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Research Article

COMPARISON BETWEEN THORACIC EPIDURAL AND PARAVERTEBRAL BLOCK TECHNIQUE FOR POSTOPERATIVE ANALGESIA IN THORACOTOMY

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ABSTRACT

Objectives: The present study was planned to compare paravertebral block with conventional thoracic epidural technique in terms of efficacy, duration of analgesia, and complications in patients undergoing thoracotomy.

Methods: A prospective randomized, double-blinded control study was conducted at King George Hospital adults undergoing thoracotomy between January 2020 and June 2021 after getting permission from the institutional ethical committee and getting consent from the patient. Patients were allocated into two groups by simple random sampling: Group A – patients receiving thoracic epidural anesthesia and Group B – patients receiving paravertebral blocks. The total sample size of the study was 32. Under strictly controlled aseptic conditions, a Tuohy needle was inserted in the midline of the thorax, and the epidural space was verified using the loss of resistance technique. The catheter was secured after being inserted via the needle. The surgeon in Group B inserted a Tuohy needle into the paravertebral space under direct view after the procedure.

Results: The age distribution of study subjects in both the groups was similar, and only a minor difference was observed. The difference in mean age between the two groups was not statistically significant (p>0.05); hence, both the groups were comparable. There was a statistically significant difference between the mean MAP between the two groups throughout the postoperative period. There was a statistically significant variation in mean value of in the mean arterial pressure over time as p<0.05. However, this variation in MAP was minimal in subjects who received paravertebral block compared to a statistically significant drop in MAP among subjects who received epidural block. This difference in MAP variation between the two groups was statistically significant. The minor difference in mean PEFR between the two groups was not statistically significant (p>0.05); hence, both the groups were comparable regarding PEFR.

Conclusion: From the present study, TPVA and TEA are helpful for pain relief, and the technique selection should depend on the patient profile, clinical scenario, and expertise of the anesthesiologist in the regional approach available.

Keywords: Thoracotomy, Epidural block, Paravertebral block, Anesthesia.

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INTRODUCTION

Thoracotomy is regarded as the most painful surgical surgery; hence, it is the responsibility of all anesthesiologists to provide adequate analgesia. Ineffective pain management prevents deep breathing, coughing, and remobilization, which leads to pneumonia and atelectasis [1]. Thoracotomy surgery is associated with excruciating postoperative pain because of pleural and muscle damage, disruption of the costovertebral joint (rib cage), intercostal nerve damage during surgery, and central nervous system hypersensitivity [2]. Ineffective breathing and secretion clearance can increase the likelihood of issues such as hypoxia, atelectasis, lung collapse, chest infections, and severe respiratory impairment. Poor pain management following surgery can also delay recovery. After a thoracotomy, effective pain management may help prevent these side effects and the emergence of chronic neuralgia [1]. Numerous postoperative analgesic regimens use a localized anesthetic strategy since comprehensive analgesia may not be achieved with a single medication or procedure.

Additionally, increased opioid use for the treatment of pain may have detrimental effects on breathing [3-5]. Adopting a localized anesthetic technique makes sense because opiates are insensitive to both central nervous system hypersensitivity and intercostal nerve injury brought on by chest trauma [5,6]. Epidural analgesia [TEA] has become the industry standard for post-thoracotomy pain management [2]. Epidural analgesia has been shown to reduce intraoperative surgical stress response and has and improves the functions of cardiovascular, regarding cardiovascular, respiratory, coagulation, gastrointestinal, metabolic, and immunological function. Contrarily, thoracic epidurals should be avoided in patients with coagulopathy or a local infection because they increase the risk of hypotension, neurological impairment, and epidural hematomas [7]. Thoracic paravertebral block [PVB] was frequently used for analgesia and anesthesia in the 20th century [8]. Hugo Sellheim first presented it in 1905. During the 1960s, it steadily lost favor. Eason and Wyatt reintroduced PVB and demonstrated the proper catheter insertion method. Sabanathan, Richardson, and Lönnqvist considerably enhanced this essentially obsolete method [8].

