Original Article

Comparative study between Preemptive Thoracic Epidural Analgesia and conventional postoperative Thoracic Epidural Analgesia in Thoracic Surgery

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Abstract:

Background : *The aim of this study is to compare and to observe the effectiveness of preemptive thoracic epidural analgesia (TEA) with conventional postoperative epidural analgesia in thoracotomy. Material and Methods: Forty patients were randomized in to two groups (preemptive Group: Group P, control: Group C). Epidural catheter was inserted in all patients preoperatively. In Group P, epidural analgesic solution was administered as a bolus before the surgical incision and was continued until the end of the surgery. Postoperative patient controlled epidural analgesia was introduced via syringe pumps for all patients. Respiratory rates (RR) were recorded. Patient's analgesia was evaluated with visual analog scale at rest (VASr) and coughing (VASc). Number of patient's demands from the pump and additional analgesic requirement were also recorded.*

Results : *RR in Group C was higher than in Group P at postoperative 1st and 2nd hours. Both VASr and VASc scores in Group P were lower than in Group C at postoperative 1st, 2nd, and 4th hours. Patient demand and bolus delivery count from pump in Group P were lower than in Group C in all measurement times. Total analgesic requirements on postoperative 1st and 24th hours in Group P were lower than in Group C.*

Conclusion: *From the study we consider that preemptive TEA may offer better analgesia after thoracotomy.*

Key words: *Preemptive Thoracic Epidural analgesia, Thoracic Epidural Analgesia, Thoracotomy.*

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Introduction

Postoperative pain is one of the most important factors affecting the patient's morbidity. Thoracotomy is considered as one of the most severe acute postoperative painful surgeries.[1] acute pain in these procedures can lead to respiratory and cardiovascular complications.[2–4] coughing and clearance of secretion can be impaired after thoracotomy in patients with inadequate analgesia and can prolong hospital stay. For this reason different analgesic techniques such as thoracic epidural analgesia (TEA), paravertibral blocks, and systemic analgesic can be used. TEA is often regarded as to be the gold standard.[5] It was demonstrated that TEA provided better analgesia than conventional analgesia models in postthoracotomy pain.[6–8] suitable planned TEA decreases postoperative morbidity and mortality providing optimal analgesia without respiratory insufficiency.[9]

Preemptive analgesia is a concept that a pain therapy is more effective if given before the surgical incision and noxious stimulus.[10-11] it is thought to decrease the incidence of hyperalgesia and allodynia by decreasing the altered central sensory processing.[12] therefore, systemic opioid nonopoid analgesic use (iv, im), local anesthetic infiltration, and epidural or spinal local anesthetic administration have been used for preemptive analgesia.[11,13,14]

The aim of this study is to find out whether preoperative initiation of epidural analgesia is superior compared to postoperative initiation on post thoracotomy pain.

Methods

After obtaining the ethics committee approval and patient informed consent at CMH Dhaka (from Jan 2017 – Jan 2019) total forty patients between the ages of 18 to 65 with ASA I–III risk group have been taken to this study. The Patients were selected by randomized trial and patients undergoing elective unilateral thoracotomy operation were divided into two groups (preemptive: Group P, n= 20 and control: Group C, n = 20). Patients with ASA IV, body mass index 30 kg/m^2 or more, and severe renal, neurologic or hepatic diseases were excluded from the study.

All patients were administered midazolam 2 mg intra- venous sedation 30 min before the proceduse. In the operating room, electrocardiography, peripheral artarial oxygen saturation, and invasive arterial blood pressuse were monitored. By appropriate sterilation of skin and local anaesthetic 20 mg lidocaine intiltration to the skin 18G epidural catheters was inserted at T_{5-8} intervertebral spaces in sitting position. For induction Propofol (1.5–2.5mg/kg) and fentanyl (2µgm/kg) were used. After administration of suxametnoneum 1.5-2mg/kg patients were intubated with double lumen endotracheal tubes. For maintenance of anesthesia total intravenous anesthesia were used by propofol 125–250µgm/kg with fentanyl 0.1–0.25µgm/kg/min and the infusions was started.

Analgesic solution was prepared for epidural infusion. By 0.25% Bupivacainc and 2µgm/ml of fentanyl. For patients in preemptive group (Group P) 0.1 ml/kg of bolus standard epidural solution was administered 20 min before surgical incision via epidural catheter. Epidural infusion with 10 ml/hr of the same solution was started 45 min after the bolus dose and was continued during the operation. In patients in control group (Group C) equal volume of solution was administered as a bolus and infusion via epidural catheter during operation. 0.1 ml/kg of standard epidural solution (0.25% bupivacainc, 2µgm/ml fentanyl) was administered as a bolus via epidural catheter 20 min before the patient woke up.

