ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 02 | February - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

LANDMARK GUIDED ERECTOR SPINAE PLANE BLOCK (ESPB) USING ROPIVACAINE IN LIMB SURGERIES ABOVE KNEE

Anaesthesiology

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ABSTRACT

The article consists of the results and observations of the scientific study done at a tertiary care centre which aims to assess postoperative analgesia after landmark guided ESPB using 0.375% isobaric ropivacaine. Seventy patients with lower limb fractures above knee were consecutively divided into two groups: 35 patients underwent only SAB and 35 patients underwent both SAB and ESPB. Intraoperative BP, heart rate, postoperative VAS score, regression of sensory and motor blocks were assessed for 24Hrs. Postoperative VAS scores in 24hrs were found to be significantly less in the ESPB group as compared to the control group. The patients who underwent ESPB had postoperative analgesia of 1023.42 ± 134.26 minutes whereas the control group who underwent only SAB had 183.85 ± 35.70 minutes, (p-value < 0.001). The study emphasizes the significance of landmark guided erector spinae plane block which provides significant postoperative analgesia and better satisfaction score in patients undergoing lower limb surgeries under spinal anaesthesia and can be used as an alternative to USG, especially in limited resources settings.

KEYWORDS

Erector Spinae Plane Block; Sub Arachnoid Block; Visual Analogue scale; Analgesia; Opioids; Non-steroidal anti-inflammatory drugs; Ropivacaine

INTRODUCTION

Postoperative pain following lower limb surgeries above knee are being conventionally managed with opioids using patient-controlled analgesia (PCA) pump, or central neuraxial technique such as epidural analgesia. However, using these modalities along with the biological and psychological mechanisms together with the equipment involved, makes the assessment of pain relief more difficult during movement as compared to rest. Increasing the dose of opioids is associated with adverse effects such as nausea, vomiting, pruritus and sedation.[1] Neuraxial analgesia has an edge over systemic opioids that it avoids systemic side-effects and postoperative analgesia can be prolonged.[2]

The erector spinae plane block is a novel interfacial paraspinal plane technique and it is easy-to-perform regional anaesthesia technique with a wide range of clinical applications. It has been utilized for postoperative pain relief in hip surgeries.[3] The patients undergoing above knee lower limb surgeries need to be assisted with post operative analgesics viz. non steroidal analgesics and or opioids, which are associated with several undesirable side effects. We need to look forward to evolve strategies to provide effective post operative analgesia in such patients while avoiding such side effects. Erector spinae plane block is one such strategy which has the potential to offer effective and safe post operative analgesia without any undesirable side effects.

MATERIALS AND METHODS

A randomised, single blinded, cross sectional, analytical study was conducted at Hind Institute of Medical Sciences, Barabanki, UP comprising of 70 individuals divided into two groups of 35 each including both sex. Group I included control group while group II included study group. All were ASA I / II categorised aged between 20-59 years, with BMI ranging from 18.5 to 29 kg/m^2. Pregnant, menstruating females, extended surgeries greater than 3 hours and patients with history of major psychiatric illness were excluded. Informed consent was obtained from all and approval from Institutional Ethics Committee was obtained.

Patients were randomly selected into two groups using chit & box method into control group (group 1) where only sub arachnoid block was administered and study group (group 2) where sub arachnoid block was assisted with erector spinae plane block for extended post-operative analgesia. The observer was blinded to the type of block administered to the studied patients. Patients were oriented about the VAS score in the preoperative period. Premedication was achieved with tablet alprazolam 0.25mg and tablet ranitidine 150mg, the night before surgery and morning of surgery at 6AM. Preloading done with intravenous (iv) Lactated Ringer's solution 10ml/kg. Peri operative monitoring performed using automated non- invasive blood pressure, pulse oximetry, electrocardiogram, heart rate, respiratory rate, urine output and assessment of patient's diaphragm function by verbal interaction intermittently to rule out high spinal. 2gm ceftriaxone was administered iv after doing sensitivity test for antimicrobial prophylaxis.

