

A COMPARATIVE STUDY OF EFFICACY OF ERECTOR SPINAE PLANE (ESP) BLOCK FOR POST-OPERATIVE ANALGESIA BY 0.2% ROPIVACAINE IN LUMBAR SPINE SURGERY

Anaesthesiology

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ABSTRACT

Background: Severe post-operative pain following spine surgery is a significant cause of morbidity, extended length of stay and marked opioid usage. In this study we described the use of low thoracic Erector Spinae Plane (ESP) Block as part of multimodal analgesia in lumbar spine surgery.

Materials and Method: Sixty patients of age group 18-60 yrs of ASA physical status I & II of both genders undergoing lumbar spine surgery were randomly allocated in two groups. In Group 'A' (n=30) patients received General Anaesthesia (GA). In Group 'B' (n=30) patients received GA and bilateral ESP block. In both groups post operative intensity & quality of pain were assessed in 1,2,4,8,12 & 24 hr by using Visual analogue scale. Inj. Diclofenac Sodium (75mg) was used as rescue analgesic. Duration of analgesia was noted and total amount of rescue analgesic needed in 1st 24 hours was also calculated.

Results: Both the groups were comparable with respect to mean age & gender. VAS score of Group B was significantly lower at 1,2,4,8 hours than Group A with p <0.05. Mean duration of analgesia in Group B was significantly higher than Group A with p <0.05. Consumed dose of rescue analgesic (Inj. Diclofenac) was higher in Group A than Group B with p <0.05.

Conclusion: Duration of post-operative analgesia was prolonged and requirement of rescue analgesic also less, in Group B patient undergoing lumbar spine surgery under GA with ESP Block.

KEYWORDS

Lumbar spine Surgery, Erector Spinae Plane Block, Diclofenac, VAS Score

INTRODUCTION

Post operative pain following lumbar spine surgery is managed by parental opioids which have got side effect e.g.-nausea, vomiting, constipation. The novel erector spinae plane block is a simple and safe alternative analgesic technique for acute post operative pain management.

ESP block is one of the newer intrafascial^{5,6,7} technique that can be performed by deep needle approach where local anesthetic drug is injected below the erector spinae muscle which is closer to costo-transverse foraminae and origin of dorsal & ventral rami of spinal nerve^{5,6}. When local anesthetic drug is injected into the intrafascial plane deep to erector spinae muscle bilaterally it spread cranio-caudally^{5,6} to anesthetizes the dorsal rami of spinal nerves that innervate the paraspinal muscle and bony vertebra.

So, it was our endeavour of present study to evaluate the efficacy of local anesthetic by ESP block for post operative analgesia and compare the duration of analgesia measured by VAS score (primary outcome) in lumbar spine surgery in first 24 hours of surgery. Mean duration of analgesia and total requirement of rescue analgesics (secondary outcome) were also observed in each group.

MATERIALS AND METHODS

After getting approval from the institutional ethics committee and obtaining consent from each patient, the study was conducted among sixty patients of ASA physical status I and II, aged between 18-60 years, who were undergoing lumbar spine surgery under general anaesthesia in orthopedics surgery operation theatre of N.R.S. Medical College and Hospital between January 2019 and August 2020.

Exclusion criteria whereas –

- ASA status III or more
- Hypersensitivity to any drug under study
- Patients have sepsis or local site infection
- Patient on anticoagulant/having known coagulopathy.
- Patients having neurodeficit in both lower limb

Sample design: Sixty (60) patients were selected according to their registration number. They were allocated as odd & even number as follows-

Group 'A'-Control group (n=30) - received General Anaesthesia (GA).

Group 'B'-Study group (n=30)-received GA and bilateral ESP block.

Procedure and Data Collection

After shifting the patient to the operating room-multichannel monitor (NIBP, SpO₂, HR, Continuous ECG, EtCO₂) were attached & base line parameter were recorded. In all patient general anaesthesia (GA) was given with following drugs -

Pre-medication:

Inj. Fentanyl (2mcg/kg body weight) i.v.
Inj. Glycopyrrolate (10mcg/kg body weight) i.v.

Induction agent: Inj. Propofol(1%)(1.5mg/kg body weight) i.v.

Muscle relaxant: Inj. Vecuronium(induction dose-0.08mg/kg body weight) i.v.

Cuffed endotracheal tube of proper size used

Maintenance were done with:

O₂:N₂O=30:70
Inhalational agent -Desflurane (2-6%) and
Intermittent top up dose of Inj. Vecuronium (maintenance dose - 0.01mg/kg body weight)
Now all patients were turned in prone position for surgery.