After the patients were extubated and all of the drug infusions were discontinued, all patients were transferred to the post anesthesia care unit under constant monitoring and clinical observation. Post operative analgesia were maintained through epidural analgesia by syringe pump for all patients. The syringe pumps were set as a 5 ml/hr of pervious solutions, 3 mL of bolus dose on demand. Patient's analgesia was evaluated with visual analog scale (VAS) (0, no pain at all; 10, worst imaginable pain). If the VAS score at rest was 4 or more tramadol 50 mg intravenously were administered as an additional analgesics.

VAS score at rest (VASr) and on coughing (VASc) and demand and total count of delivery from syringe pump were independently measured at postoperative 1st, 2nd, 4th, 6th, 12th and 24th hours by a trained physician blinded to the randomization. Total tramadol requirements at 1st and 24th hours were also recorded. The incidence of side effects such as nausea, vomiting, and pruritus was also recorded. Mean arterial pressure (MAP), heart rate (HR), and respiratory rate (RR) were measured at the same time periods. Hypotension was defined as a decrease of mean arterial pressure below 60 mmHg lasting at least 30 min and bradypnoea was defined as a respiratory rate <10 bpm. It was planned that the patient who developed

hypotension or bradypnoea treated and excluded from the study.

Data were presented in the form of mean ± SD. All statistical analysis were carried out using SPSS statistical software (SPSS for windows, version 14.0). The Kolmogorov-Smirnov test was used to determine normality and homogeneity of data distribution. Parametric data (age, blood pressure, and lung ventilations/OLV time) were compared using one-way analysis of variation (ANOVA). Nonparametric data were compared using the Kruskal-Wallis test. Unpaired t test was used for pains score.

Results

There were no significant differences between the groups with respect to age, sex, ASA score, and surgery time (Table 1). Although MAP and HR were insignificant in comparison of the groups, RR in Group C was higher than in Group P at postoperative 1st and 2nd hours (postoperative 1st hour: 31.08±3.71, 18.36±3.64, postoperative 2nd hour: 21.46±3.43, 18.37 ± 2.86, resp.) ($P < 0.05$) (Table 2).

Data on postoperative pain at rest (VASr) and coughing (VASc) are shown in Tables 3 and 4. Both VASr and VASc scores in Group P were lower than in Group C at postopera-tive 1st, 2nd, and 4th hours ($P < 0.01$) (Tables 3 and 4).

When syringe pump was record was examined patieud demand and extra delivery count for bolus dose in Group P were found lower than in Group C on all measurement times ($P < 0.01$) (Figures 1 and 2).

When the additional analgesic requirement was compared, total tramadol amount on postoperative 1st and 24th hours in Group P was lower than in Group C (postoperative 1st hour: 17.5 ± 14.4, 45.0 ± 22.3, postoperative 24th hour: 75.0 ± 63.8, 130.0 ± 89.4, resp.) ($P < 0.01$ and $P < 0.05$, resp.) (Figure 3).

There were no differences between the groups with respect to side effects.

TABLE 1: Patients characteristic and surgery time

	Group C	Group P
Age (years)	48.32 ± 12.31	47.15 ± 12.70
Sex (M/F)	13/7	12/8
ASA (I/II/III)	3/10/7	4/9/7
Surgery time (hours)	4.06 ± 1.15	4.25 ± 1.25

TABLE 2: Mean arterial pressuse (MAP; mmHg), heart (HR; beat/min), and respiratory rate (RR; breath/min)

	Group C			Group P		
	MAP	HR	RR	MAP	HR	RR
Postoperative 1st hour	68.31 ± 11.31	88.14 ± 19.31	21.08 ± 3.71*	67.34 ± 12.30	87.40 ± 15.32	18.36 ± 3.64
Postoperative 2nd hour	67.25 ± 10.25	86.44 ± 16.41	21.46 ± 3.43*	65.21 ± 12.85	78.80 ± 12.38	18.37 ± 2.86
Postoperative 4th hour	67.13 ± 12.88	84.12 ± 13.63	18.32 ± 3.58	66.21 ± 14.00	82.21 ± 12.58	17.92 ± 3.02
Postoperative 6th hour	68.20 ± 13.02	84.03 ± 11.78	18.61 ± 2.64	66.25 ± 14.12	84.32 ± 12.02	18.44 ± 3.10
Postoperative 12th hour	67.15 ± 12.78	84.06 ± 13.28	18.86 ± 2.26	65.56 ± 12.02	82.05 ± 8.06	19.00 ± 2.90
Postoperative 24th hour	66.47 ± 14.21	83.72 ± 11.04	18.57 ± 2.68	66.75 ± 12.00	82.60 ± 13.05	18.12 ± 2.46

*$P < 0.05$ when RR at 1st and 2nd Postoperative hours in Group C was compared with those in Group P.

