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COMPARISON OF PARAVERTEBRAL BLOCK VERSUS THORACIC EPIDURAL BLOCK FOR POST-OPERATIVE ANALGESIA IN THORACOTOMY PATIENTSSwati Bisht¹, B. M. Patel²**HOW TO CITE THIS ARTICLE:**

Swati Bisht, B. M. Patel "Comparison of Paravertebral Block versus Thoracic Epidural Block for Post-Operative Analgesia in Thoracotomy Patients". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 85, October 22; Page: 14869-14879, DOI: 10.14260/jemds/2015/2114

ABSTRACT: BACKGROUND: Thoracotomy is associated with severe postoperative pain and impaired pulmonary function leading to delayed recovery. Thoracic epidural block is a popular technique for pain management. Paravertebral block is an alternate technique providing ipsilateral analgesia. **AIM:** To compare the efficacy of Paravertebral and epidural block for postoperative analgesia in thoracotomy patients. **METHODS:** This study was conducted on 50 patients undergoing thoracotomy divided into two groups of 25 each. Group I received paravertebral injection of 0.25% 15 ml bupivacaine between T5 & T9 levels. Group II received epidural injection of 0.25% 15 ml bupivacaine between T5 & T9 levels. We studied the quality and duration of analgesia and the complications. The effects on the respiratory mechanics were also studied. **RESULTS:** After 20 minutes of injecting the drug, the VAS in group I dropped to a mean of 2.2 ± 0.41 , while in group II it was 1. The difference was not significant for the next 9 hours. The mean duration of effective analgesia in group I was 8.96 ± 1.31 hours while in group II it was 7.80 ± 1.91 hours. The PEFR was higher in paravertebral group for 6 hours. After 20 minutes of drug administration PEFR in group I was 144 ± 20.41 ml/mt, while in group II it was 120.8 ± 18.69 ml/mt ($p < 0.001$). Three hours later, the scores were 167.66 ± 15.51 ml/mt and 138.4 ± 24.6 ml/mt respectively ($p < 0.001$). The same was seen till next 6 hours. 6 patients in group II had hypotension. 1 patient in group II had both hypotension and urinary retention. The incidence of nausea and vomiting were comparable. **CONCLUSIONS:** Thoracic epidural block of bupivacaine provides excellent post-operative analgesia but is associated with hypotension and urinary retention. Paravertebral block provides a superior analgesia and being unilateral there is no incidence of sympathetic block. It also reduces early loss of post-operative pulmonary functions and rapidly restores respiratory mechanics.

KEYWORDS: Thoracotomy, Paravertebral block, Epidural block, Bupivacaine.

INTRODUCTION: Thoracotomy is done in patients with a preexisting thoracic pathology like Carcinoma lung, Carcinoma Esophagus, mediastinal mass, COPD.^[1] The post-operative period is marked by severe pain and further impairment of lung functions leading to delayed recovery.^[2,3,4,5] Thoracotomy pain arises due to rib retraction and intercostal nerve damage. Posterolateral approach is more painful than the muscle sparing thoracotomy.^[1]

Normal respiratory excursions, deep breathing and coughing stretch the skin incision aggravating further pain. Coexisting cardiac and respiratory diseases, elderly age group and malnourishment further aggravate the situation.^[6] pulmonary complications like atelectasis, pneumonia and venous thrombosis due to immobility follow as a result of pain.

There are many drugs and techniques for relief of post-operative pain. Regional techniques or systemic analgesics are common. Systemic opioids carry the risk of respiratory depression and NSAIDs are poor analgesics for thoracotomy incision. Epidural analgesia is more effective than i.v. opioids, intercostal and interpleural nerve blocks.^[7]

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However epidurals are associated with significant adverse effects like block failure, hypotension, urinary retention, pulmonary complications and nausea.^[1] Thoracic paravertebral block has enjoyed a resurgence in recent years.^[8]

Paravertebral space is a wedge shaped space that lies to the side of the vertebral column and contains the spinal (Intercostal) nerve, the dorsal ramus, the rami communicantes and the sympathetic chain. Placement of local anaesthetics within the paravertebral space produces unilateral somatic and sympathetic block.^[9]

Paravertebral analgesia produces ipsilateral analgesia through injection of local anaesthetics along the side of vertebral column and is devoid of above mentioned adverse effects. By this concept, we have carried out this study to compare paravertebral block and thoracic epidural block in thoracotomy patients. The primary objective was to evaluate the postoperative analgesia. Secondary objective was pulmonary function assessment and adverse effects.