The paravertebral gap is where the spinal nerves that exit the intervertebral foramina and travel through it are obstructed. It is advantageous for unilateral chest and abdominal surgery to have a local anesthetic administered into the paravertebral region because it induces a unilateral somatic and sympathetic block. Evidence of moderate quality suggests that PVB reduces pain in a manner comparable to TEA while having fewer adverse effects [2]. The typical strategy outlined for PVB is a posterior approach with a loss of resistance technique to air or saline as the superior costotransverse ligament is crossed [8]. Recently, a nerve stimulator has been incorporated into this strategy. Catheters can also be inserted into the paravertebral region intraoperatively while the surgeon is present before chest closure. The present study was planned to compare paravertebral block with conventional thoracic epidural technique in terms of efficacy, duration of analgesia, and complications in patients undergoing thoracotomy.

MATERIALS AND METHODS

A prospective randomized, double-blinded control study was conducted at King George Hospital for adults undergoing thoracotomy between

January 2020 to June 2021 after getting permission from the institutional ethical committee and getting consent from the patient. Patients were allocated into two groups by simple random sampling: Group A – patients receiving thoracic epidural anesthesia and Group B – patients receiving paravertebral blocks. The total sample size of the study was 32.

Inclusion criteria
- Patient consent
- Both males and females
- Age group 18–80 years
- American Society of Anesthesiologists [ASA] I and II
- Patients with COPD.

Exclusion criteria
- Patient refusal.
- Patients with coagulopathy
- Children with ages <18 years were excluded from the study
- Patients who are not extubated immediately after surgery
- Patient with an allergy to local anesthetic.

Methodology

Patients who met the inclusion criteria and were admitted to King George Hospital for lateral thoracotomy surgery in either an elective or emergency scenario were considered for our study. Before surgery, a thorough pre-anesthetic 27 examination was carried out. Patients were told of the block procedure and any potential problems, and a signed informed agreement was acquired. For elective procedures, each patient received 150 mg of ranitidine and 0.25 mg of tablet alprazolam orally the night before the procedure. Preoperative heart rate, mean arterial blood pressure, and oxygen saturation were measured on the day of surgery and used as baseline data for each patient. A group of epidural patients (n=16) and paravertebral patients (n=16) were divided into two groups of 32 individuals each. Before surgery, patients in Group A were held in a sitting or lateral position on the operating table. Under strictly controlled aseptic conditions, a Tuohy needle was inserted in the midline of the thorax, and the epidural space was verified using the loss of resistance technique. The catheter was secured after being inserted via the needle. The surgeon in Group B inserted a Tuohy needle into the paravertebral space under direct view after the procedure. The area was examined with saline. The catheter was inserted and fastened to the skin. 30 min before the anticipated conclusion of the surgery, a first dose of the medication – ropivacaine 0.25% with 50 micrograms of fentanyl – will be administered intravenously. After that, intermittent doses every 6 h will be administered. Injection fentanyl IV was given as a rescue analgesia for the patients who complained with pain. Injection paracetamol 1g was given twice daily to all the patients. Postoperatively, pain was assessed by VAS score. VAS score ranges from 0 to 10, with 0 as no pain and 10 as the worst pain experienced by the patient. The VAS score for (VAS 0), mild pain (VAS 1–3), moderate pain (VAS 4–7), severe (8–9), 10 is worst possible pain. Breakthrough pain - if VAS score > 4 at rest. Rescue analgesia is administered if the VAS score is >4 at rest or patient demands. VAS score measured at post-extubation in the time intervals of 0, 3, 6, 9, 12, 15, 18, 21, 24 h during resting period.

Statistical analysis

The collected data were transformed into variables, coded, and entered in Microsoft Excel. Data were analyzed and statistically evaluated using SPSS 25.0 version. Quantitative data was statistically analyzed by Student's t-test or Mann–Whitney U-test. Qualitative data were expressed in percentages, and the Chi-square or Fisher's exact test was used. p<0.05 was considered statistically significant.

RESULTS

The age distribution of study subjects in both the groups was similar, and only a minor difference was observed. The minor difference in mean age between the two groups was not statistically significant (p>0.05), and hence, both the groups were comparable (Table 1). The gender distribution of study subjects in both the groups can be considered similar, as the minor difference observed was not statistically significant (p>0.05). Hence, both the groups were comparable (Fig. 1).