Group -1 (control group (n=35)) received only subarachnoid block with 25G Quincke needle using 0.75% isobaric ropivacaine 3ml at the level of L3-L4 in lateral decubitus position.

Group - 2 (study group (n=35)) received subarachnoid block with 25G Quincke needle using 0.75% isobaric ropivacaine 3ml at the level of L3-L4 along with ESPB with 22G×5cm Stimuplex®-A needle using 0.375% isobaric ropivacaine 30ml at the level of L3 unilaterally by lateral decubitus position with affected limb upside.

For ESP block, 22G×5cm Stimuplex®-A needle was inserted perpendicular to the skin at the level of L3 transverse process, 3cm lateral to the midline, parallel to the sagittal plane, whence the tip of the needle contacts the transverse process of L3 vertebra at a depth of 3.5 - 4cm, to deliver 0.375% isobaric ropivacaine 30ml (Fig.1).Sensory testing to asses by using sponge holding forceps for pinching the corresponding dermatome level was examined every 3min, 5min, 7 min and 10 min until the sensory dermatome has stabilized by consecutive testing. On achieving T10 sensory blockade level, surgical anaesthesia was defined. The motor block of both legs was evaluated using the Bromage scale (0 = (none) no motor block, 1= (partial) just able to move lower limb, 2= (almost complete) able to move feet only, 3= complete motor block of limb. Immediately after completion of the ESPB, patients were placed in supine position. After 30mins of ESPB sensory and motor levels were again assessed. Oxygen (4l/min) was administered via mask, if SpO_2 decreased below 94%. Hypotension, defined as a decrease of systolic blood pressure by more than 20% from baseline or a fall below 90 mmHg, was treated with incremental iv doses of mephentermine 6 mg and iv fluid as required. Bradycardia, defined as heart rate < 60 bpm, was treated with iv atropine 0.6 mg. The incidence of adverse effects, such as nausea, vomiting, shivering, pruritus, respiratory depression, sedation, and hypotension were

recorded. Injection Acetaminophen 1gm iv was given at the beginning of surgery and repeated every 6 hourly. Hemodynamic parameters and autonomic changes such as blood pressure and heart rate were monitored perioperatively and data was collected at 5mins, 10mins, 15mins, 20mins, 30mins, 45mins respectively extending up to 24 hrs. For quality of postoperative analgesia VAS score was used which is monitored postoperatively at 30mins, 1hr, 2hrs, 4hrs, 6hrs, 8hrs, 10hrs, 12hrs, 14hrs, 16hrs, 18hrs, 20hrs and 24hrs.

Injection tramadol 100mg in 100ml normal saline was administered iv as rescue analgesic, when VAS score was ≥4. If after 1hr of first rescue analgesic VAS score remains ≥4 then injection diclofenac aqua 75mg IV was used as second rescue analgesic. For side effects such as post-operative nausea and vomiting injection ondansetron 4mg was given. All the data of time of first dose of rescue analgesic and incidence of side effects were recorded. Regression of sensory and motor blockade were examined by the observer blinded to the procedure postoperatively. The residual sensory blockade was examined every 15 min and it's wearing off time was noted (when sensation to pinching regressed two segments below T10). Residual motor blockade was examined every 15 min and it's wearing off time was noted whence score of Bromage scale -1, was defined as motor regression.

Sample size has been calculated by manual calculation of the number of patients by the statistician and analysis by using SPSS 26.0. Data was analysed using SPSS (Statistical Package for Social Sciences) version 26.0. Results were expressed as mean and standard deviation (SD) or number or percentage. Analysis of data between groups was performed using one-way analysis of variance (ANOVA). Between the study group data was compared using t-test. The p-value of less than 0.05 were considered statistically significant.