MATERIAL & METHODS: This study was done on patients of Carcinoma esophagus, Carcinoma lung who required thoracoscopy, Ivor Lewis procedure, pneumonectomy and lobectomy. Fifty patients were divided into two groups of 25 each. Group I received paravertebral injection of 15ml of 0.25% bupivacaine between T5 and T9. Group II received epidural injection of 15ml of 0.25% bupivacaine between T5 and T9.

The aims of the study were:

1. To compare the quality and duration of pain relief.
2. To compare the side effects.

After the approval of institutional ethical committee and informed written consent we chose 50 patients of ASA 2 or 3 undergoing elective posterolateral thoracotomy. Exclusion criteria were lack of patient consent, allergy to local anaesthetics/Diclofenac/Morphine, need for an additional incision and those with contraindication to regional techniques.

Preanaesthetic Preparation: All patients were evaluated clinically, biochemically and radiologically. They were familiarized with linear visual analogue scale and hand held spirometer. On the previous night of surgery, they were kept fasting for 9 hours and were given tablet Diazepam 10mg. On the day of surgery tablet Lorazepam 1mg and tablet Ranitidine 50mg was given with sips of water. None received any narcotic. Patients were randomised via computer generated code into two equal groups:

Anaesthetic Technique: On arrival to the operation table, cardiac monitor was attached to the patient. Pre-operative vitals were checked. All patients were induced with Inj. Fentanyl 2 microgram/kg IV, inj. Propofol 2mg/kg and inj. Vecuronium bromide 0.1mg/kg. Inj. Xylocard 1.5mg/kg was given 90 seconds prior to intubation. Patients were intubated with double/single ETT as per the surgery. Anaesthesia was maintained with 00xygen. N₂O, Isoflurane and Vecuronium bromide.

In group I, after the surgery and before thorax closure, parietal pleura was stripped upto vertebral bodies and a blunt dissection of extrapleural fascia two dermatomes above and below the incision was carried out. An externally introduced Tuohy needle was advanced into the paravertebral space and an extradural catheter was advanced under vision in position alongside the vertebral column. 15 ml of 0.25% bupivacaine was given via this Paravertebral catheter. In group II after the skin closure, patients were put in lateral position. After skin preparation, 16 gauge epidural catheter was inserted via 16 gauge epidural needle at T5-T9 intervertebral space.

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The epidural space was identified by loss of resistance method. 15 ml of 0.25% bupivacaine was administered through the epidural catheter. Haemodynamic vitals prior to administration of paravertebral and epidural drug were recorded as the baseline values.

Patients were given assisted ventilation till spontaneous respiratory attempts, and then reversed with 50 microgm/kg of Neostigmine and 20 microgm/kg of Glycopyrolate. After adequate reversal, patients were extubated. Postoperatively they were shifted to surgical ICU and subjected to the same physiotherapy regimen. Continuous Oxygen was given at 4 litres/minute for the next 72 hours post operatively.

Pain was assessed using visual analogue scale (0=no pain;10=worst imaginable pain) at 0 min, 10min, 20min, 30min, 1hr, 3hrs, 6hrs, 9hrs & 12hrs. VAS score of 0 was taken as complete analgesia and a score<4 as effective analgesia. Whenever VAS was $\geq$ 4, patients were given IV Morphine 4mg. Any complications like respiratory depression, hemodynamic changes like bradycardia, hypotension, nausea, vomiting, urinary retention etc. were recorded.

All results were tested for statistical analysis.

Statistical Methods: Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean $\pm$ SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance, Student t test (Two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis).

Mann Whitney U test (Two tailed, independent) has been used to find the significance of study parameters on continuous scale between group. Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

RESULTS: As is evident from table 1, group I and group II patients are comparable regarding age, gender and weight.