TABLE 3: Postoperative pain score at rest (VASr) (mean ± SD)

	Group C	Group P	T value	P value
Postoperative 1st hour	4.07 ± 2.26ß	1.88 ± 1.19	3.84	< 0.0005
Postoperative 2nd hour	3.56 ± 2.18α	1.42 ± 0.92	4.05	< 0.0005
Postoperative 4th hour	2.85 ± 1.84*	1.22 ± 0.81	3.31	< 0.001
Postoperative 6th hour	1.55 ± 1.18	1.08 ± 1.52	1.09	> 0.1
Postoperative 12th hour	1.21 ± 1.27	0.62 ± 0.78	1.77	> 0.05
Postoperative 24th hour	0.88 ± 1.09	0.41 ± 0.78	1.57	> 0.05

ß When VASr score at 1st postoperative hour in Group C were compared with those in Group P.

When VASr score at 2nd postoperative hour in Group C were compared with those in Group P.

* When VASr score at 4th postoperative hour in Group C were compared with those in Group P.

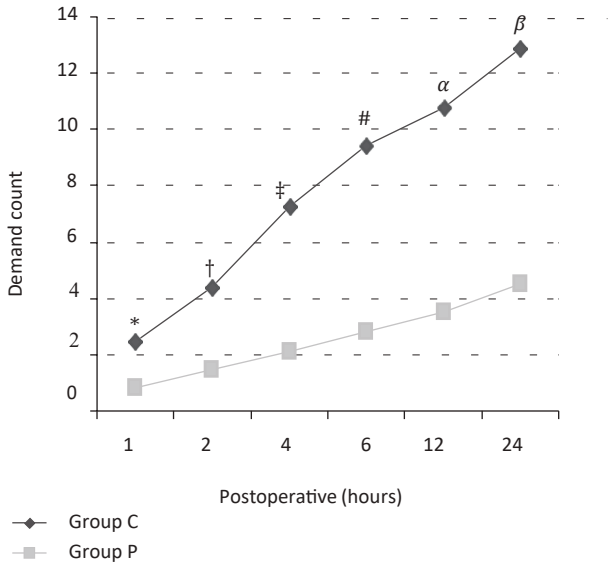

FIGURE 1: Patient's demand count on syringe pump when Group C is compared to Group P (*: P = 0.013, †: P = 0.000, ‡: P = 0.002, #: P = 0.001, : P = 0.000, and : P = 0.000).

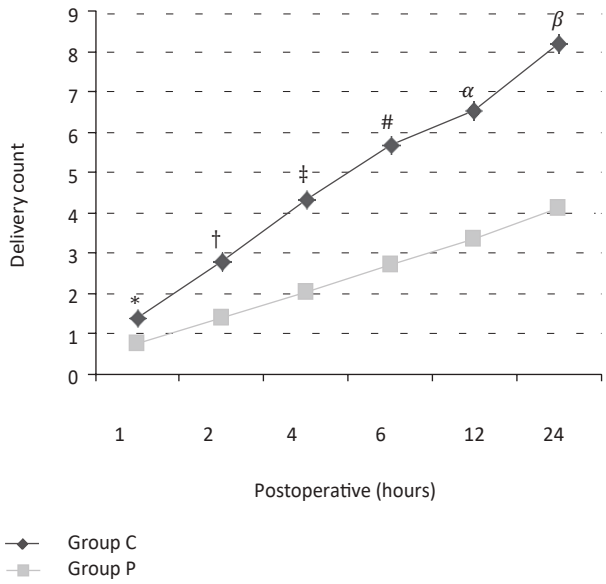

FIGURE 2: Pump's delivery count on suringe pump when Group C is compared to Group P (*: P = 0.013, †: P = 0.000, ‡: P = 0.002, #: P = 0.001, : P = 0.000, and : P = 0.000).

TABLE 4: Postoperative pain score at coughing (VASc) (mean + SD)

	Group C	Group P	T value	P value
Postoperative 1st hour	4.92 ± 2.00β	3.18 ± 1.20	3.34	< 0.001
Postoperative 2nd hour	4.38 ± 2.10α	2.55 ± 1.13	3.43	< 0.001
Postoperative 4th hour	3.51 ± 1.75*	2.20 ± 0.94	2.95	< 0.01
Postoperative 6th hour	2.45 ± 1.22	2.10 ± 1.43	0.833	> 0.1
Postoperative 12th hour	2.22 ± 1.52	1.54 ± 0.92	1.712	> 0.05
Postoperative 24th hour	1.60 ± 1.16	1.04 ± 1.06	1.59	> 0.05

β When VASr scores at 1st postoperative hour in Group C were compared with those in Group P.
α When VASr scores at 2nd postoperative hour in Group C were compared with those in Group P.
* When VASr scores at 4th postoperative hour in Group C were compared with those in Group P.