The ASA grades of study subjects in both the groups can be considered similar as the minor difference observed was not statistically significant (p>0.05). Hence, both the groups were comparable (Fig. 2). The type of surgery done in study subjects in both the groups can be considered similar as the minor difference observed was not statistically significant (p>0.05). Hence, both the groups were comparable (Table 2). There was a statistically significant difference between the mean MAP between the two groups throughout the postoperative period. There was a statistically significant variation in MEAN in the mean arterial pressure over time as p<0.05 (Table 3). However, this variation in MAP happened to be minimal in subjects who received paravertebral block compared to a statistically significant drop in MAP among subjects who received epidural block. This difference in MAP variation between the two groups was statistically significant. There was a statistically significant variation in mean heart rate over time as p<0.005. However, this variation in heart rate happened to be relatively less in subjects who received paravertebral block than those who received epidural block. The minor difference in mean SPO_2 between the two groups was not statistically significant (p>0.05), and hence, both the groups were comparable with regard to SPO_2 (Table 4). The HR comparisons

Table 1: Age distribution of study subjects

Variable	Groups		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
Mean age group	45.06±10.67	44.44±11.36	0.77

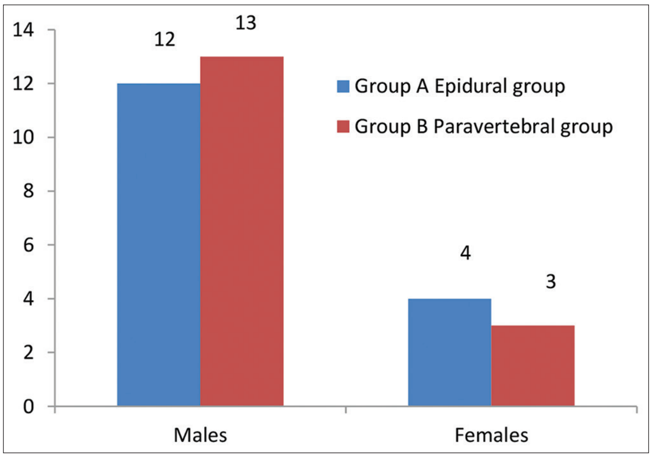

Fig. 1: Gender-wise distribution of study subjects

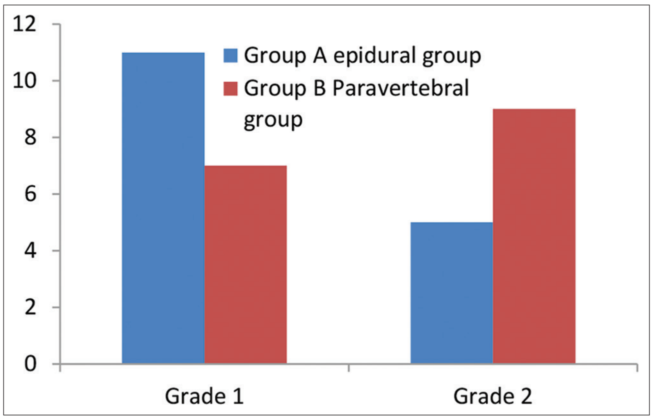

Fig. 2: ASA grade-wise distribution of cases

between the two groups are depicted in Table 5. The minor difference in mean VAS score between the two groups was not statistically significant (p>0.05), and hence, both the groups were comparable with regard to VAS score (Table 6). The difference in mean rescue analgesia used between the two groups was not statistically significant (p>0.05). Hence, both the groups were comparable in rescue analgesia (Table 7). Nausea and vomiting saw more in the epidural group than in the paravertebral group but then a minor difference in mean values of nausea and vomiting between the two groups (Table 8). Total rescue analgesia given in 24 h between for both groups both groups Group A (epidural group) n=16 Group B (paravertebral 1 group) n=16 was statistically insignificant (p>0.05), and hence, both the groups were comparable with regard to nausea and vomiting (Table 8). The minor difference in mean urinary retention between the two groups was not statistically significant (p>0.05). Hence, both the groups were comparable in urinary retention, but urinary retention was seen more in the epidural group than the paravertebral group (Table 9). The minor difference in the mean length of ICU stay (days) between the two groups was not statistically significant (p>0.05). Hence, both the groups were comparable in length of ICU stay (Table 10). The minor difference in mean PEFR between the two groups was not statistically significant (p>0.05), and hence, both the groups were comparable with regard to PEFR (Fig. 3).