	Group I	Group II	p value
Mean Age	52.24 $\pm$ 10.17	56.08 $\pm$ 10.22	p=0.189
Sex Distribution	M/F = 19/6	M/F=19/6	p=1
Mean Weight	59.88 $\pm$ 7.57	58.40 $\pm$ 8.06	p=0.507

Table 1: Patient Characteristics

Pulse	Group I	Group II	P value
Before giving drug	106.24 $\pm$ 9.46	108.48 $\pm$ 29.99	t=0.356;p=0.723
After 10 minutes	102.08 $\pm$ 10.02	92.52 $\pm$ 10.87	t=3.232;p=0.002**
After 20 minutes	87.60 $\pm$ 7.39	89.76 $\pm$ 6.67	t=1.085;p=0.283
After 30 minutes	83.36 $\pm$ 5.06	84.56 $\pm$ 4.71	t=0.868;p=0.390
3 hour later	83.12 $\pm$ 3.37	81.60 $\pm$ 3.00	t=1.684;p=0.099+
6 hour later	81.28 $\pm$ 2.64	82.80 $\pm$ 3.51	t=1.73;p=0.090+
9 hour later	81.92 $\pm$ 3.39	89.28 $\pm$ 6.40	t=5.081;p<0.001**
12 hour later	88.72 $\pm$ 7.41	95.12 $\pm$ 6.00	t=3.355;p=0.002**

Table 2: Comparison of Pulse in two groups of patients

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Graph 1

The pulse rate before giving the drug in paravertebral group and epidural group were $106.24 \pm 9.46/\text{mt}$ and $108.48 \pm 29.99/\text{mt}$ respectively (Statistically non-significant). After 10 minutes of giving bupivacaine paravertebrally post-operative the PR was $102.08 \pm 10.02/\text{mt}$ while in the epidural group it dropped to $92.52 \pm 10.87/\text{mt}$ ($p = 0.002$).

The difference is statistically significant. For the next 9 hours however the difference was not much significant. After 9 hours PR in group I was $81.92 \pm 3.39/\text{mt}$, while in group II it was $89.28 \pm 6.40/\text{mt}$ ($p < 0.001$, i.e., statistically significant). Thus we conclude that paravertebral block is as good as epidural block for pain relief post operatively.

SBP(mm Hg)	Group I	Group II	P value
Before giving drug	146.40±8.60	144.40±7.68	t=0.867;p=0.390
After 10 minutes	140.16±9.41	131.52±13.48	t=2.627;p=0.012*
After 20 minutes	129.44±5.79	126.48±7.79	t=1.524;p=0.134
After 30 minutes	125.36±6.05	113.36±15.86	t=3.535;p=0.001**
3 hour later	121.84±7.14	119.52±4.17	t=1.403;p=0.167
6 hour later	122.00±5.35	123.84±7.21	t=1.025;p=0.311
9 hour later	124.24±6.64	132.32±7.65	t=3.987;p<0.001**
12 hour later	130.00±8.16	138.64±5.38	t=4.419;p<0.001**

Table 3: Comparison of Systolic BP (mm Hg) in two groups of patients

Graph 2

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The baseline systolic pressure in group I was 146.40 ± 8.60 mm Hg while in group II it was 144.40 ± 7.68 mm Hg. ($P=0.39$, i.e., statistically non-significant). The systolic blood pressure recorded are shown in table. After 30 minutes of injecting the drug the systolic pressure in group II fell to 113.36 ± 15.86 mm Hg, while in group I it fell to 125.36 ± 6.05 . P value = 0.001. Significant hypotension was recorded in group II.

RR (min)	Group I	Group II	P value
Before giving drug	27.44 ± 3.68	25.84 ± 1.91	$t=1.932; p=0.059$
After 10 minutes	17.44 ± 6.31	21.04 ± 4.25	$t=2.366; p=0.022^*$
After 20 minutes	13.44 ± 1.23	15.76 ± 1.85	$t=5.216; p<0.001^{**}$
After 30 minutes	12.32 ± 0.75	13.12 ± 1.30	$t=2.665; p=0.010^*$
3 hour later	12.24 ± 0.66	12.56 ± 0.92	$t=1.414; p=0.164$
6 hour later	12.4 ± 0.82	12.72 ± 0.98	$t=1.255; p=0.216$
9 hour later	14.40 ± 2.77	12.64 ± 0.95	$t=3.005; p=0.004^{**}$
12 hour later	15.60 ± 2.38	14.16 ± 1.52	$t=2.550; p=0.014^*$

Table 4: Comparison of Respiratory rate (per min) in two groups of patients

Graph 3

In group I the mean respiratory rate post-operative before giving the drug was 27.44 ± 3.68 / mt while in group II it was 25.84 ± 1.91 / mt ($p < 0.059$, statistically non-significant). After 10 minutes of giving the drug the respiratory rate fell to 17.44 ± 6.31 / mt in group I, while it took 20 minutes in group II to fall to 15.76 ± 1.85 / mt. ($p = 0.022$ at 10 mts, $p < 0.001$ at 20 minutes). There is significant statistical difference. Around 3-6 hours later there was no significant difference.