RESULTS

Tables 1(a) and 1(b) shows the post-operative VAS scores after SAB (two and a half hours) at 0,30,60,120,240,360,480,600,720,840,960, 1080,1200,1440 minutes. It was observed that the pain scores were statistically significant in both groups with higher VAS scores in the control group compared to study group from 60 minutes to 1200 minutes in the post-operative period. Table 2 reveals the mean duration of analgesia in Group 1 is 183.85 which is much less than Group 2 mean i.e. 1023.42 minutes. The independent t-test analysis shows that the results are statistically significant ($p<0.05$). Table 3 shows the mean comparison of intraoperative SBP and DBP in the two groups. The independent t-test result shows statistically non-significant difference ($p>0.05$) between the two groups at different time intervals. Table 4 shows the mean comparison of the intraoperative heart rate. The independent t-test result shows statistically non-significant difference ($p>0.05$) between the two groups at different time intervals. Table 5 (a), (b), (c) and Table 6 reveals that the difference in the total rescue analgesics viz. tramadol and diclofenac in the two study groups was statistically significant with the control group requiring much higher analgesic dose over period of 24 hours in the post-operative period than the patients who received ESPB (p value < 0.05). Table 7 (a), (b), (c) reveal the data regarding post-operative nausea and vomiting in the two groups. It was observed that the incidence of PONV in the control group was significantly greater than the ESPB group (p value< 0.05).

DISCUSSION

ESPB is a truncal block that has been used for many abdominal and thoracic pain conditions.[4,5] Ultrasonography (USG) guided ESPB has been used for controlling postoperative pain after surgery as a part of multimodal analgesia.[6]

In our study, there was a significant decrease in the requirement of rescue analgesia in patients who were administered ESPB in the initial 24 h. The patients who underwent ESPB had post-operative analgesia of 1023.42 ± 134.26 minutes, whereas the control group had 183.85 ± 35.70 minutes in our study. Our findings were further supported by the study conducted by Hamed et al .[6] who concluded that the average duration of postoperative analgesia was more than 12 h in patients who were given USG-guided ESPB in patients undergoing TAH. Tulgar et al .[7] used USG-guided ESPB for three different abdominal procedures in three patients and found postoperative analgesia ranging from 13 h to 17 h which was very close to our results. In a case series by Altinpulluk et al.,[8] patients who underwent open abdominal hysterectomy had mild discomfort during first 6 h of postoperative period, especially in the pubic region due to urinary catheter but were quite satisfied in the first 48 h after surgery. Rescue analgesic dose was significantly lower in ESPB group during the initial 24 h of post-operative period as is shown by Hamed et al .[6] study where ESPB significantly reduced opioid consumption. Cadaveric studies had demonstrated the drug spread in paravertebral spaces, and both ventral and dorsal rami in the paravertebral space were dyed.[8] Our data suggest that landmark guided ESPB can be used effectively as alternatives to USG, especially in low resource settings.

Pain following PCNL was conducted through T10 to L2 nerves.[9] Complete analgesia can be provided by unilateral blockade of these nerves. ESPB, a myofascial plane block, is less invasive and is relatively safe because of the lack of vascular and other significant structures in the vicinity and because the end-point of needle contact is a bony landmark. In a review of the ESPB by De Cassai et al.,[10] it was concluded that the median volume required to cover one dermatome would be 3.4 mL. In the case report by Kim et al.,[11] 20 mL of 0.375% ropivacaine was administered for the ESPB and was found to provide adequate postoperative analgesia after PCNL. ESPB has been used in various contexts like in the emergency room for analgesia following rib fractures, intraoperative and postoperative analgesia following laparotomy, laparoscopic cholecystectomy, breast surgery, scapula resection, thoracotomy, sternotomy and chronic pain.[12,13,14,15,16,17,18,19] Though the mechanism of action is still not fully understood, it has been demonstrated in cadaveric and in vivo studies that one of the prime mechanisms is by drug penetration into the paravertebral region.[20,21,22]

CONCLUSION

To conclude, the results presented in our study showed the superiority of the ESP block over a control group in the quality of recovery in patients undergoing lower limb surgery. Moreover, the ESP block lessened pain severity and reduced opioid consumption. We conclude on the basis of our study that ESPB is a technique that can provide adequate analgesia and has an opioid-sparing effect. Landmark guided ESPB provides significant postoperative analgesia in patients undergoing lower limb surgeries under spinal anaesthesia and can be used as an alternative to USG technique, especially in limited resources settings.