Before starting of surgery all the patients of Group B received ESP block. Blocks were provided by disinfecting the skin with 5% Povidone Iodine solution followed by 95% w/v Ethyl alcohol. By using anatomical land mark (by identifying 12th rib or by identifying Tuffier's line – L4 vertebrae) T₁₂ spinous process was identified and marked with a skin marker and transverse process marked 3cm lateral from this marking point bilaterally. A 25G spinocan needle now inserted through lateral marking and when needle tip will hit the transverse process 20ml of 0.2% Ropivacaine was injected. Same process repeated on other side.

Intra-operatively all patient received infusion Paracetamol (1gm). Duration of surgery for all cases were about of 2hr.

All patient were reversed by using Inj. Neostigmine (0.05mg/kg body weight) and Inj. Atropine (0.02mg/kg body weight) and then extubated prior to transport to post anaesthesia care unit.

In both groups post operative intensity & quality of pain were assessed in 1,2,4,8,12 & 24 hr by using Visual analogue scale. Inj. Diclofenac Sodium (75mg) were used as rescue analgesic.

Use of dose of analgesic was also being calculated in two groups post-operatively. Muscle power assessed in all patient by using bromage scale after 24hr of surgery.

RESULTS AND ANALYSIS

Data was analyzed by IBM SPSS 26 software. A 'p' value of ≤ 0.05 was considered as significant. In this study there were 2 block failure cases, so we added extra 2 cases. 60 patients were finally followed up of whom Group A had 53.33% male population and 46.66% female population whereas group B had 53.3% male and 46.7% female population. Mean age of Group A and Group B were 39.67 ± 10.10 and 39.27 ± 9.534 respectively. The difference was not statistically significant. So both the groups were comparable in terms of demographic profile.

Intergroup comparison of VAS Score at different point of time at post-operative period (Table 1, Fig 1) was done by Mann-Whitney U test and independent-t test and found that The VAS score in the B group were lower at 1,2,4,8 hours as compared with A group with p value of 0.000, 0.000, 0.001, 0.000 respectively and also found to be statistically significant ($p < 0.05$). At 12,24hrs data shows no significant difference in between both the groups.

Table 1 - Comparison Of Post Operative Visual Analogue Scale (vas) Score

VAS Score	Group	Mean SCORE	STD. DEV.	Mean Rank	p-Value	Significance
VAS-1 Hr.	A	6.57	0.774	45.50	0.000	YES
	B	1.30	0.466	15.50		
VAS-2 Hr.	A	2.37	0.466	42.65	0.000	YES
	B	1.30	0.490	18.35		
VAS-4 Hr.	A	3.23	0.711	37.20	0.001	YES
	B	2.67	0.504	23.80		
VAS-8 Hr.	A	6.13	0.571	42.53	0.000	YES
	B	4.87	0.681	18.47		
VAS-12Hr.	A	2.43	0.504	32.00	0.434	NO
	B	2.33	0.479	29.00		
VAS-24Hr.	A	3.53	0.507	30.00	0.799	NO
	B	3.57	0.504	31.00		

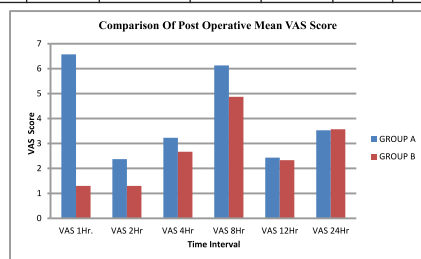


Fig 1: Cluster Bar Mean Of Vas-1hr, Vas-2hr, Vas-4hr, Vas-8hr , Vas-12Hr And Vas-24Hr By Group.

Intergroup comparison of mean value of DURATION OF ANALGESIA (Table :2, Fig :2) was done by Student Unpaired T test and difference was found to be statistically significant (Gr A: 24.33 ± 10.14 min vs Gr B: 538 ± 20.78 min) with the p value of 0.013.

Table 2: Comparison Of Duration Of Analgesia (min.)

GROUP	MEAN (in min.)	MIN.	MAX.	STD.DEV.	p-VALUE	Significance
GROUP A	24.33	5	45	10.148	0.013	YES
GROUP B	538.00	485	580	20.786		

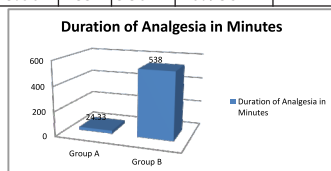


Fig. 2 - Comparison of mean Duration of Analgesia (min.) in Two Groups

Total dose of rescue analgesic (mean) administered in first 24hr in the B group (150mg.) was lower than A group (Table: 3) Applying Independent Sample T test it was found out statistically significant ($p = 0.000$).