Table 2: Surgery proposed in study subjects

Surgery proposed	Group A (epidural group) n=16		Group B (paravertebral group) n=16	
Lobectomy+cyst excision	1	6.2	1	6.2
Lt bullectomy+lobectomy	0	0	1	6.2
Lt lower lobectomy	1	6.2	2	12.5
Lt lung decortication	4	25	2	12.5
Lt upper lobectomy	2	12.5	2	12.5
Pneumonectomy	1	6.2	1	6.2
Rt bullectomy+lobectomy	1	6.2	0	0
Rt lower lobectomy	2	12.5	1	6.2
Rt lung decortication	2	12.5	4	25
Rt upper lobectomy	2	12.5	2	12.5

Lt: Left, Rt: Right

Table 3: MAP comparison between both the groups at different intervals

Map (Mm Hg)	Group		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
Pre-Op	88.13±11.08	92.50±12.38	0.30
At 30 min	69.06±8.60	75.0±11.40	0.10
At 1 h	90.0±8.16	84.63±12.30	0.15
At 3 h	104.38±8.92	97.75±10.45	0.06
At 6 h	67.31±6.03	73.75±10.72	0.04
At 9 h	89.38±6.80	83.25±10.40	0.05
At 12 h	65.94±5.32	75.0±11.40	0.007
At 15 h	95.0±9.66	90.0±11.68	0.19
At 18 h	68.31±7.23	75.31±11.03	0.004
At 21 h	100.63±9.98	97.75±10.45	0.43
At 24 h	68.44±7.09	75.31±11.03	0.04

Table 4: Heart rate comparison between both the groups at different intervals

HR	Group		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
Pre-Op	**84.81±5.40**	**85.56±4.80**	0.68
At 30 min	79.44±6.09	81.635.67	0.30
At 1 h	79.38±5.45	82.50±5.34	0.11
At 3 h	83.50±5.34	86.13±5.77	0.19
At 6 h	77.69±6.26	82.13±5.77	0.04
At 9 h	85.38±5.30	85.88±6.04	0.80
At 12 h	77.13±5.74	81.63±5.66	0.03
At 15 h	81.63±6.37	81.75±6.69	0.95
At 18 h	76.63±4.36	81.50±6.51	0.01
At 21 h	83.13±3.99	84.75±5.16	0.32
At 24 h	76.25±5.01	80.63±5.25	0.02

DISCUSSION

Post-thoracic trauma causes a great deal of pain, which hinders healing and raises morbidity [9]. Rib retraction causes pain by putting strain on the costotransverse and costovertebral ligaments. Effective pain treatment is essential for better outcomes and enhanced pulmonary

Table 5: SPO_2 comparison between both the groups at different intervals

SPO_2	Group		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
Pre-Op	**97.19±00.91**	**97.38±0.96**	0.57
At 30 min	98.38±1.41	9819±1.76	0.74
At 1 h	98.25±1.0	98.25±1.0	1.0
At 3 h	98.13±1.71	97.88±2.16	0.71
At 6 h	98.31±1.25	98.0±1.67	0.55
At 9 h	98.0±1.67	98.0±2.19	1.0
At 12 h	98.25±1.0	98.13±1.20	0.75
At 15 h	98.06±1.69	98.13±1.71	0.91
At 18 h	98.19±1.22	98.25±1.24	0.88
At 21 h	98.0±1.67	98.13±1.71	0.83
At 24 h	98.25±1.24	98.19±1.22	0.88

Table 6: VAS score comparison between both the groups at different intervals

VAS score	Group		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
At 30 min	1.63±0.50	1.81±0.65	0.43
At 1 h	1.63±0.50	1.75±0.58	0.56
At 3 h	2.38±0.50	2.69±0.70	0.20
At 6 h	1.38±0.50	1.50±0 0.52	0.48
At 9 h	2.44±0.51	2.25±0.45	0.27
At 12 h	1.63±0.50	1.81±0.65	0.43
At 15 h	2.56±±0.51	2.38±0.62	0.40
At 18 h	1.56±0.51	1.38±0.50	0.29
At 21 h	2.75±0.58	2.19±0.54	0.01
At 24 h	163±0.50	1.63±0.50	1.0