Limitations

In our study, we have given ESPB after SAB, so sensory and motor dermatomal level of SAB overlap that of ESPB. This limitation can be prevented in future studies by giving ESPB 15 min prior to SAB after assessing sensory and motor dermatomal spread of ESPB.

Figures:

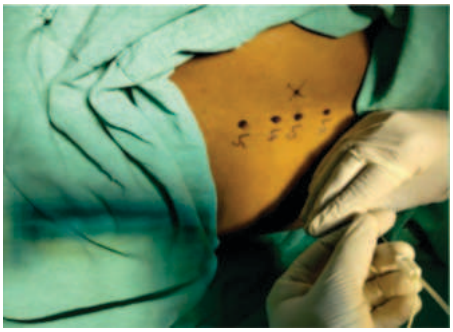

Fig.1: Using 22G×5cm Stimuplex®-A needle insertion 3 cm lateral to midline at L3 level.

Tables:

Table 1(a): Post-operative VAS score from 0 min to 480 minutes post procedure

Time (mins)	0	30	60		120			240		360		480		
VAS	0	0	0	2	0	2	4	0	4	0	4	0	2	4
Group-1	35	35	8	27	0	28	7	0	35	0	35	0	0	35
Group-2	35	35	35	0	35	0	0	35	0	35	0	30	5	0
p-value	-	-	<0.001		<0.001			<0.001		<0.001		<0.001		

Table 1(b): Post-operative VAS score from 600 minutes to 1440 minutes post procedure.

Time (mins)	600	720	840	960	1080	1200	1440

VAS	0	2	4	0	2	4	2	4	2	4	2	4	2	4	4
Group-1	0	0	35	0	0	35	0	35	0	35	0	35	0	35	35
Group-2	23	12	0	4	31	0	30	5	22	13	8	27	4	31	35
p-value	<0.001			<0.001			<0.001		<0.001		0.003		0.039		-

Table 2: Duration of analgesia in 2 groups

	Group 1		Group 2		p- value
	Mean	SD	Mean	SD	
Duration of analgesia (in minutes)	183.85	35.70	1023.42	134.26	<0.001

Table 3: Intra Operative Blood Pressure at various time intervals

Time intervals		Group 1		Group 2		p-value
		Mean	SD	Mean	SD	
5 min	SBP	122.51	8.19	122.63	5.54	0.946
	DBP	78.80	3.29	77.77	4.79	0.299
10 min	SBP	123.26	8.04	122.91	5.29	0.740
	DBP	78.17	3.51	78.29	3.76	0.896
15 min	SBP	123.26	7.98	123.09	4.78	0.914
	DBP	78.86	2.84	79.09	3.23	0.754
20 min	SBP	123.14	8.13	122.7	4.66	0.815
	DBP	79.31	2.47	79.03	2.96	0.663
30 min	SBP	122.06	7.69	119.43	19.18	0.454
	DBP	79.37	2.73	79.71	3.63	0.657
45 min	SBP	122.51	7.41	122.63	3.68	0.935
	DBP	79.60	3.72	77.54	12.41	0.351
60 min	SBP	122.06	6.91	123.03	3.83	0.470
	DBP	79.77	3.49	80.57	2.45	0.271
90 min	SBP	122.29	7.92	122.80	4.68	0.742
	DBP	79.77	2.36	80.29	2.95	0.424
120 min	SBP	123.31	7.98	122.06	4.81	0.428
	DBP	79.09	3.89	79.60	2.90	0.533
150 min	SBP	123.37	7.58	121.89	4.25	0.316
	DBP	79.37	3.05	79.66	2.93	0.691