Table 3- Comparison Of Requirement Of Total Dose Of Rescue Analgesic Within 24 Hours

Variable	Group A	Group B	p-Value	Significance
Amount of Inj. Diclofenac Sodium administered(mg.)	150	75	0.000	YES

Intergroup comparison of BROMAGE SCORE (MEAN) in Group A and Group B (Table 4) after 24hr of Surgery was done by Mann-Whitney U test and found that there was no significant difference in between study group ($p > 0.05$) - the score was 0.

Table 4: Comparison Of Bromage Score.

GROUP	MEAN	STD. DEV.	p-value	Significance
A	0.00	0.00	1.000	NO
B	0.00	0.00		

DISCUSSION

Opioids have traditionally been the mainstay of analgesic therapy but – they may not control pain adequately. But at high dose associated with significant adverse effects (sedation, cognitive impairment, constipation) and risk of long term habituation and dependence.¹

Some of the other method which are generally implicated for post-operative pain management are following-

I) Local anaesthetic wound infiltration is commonly performed but it's benefit tends to be short lived.²

II) Regional anaesthesia- in spine surgery confined to epidural analgesia & intrathecal opioids^{3,4} are an important component of multimodal analgesic regimens. These have side effect, limitation and not widely used.

In 2016 **Forero et al**⁵ first described novel interfascial plane block - the Erector Spinae Plane block and its successful application in 2 cases of severe neuropathic pain. Patients presented with constant burning & stabbing neuropathic pain of 10/10 on numerical rating scale (NRS) not relieved by using opioid and NSAID per oral at T5 dermatomal region. They provided ESP block 3cm lateral to T5 spinous process with 20ml of 0.25% bupivacaine to these patients and 2hr later pain assessment showed NRS of 0/10 with subsequently reported recurrence of the pain 36hr after 1st dose in 1st case while it was 7hr in other case.

Major advantage of the ESP block is that –

- It can be performed at a distance from the surgical field- thus minimizing the risk of microbial contamination.⁶
- There is no structure (e.g. major vessels, pleura) at risk of needle injury in the immediate vicinity.

The paraspinal muscle & posterior bony elements of the spine are innervated by the dorsal rami of the spinal nerves. These dorsal rami of thoracic and lumbar spinal nerves originated shortly after the respective spinal nerves exit the vertebral foramina. The ventral ramus of thoracic spinal nerve continue as intercostals nerve and in case of lumbar spinal nerve it form Lumbar Plexus. The ventral ramus supply the antero-lateral thoracic wall and upper abdomen. The cadaveric data showed penetration of injectate anteriorly through the costo-transverse foramen and into the vicinity of the origin of the dorsal and ventral rami when dye was injected into the interfascial plane deep (posterior) to erector spinae muscle⁷. In the ESP block local anesthetic is injected at transverse process deep to erector spinae muscle and spread within the multifascial plane and act on dorsal rami of spinal nerve at multiple level. Evidence to date indicates that spread with 20 ml of injectate extend 3-4 vertebral or more from the site of injection in a cranio-caudal direction^{5,7,8}.

In our study we therefore aimed in all cases to target T₁₂ transverse process. Physical spread to the lumbar paraspinal area from a thoracic site of injection has also been documented⁷.

In present study patients of the two groups were comparable in respect to the demographic profile and baseline vital parameters. It was found

that duration of analgesia in Group B was (538±20.78min) with maximum duration of 580min and minimum duration of 485min. In the other group A mean duration of analgesia was (24.33± 10.14min) with maximum duration of 45min and minimum duration of 5min. In **August'2018 Hironobu Ueshima et al** performed a retrospective study on the efficacy of Erector spinae Plane block on 41 patients undergoing lumbar spine surgery after giving general anaesthesia(GA). In group G patients they gave only GA & group E patients they provided ESP block after GA 40ml of 0.375% levobupivacaine (20ml into each side) was injected bilaterally 3cm lateral to target vertebral level. They found the ESP block for patient undergoing lumbar laminoplasty provide more effective analgesia that persist until the morning of post-operative day 2. Our study corroborate with this study.

