjustments (P'=0.001) (Table 7); a less need for noradrenaline (P'=0.001) (Table 8) and antiemetic drugs (P'= 0.001) (Table 9).There were no significant differences between the groups for sedation scores or the incidence of respiratory depression.

DISCUSSION: The present study demonstrates that epidural analgesia with ropivacaine and fentanyl causes a moderate decrease in arterial pressure. Epidural administration of ropivacaine and Fentanyl reduce the requirement of nitroglycerine and IV Fentanyl perioperatively. Epidural administration with ropivacaine requires more perioperative and postoperative crystalloid and colloids. Thus the hypotensive effect of epidural blockade should not be underestimated, especially in hemodynamically unstable patients. Similar results were obtained by other authors studying EA in coronary surgery [11, 12].

Postoperative epidural administration provides adequate analgesia in both group but more superior with ropivacaine. It also decreases the duration of mechanical ventilation after OPCAB.

We found that epidural analgesia after OPCAB resulted in mild hyperventilation. Moreover, the EA with ropivacaine/fentanyl led to transient postoperative improvement in arterial oxygenation, possibly due to improvement of pulmonary and systemic perfusion [13]. In addition to these mechanisms, the advantageous respiratory effects of epidural blockade in cardiac surgery were associated with reduced incidence of postoperative atelectasis and improved quality of analgesia[11, 13, and 14]. In our study, epidural anesthesia and analgesia provided adequate pain control, compared to that observed after administration of fentanyl in the group 2, as confirmed by VAS score < or = 4/10 in both epidural groups; optimal analgesia was observed after EA. Thus, the combined effects of analgesia, pulmonary vasodilation, and prevention of lung oedema and improvement of pulmonary mechanics might have resulted in a better lung function in the both group that allowed earlier termination of respiratory support.

The postoperative use of EA does not influence the incidence of adverse events after OPCAB, like over sedation, pruritus, nausea, vomiting or arrhythmias in both groups. This is consistent with other investigations in this field. By contrast, several authors report reduced incidence of atrial

fibrillation after EA for coronary surgery, probably due to the sympatholytic action of epidural blockade[11-13, 16]. Thus, by reducing the requirements in opioids, time to tracheal extubation and number of complications, EA can become part of a fast-track concept of cardiac anesthesia that is aimed to achieve cost-savings, and improve clinical outcome, as suggested by recent workers[13].

CONCLUSION: This study suggests that TEA ropivacaine 0.2% was found to be superior to thoracic epidural Fentanyl for perioperative and postoperative analgesia for CABG surgery. In ropivacaine group requirement of fluid and vasopressors therapy is more as compared to Fentanyl group. In both group TEA found good tissue perfusion and lung function thus shortening the duration of mechanical ventilation.

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