Table 4: Intra operative Heart Rate post procedure

	Group 1		Group 2		p-value
	Mean	SD	Mean	SD	
5 min	79.83	5.34	77.41	6.97	0.110
10 min	79.20	6.49	76.69	6.39	0.107
20 min	79.89	5.96	77.89	6.13	0.171
30 min	80.57	4.27	78.69	5.77	0.125
45 min	80.57	4.71	79.03	5.49	0.212
60 min	80.23	5.21	80.17	4.78	0.962
90 min	81.09	4.37	80.40	4.77	0.533
120 min	80.74	5.51	80.51	4.58	0.851
150 min	80.74	4.57	80.69	4.28	0.957

Table 5(a): Total dose of rescue analgesics viz. tramadol and diclofenac in the two groups over 24 hours in the post-operative period (1-12 patients).

		1	2	3	4	5	6	7	8	9	10	11	12
Group 1	Tramadol	200	200	200	200	200	200	200	100	100	200	200	200
	Diclofenac	75	75	150	75	150	75	75	75	75	150	150	75
Group 2	Tramadol	100	100	100	100	100	200	100	100	100	100	100	100
	Diclofenac	0	75	0	0	75	75	0	0	75	75	0	0

Table 5(b): Total dose of rescue analgesics viz. tramadol and diclofenac in the two groups over 24 hours in the post-operative period (13 to 25 patients).

		13	14	15	16	17	18	19	20	21	22	23	24	25
Group 1	Tramadol	100	200	200	100	200	200	200	200	200	100	200	200	200
	Diclofenac	75	75	75	75	75	75	150	150	75	75	150	75	75
Group 2	Tramadol	100	100	100	100	100	100	100	100	100	100	100	100	100
	Diclofenac	75	0	0	75	0	0	0	0	0	75	0	75	0

Table 5(c): Total dose of rescue analgesics viz. tramadol and diclofenac in the two groups over 24 hours in the post-operative period (26 to 35 patients).

		26	27	28	29	30	31	32	33	34	35	Total dose of analgesic
Group 1	Tramadol	100	100	200	200	200	100	200	100	200	100	6000 mg
	Diclofenac	75	75	75	75	75	75	75	75	150	75	3225 mg
Group 2	Tramadol	100	100	100	100	100	100	100	100	100	100	3600 mg
	Diclofenac	0	0	0	75	0	0	0	0	0	0	750 mg

Table 6: The comparative statistical analysis of rescue analgesics in the two groups

Group 1	Tramadol	6000mg	p value < 0.001
Group 2	Tramadol	3600 mg	
Group 1	Diclofenac	3225 mg	p value = 0.0004
Group 2	Diclofenac	750 mg	

Table 7 (a): Incidence of post-operative nausea & vomiting in the peri-operative period in the two groups (patients 1-12).

		1	2	3	4	5	6	7	8	9	10	11	12
Group 1	Adverse effects (PONV)	yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	yes
Group 2	Adverse effects (PONV)	no	yes	no	no	yes	yes	no	no	yes	no	no	no

Table 7 (b): Incidence of post-operative nausea & vomiting in the peri-operative period in the two groups (patients 13 to 25).

		13	14	15	16	17	18	19	20	21	22	23	24	25
Group 1	Adverse effects (PONV)	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes
Group 2	Adverse effects (PONV)	yes	no	no	no	no	yes	no	no	no	yes	no	yes	no

Table 7 (c): Incidence of post-operative nausea & vomiting in the peri-operative period in the two groups (patients 26 to 35).

		26	27	28	29	30	31	32	33	34	35	No. of Times of PONV
Group 1	Adverse effects (PONV)	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	30
Group 2	Adverse effects (PONV)	no	no	no	yes	no	yes	no	no	yes	no	11
p Value												< 0.0001

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