In present study VAS score value (mean Rank) in group B were lesser at 1hr, 2hr, 4hr & 8hr than group B & showed statistically significant result ($p<0.05$) with p value of 0.000, 0.000, 0.001, 0.000 respectively. Although at 12hr, 24hrs VAS score showed no significant difference in between both the groups. There was less requirement of analgesic (Inj Diclofenac Sodium) in group B (75mg) than group A (150mg)- which was also statistically significant with p value of 0.000.

In this study comparison of BROMAGE SCORE (MEAN RANK) in between two groups after 24hr of surgery showed no significant difference in between study groups ($p>0.05$). his corroborate **J.P.Melvin et al** study showed after placing bilateral ESP catheter at T₁₂ they administered 25ml of 0.375% Ropivacaine with 0.25mcg/kg Dexmedetomidine and 2mg Dexamethasone per side. Somatosensory evoked potential waveform recorded from both lower limb of patient showing no significant changes following ESP block.

In **September'2018 S.Tulgar et al**¹² evaluated the effectiveness of Erector Spinae Plane Block (ESPB) for postoperative analgesia management in Laparoscopic cholecystectomy (LC) in 36 patients. Standard multimodal analgesia was performed in Group C (control) while ESP block was also performed in Group B (block). Also, tramadol consumption and additional rescue analgesic requirement were measured. NRS was lower in Group B during the first 3 h. There was no difference in NRS scores at other hours. Tramadol consumption was lower in Group B during the first 12 h. Less rescue analgesia was required in Group B. They concluded bilateral ultrasound guided ESPB leads to effective analgesia and a decrease in analgesia requirement in first 12 h in patients undergoing LC. In **Apr'19 S.Singh et al**¹³ performed a randomized controlled study was to compare the effect of ultrasound (US)-guided erector spinae plane (ESP) block on 24-hour postoperative cumulative opioid requirements with standard (opioid-based) analgesia in lumbar spine surgery under GA. Postoperative morphine consumption was significantly lower in patients in the ESP group compared with those in the control group (1.4±1.5 vs. 7.2±2.0 mg, respectively; $P<0.001$). Pain scores immediately after surgery ($P=0.002$) and at 6 hours after surgery ($P=0.040$) were lower in the ESP block group compared with the control group. In **February'2020 Reddy et al**¹⁴ administered erector spinae plane block (ESPB) to six patients scheduled for different abdominal surgeries planned under general anaesthesia. Bupivacaine 0.5% with or without adjuncts like dexamethasone, dexmedetomidine was injected deep into the erector spinae muscle in cranial to caudal direction at T₁₂ transverse process. Post operatively, median VAS score was 2.5 after 6 hours of surgery, 2 after 12 hours, 1 after 36 hours and 1 after 48 hours of surgery. They concluded these patients seemed to require lesser dose of opioids and analgesics in the early recovery period than patients who did not receive block. In **2017 Chin et al**¹¹ performed pre-operative bilateral ESP block with 20-30 ml Ropivacaine 0.5% at the level of T7 transverse process in 4 patient undergoing laparoscopic ventral hernia repair. Median (range) 24hr opioid consumption was 18.7mg (0.0-43.0) oral morphine. The highest and lowest median (range) pain score in the first 24 hr were 3.5(3.0-5.0) on an 11 point numerical rating scale. They concluded that the ESP block is a promising regional anaesthesia technique for laparoscopic ventral hernia repair and other abdominal surgeries. In **December'2019 Q.Wang et al**¹⁴ compared the effects of preoperative ultrasound-guided erector spinae plane block (ESPB) and preoperative wound infiltration on perioperative opioid consumption and postoperative pain in thoracotomy surgery in Sixty adult patients. In ESPB group (group EB), ESPB with 20 ml of 0.5% ropivacaine was performed at the level of thoracic 5 transverse process. Whereas, in wound infiltration group (group WI), 20 ml of 0.5% ropivacaine was

injected subcutaneously along the marked line of skin incision. Compared with group WI, the intraoperative and postoperative opioid consumptions, postoperative tramadol consumption were significantly less in group EB ($p<0.05$). Moreover, the postoperative pain scores immediately after surgery, at Post op Day (POD) 1 and POD 2, were all lower in group EB compared to group WI ($p<0.05$).

CONCLUSION

Based on the study results, it may be concluded that duration of post-operative analgesia prolonged in Group B having ESP Block and requirement of rescue analgesic also less, in patient undergoing lumbar spine surgery.

Therefore ESP block can be used as a part of multimodal analgesia in post-operative cases.

Limitation of the study

- Spread of the injectate drug was not visualized.
- This study only focused on first 24 hours after surgery. We are unaware of efficacy of ESP block in reducing chronic pain.

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