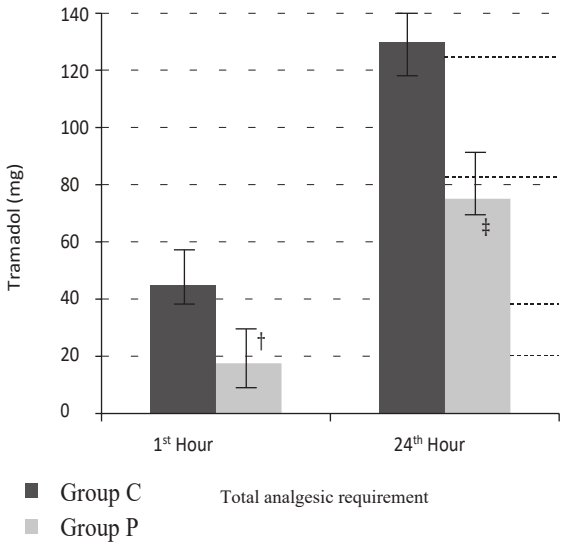

FIGURE 3: Total analgesic requirement. †: P = 0.004 when tramadol amount at 1st postoperative hour in Group C was compared with those in Group P. ‡: P = 0.032 when tramadol amount at 24th postoperative hour in Group C was compared with those in Group P.

Discussion

This study showed that preincisional epidural provided better analgesia than postoperative application for postthoracotomy pain. Pain score at rest and coughing were lower with preemptive epidural analgesia, especially in early postoperative period. Decreased number of bolus dose of epidural from syringe pump of the patient's in group P group supported the idea that preemptive analgesia initiations was superior compared to postoperative initiations.

Bong et al.[1] stated that the effectiveness of preemptive epidural analgesia is more clear in thoracotomy surgery than in other surgical procedures. This procedure was carried out for thoracotomy procedures as because it was stated that in thoracotomy procedures excessive noxious stimuli caused by central sensitization.[15–17]

Yegin et al.[18] investigated the effectiveness of pre- and postoperative epidural analgesia versus postoperative analgesia in thoracic surgery.

They used bupivacaine and fentanyl as a bolus to intervention group preoperatively, patient's controlled epidural analgesia (PCEA) was applied to each group with the same protocol and VAS scores were recorded postoperatively. They found better analgesia with the preoperative initiation of epidural analgesia, which is similar to our results.

Amr et al.[19] carried out a study to find out the effects of preincisional epidural application on pulmonary and endocrine system besides pain. They showed significant improvement in pulmonary functions along with better analgesia in preincisional group.

Ideal local anesthetic agent for thoracic epidural analgesia must have fast and long acting analgesia, lower motor block and hemodynamic side effects, and higher toxic dose limit. Levobupivacaine, S-enantiomer of racemic bupivacaine, is along acting local anesthetic that caused less neuro- and cardiotoxic side effects than other local anesthetics.[9, 21] we couldn't use levobupivacaine due to nonavailability in our country. Mendola et al.[22] used 10 mg/h levobupivacaine via epidural catheter postoperatively for post thoracotomy pain and stated that this application can provide sufficient analgesia.

Chronic postthoracotomy pain is recurred or persisted along the thoracotomy scar more than two months after surgery.[23] it was stated that acute pain after on was related to chronic postthoracotomy pain.[17] studies were carried out to demonstrate the preventive effects of preemptive epidural analgesia on chronic postthoracotomy pain.[24–27] they concluded a benefit of preemptive analgesia.

On the other hand, studies show that clinical effectiveness of preemptive analgesia is controversial.[28–30] Neustein et al.[27] compared the pre-versus postoperative initiated TEA using bupivacaine. They found that preemptive TEA provided better analgesia until postoperative 6th hour and VAS scores after 6th hour which is insignificant. They only used postoperative bolus of bupivacaine but not infusion. But there VAS scores in both the groups were higher than ours, may be due to insufficient analgesia.

Although our findings encourage us to use preemptive TEA, there were some limitations in our study. We record VAS scores only until postoperative 24th hour. We could not use patient's controlled epidural analysia (PCEA) Pump. We did not investigate the effects of TEA on pulmonary functions and stress response in more detail. If we had evaluated these parameters, this study would have been more powerful.

Conclusion

We consider that preemptive TEA may offer better analgesia after thoracic surgery in comparison with postoperative epidural analgesia. However, further studies with more patients are needed to demonstrate the benefits of preemptive epidural analgesia providing better outcome with less side effects and positive outcomes from stress response.

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