9 hours later however the respiratory rate in group I rose to 14.4 ± 2.77 / mt while in group II it remained to 12.64 ± 0.95 / mt.

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PEFR(L/ML)	Group I	Group II	P value
Pre-operative	304.00±71.59	316.40±66.32	t=0.635;p=0.528
Before giving drug	104.80±11.94	96.80±16.51	t=1.963;p=0.055+
After 10 minutes	125.60±20.02	100.80±14.41	t=5.027;p<0.001**
After 20 minutes	144.00±20.41	120.80±18.69	t=4.191;p<0.001**
After 30 minutes	161.60±15.99	131.20±19.86	t=5.962;p<0.001**
3 hour later	163.60±15.51	138.40±24.61	t=4.331;p<0.001**
6 hour later	158.80±16.41	141.60±25.28	t=2.853;p=0.006**
9 hour later	144.00±17.8	144.80±22.01	t=0.141;p=0.888
12 hour later	132.00±14.72	135.20±22.01	t=0.604;p=0.548

Table 5: Comparison of PEFR in two groups of patients

Graph 4

The pre-operative PEFR in group I was 304±71.59ml/mt, while in group II, it was 316±66.32 ml/mt. (P value 0.528 i.e. statistically non-significant). The same immediate post-operative period before giving the drug was 104.80±11.94 ml/mt and 96.8±16.51ml/mt respectively in group I and group II.

After 20 minutes of giving the drug however the PEFR in paravertebral group rose to 144.0±20.41ml/mt while in epidural group it was 120.80±18.69ml/mt (p<0.001statistically significant). 3 hours later the paravertebral group had PEFR score1 was 167.66±15.51ml/mt while in epidural group it was 138.4±24.6ml/mt (p<0.001) the PEFR was higher in the paravertebral group till 6 hours post-operative after which p value was not significant.

Thus we conclude that PEFR parameter was better preserved in the paravertebral group.

Pain Score (PS)	Group I	Group II	P value
Before giving drug	5.44±0.58	5.6±0.71	Z=1.038;p=0.299
After 10 minutes	2.96±0.89	2.64±0.76	Z=1.294;p=0.199
After 20 minutes	2.2±0.41	1.00±0.00	Z=6.736;p<0.001**
After 30 minutes	1.04±0.2	1.00±0.00	Z=1.000;p=0.317
3 hour later	1.00±0.00	1.00±0.00	-
6 hour later	1.00±0.00	1.00±0.00	-
9 hour later	1.00±0.00	1.00±0.00	-
12 hour later	2±0.91	2.48±0.59	Z=2.329; p=0.020*

Table 6: Comparison of Pain Score (PS) In Two Groups of Patients

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Graph 5

The VAS prior to giving drug in group I was 5.44 ± 0.05 and in group II it was 5.6 ± 0.71 . There being no statistical difference. After 20 minutes it dropped to 2.2 ± 0.41 in group I, while in group II it dropped further to 1. The difference was not much till 9 hours.

Duration in Hours	Group I	Group II
Min-Max	6.50-12.00	5.00-10.50
Mean $\pm$ SD	8.96 ± 1.31	7.80 ± 1.91
Inference	Duration in hours is significantly more in Group I with $t=2.501$; $P<0.001^{**}$	

Table 7: Comparison of Duration in Hours

Graph 6

The mean duration of effective analgesia in group I was 8.96 ± 1.31 hours, while in group II it was 7.80 ± 1.91 hours. Duration is significantly more in paravertebral group ($p < 0.001$).