VAS: Visual analog scale

Table 7: Total rescue analgesia given in 24 h between both the groups

Total rescue analgesia in 24 h	Groups		p-value
	Group A (epidural group) n=5	Group B (paravertebral group) n=5	
Mean±SD	44.0±32.86	56.0±35.77	0.28
Median (IQR)	40 (20–70)	40 (40–80)	

Table 8: Incidence of nausea and vomiting in study subjects

Nausea and vomiting	Group A (epidural group) n=16		Group B (paravertebral group) n=16		p-value
	Number	Percentage	Number	Percentage	
No	10	62.5	14	87.5	0.22
Yes	6	37.5	2	12.5	

Table 9: Incidence of urinary retention in study subjects

Urinary retention	Group A (epidural group) n=16		Group B (paravertebral group) n=16		p-value
	Number	Percentage	Number	Percentage	
No	12	75.0	16	100	0.10
Yes	4	25.0	0	0	

Table 10: Length of ICU stay in study subjects

	Group		p-value
	Group A (epidural group) n=16	Group B (paravertebral group) n=16	
Length of ICU stay (days)	1.56±0.89	1.31±0.79	0.26

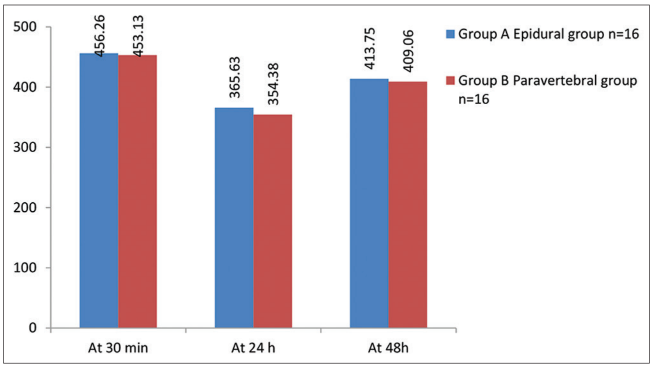

Fig. 3: PEFR comparison between both the groups at a different interval

performance in thoracic injuries because the pain is transmitted by the posterior branches of the thoracic nerves and is particularly visible in the dorsal area [6]. Because of this, anesthesiologists are critical in the care of thoracic trauma. The sympathetic trunk is the main trunk that transmits pain through the posterior branches of the thoracic nerves. Hence, it is essential to control postoperative pain after thoracic trauma. Peripheral intercostal nerve blocking has a restricted application [10,11]. In epidural anesthesia, all peripheral nerves, typically implicated in pain following thoracotomy, are blocked, making it a successful procedure. It is susceptible to failure, though, and is connected to several adverse side effects, including vomiting, hypotension, urine retention, nausea, and respiratory depression [12]. Paravertebral anesthesia was developed as a method of compartment blocking. The sympathetic nerve is divided into tiny bundles in the paravertebral region's fat, making it simple to block. As a result, it is a very successful technique for reducing pain following a thoracotomy. Guidelines for assessing pain and managing it in trauma have not yet been developed. Few studies have demonstrated that PVB is preferable to intrapleural block or systemic opioids for post-thoracotomy analgesia and lung function improvement [13]. For severe pain, regional anesthetic techniques seem superior to all other pharmacological and non-pharmacological methods. However, limited well-conducted trials compare regional pain management methods for post-thoracotomy pain. Therefore, the present study was planned to compare paravertebral block with conventional thoracic epidural technique in terms of efficacy, duration of analgesia, and complications in patients undergoing thoracotomy.

CONCLUSION

From the present study, we conclude that TPVA and TEA are helpful for pain relief, and the selection of technique should depend on the patient profile, clinical scenario, and expertise of the anesthesiologist in the regional approach available. Hemodynamic parameters are better maintained in the paravertebral group than in the epidural group. Pulmonary function is kept well in both the groups. Complications, such as urinary retention, nausea, and vomiting, are seen more in the epidural group.

AUTHORS' CONTRIBUTION

Author Radha Sundari contributed conceptual design, performed the work, and wrote the first draft of the manuscript. Author Venkata Ramesh collected the literature and data collection. Author Satyanarayana guided the work and corrected the manuscript.

CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

AUTHORS' FUNDING

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