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Side Effects	Group I (n=25)	Group II (n=25)
No	20(80.0%)	14(56.0%)
Yes	5(20.0%)	11(44.0%)
Hypotension	0	6(24.0%)
Hypotension & Urinary retention	0	1(4.0%)
Nausea & Vomiting	5(20.0%)	4(16.0%)
Inference	Incidence of side effects are more in Group II(44.0% vs 20.0% when compared to Group I) with p=0.128	
Table 8: Comparison of Side Effects

Graph 7

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Graph 8

We looked for any complications like nausea, vomiting, hypotension and urinary retention. 6 patients in group II, i.e., and 24% recorded hypotension. One patient in group II had both hypotension and urinary retention. 5 patients in group I reported nausea and vomiting, while in group II, 4 patients reported the same. Thus we see that the incidence of hypotension and urinary retention more in group II.

DISCUSSION: Presently, the role of Anaesthesiologist has extensively increased in the provision of post-operative pain management. Effective pain management improves patient compliance, facilitates early ambulation and easy discharge thereby reducing the cost of hospital stay. Post thoracotomy pain is one of the most intense post-operative pain experiences. It results due to straining of ligaments of costovertebral and costotransverse joints by rib retraction.^[10] This pain is mediated by posterior primary ramus and sympathetic chain.

The concept of providing pain relief by thoracic epidural is the gold standard. However this technique may fail or may have complications like urinary retention, nausea, itching, hypotension, and respiratory depression.^[11] Paravertebral block, once practised had lost publicity in the last few decades. These days it has aroused much interest in pain management.

Segmentation of sympathetic nerve into small bundles in the fat of paravertebral space makes the nerve easy to block. Para vertebral space is the ideal site for afferent nociceptive block. It is an effective technique for acute post-operative pain management.^[12] It avoids the severe autonomic dysfunction seen with neuraxial techniques.^[13]

Our study has revealed that paravertebral and epidural blocks had comparable pain scores but the analgesia was longer in case of paravertebral block. Gulbahar et al.^[14] compared epidural and Para vertebral continuous block for elective posterolateral thoracotomy and concluded that both the technique are equally effective in post-operative pain management. Detterbeck et al.^[15] conducted a review of prospective, randomized studies for pain relief after thoracotomy.

They reported equally effective analgesia with epidural and paravertebral block. Several systematic review and meta-analysis of randomized trials comparing paravertebral versus epidural

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blockade for thoracotomy pain in adults found no difference in analgesia. Vogt, Stieger et al concluded that single shot preoperative Para vertebral block improves postoperative pain management in thoracoscopic patients.

Our study revealed a higher PEFR values in paravertebral group. In a similar study, Richardson et al reported better preservation of pulmonary function in the paravertebral group and higher side effects in the epidural group.

Six patients in the epidural group in our study became hypotensive. A falling systolic pressure >30 mm Hg from preoperative value was recorded. One patient in the same group developed urinary retention and had to be catheterized. PJ Matthews and Govendan V compared the epidural and Para vertebral analgesia and concluded that pain score were similar but incidence of postural hypotension and urinary retention were significantly low in paravertebral group.

In our study, no single patient had pleural puncture. No pneumothorax was seen in any postoperative chest x ray. All patients had intercostal tube inserted post operatively. This concurs with the study of Mehta et al., Perttunen et al. and Kirvela et al. The potential complication of paravertebral block include vascular puncture, pneumothorax and total spinal block.

The limitation of this study is that we did not include a placebo group as we considered it unethical to omit the use of regional technique in the presence of post thoracotomy pain. Another limitation of this study was that we have not considered the stress response in either groups. The measurement of serum cortisol would reflect the stress response. Further studies including a third group with intercostal blocks or I. V. Opioids are needed.

Also, the confirmation of epidural catheter using ultrasound and the sonographical placement of paravertebral catheter would help comparing the ease of both the techniques.

We conclude that in thoracotomy patients, thoracic paravertebral and thoracic epidural result in comparable analgesia. Pulmonary mechanics is better preserved in paravertebral block. Also being a unilateral block it is not associated with hypotension and urinary retention which are encountered in epidural block. Hence, paravertebral block is a better option than epidural block in thoracotomy patient's pressure >30mmHg from pre-operative value was observed. One patient in the same group had urinary retention and was catheterized.

PJ Matthews and V Goverden et al.^[13] in 1989 concluded that pain scores were similar in paravertebral and epidural group. But hypotension and urinary retention were seen with epidural block.

Karmakar et al.^[14] in 1996 found that paravertebral catheter placement under direct vision was easier.

Vogt, Stieger et al.^[15] in 2005 concluded that single shot pre-operative paravertebral block improves post-operative pain management after thoracoscopic surgery.

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