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ANALGESIC EFFICACY OF LANDMARK GUIDED ERECTOR SPINAE PLANE BLOCK (ESPB) FOR LUMBAR SPINE SURGERIES— AN OBSERVATIONAL STUDY

Anaesthesiology

Dr. Sushmita Nath Post Graduate Trainee, Department Of Anaesthesiology, Assam Medical College And Hospital, Dibrugarh, Assam, India.

Dr. Karuna Kumar Das M.D., Professor And Head, Department Of Anaesthesiology, Assam Medical College And Hospital, Dibrugarh, Assam, India.

ABSTRACT

Background: Perioperative pain management is crucial to facilitate patient's quick recovery to normal function following any surgical procedure.The aim of this study was to evaluate the effect of erector spinae plane block (ESPB) following lumbar spine surgery under general anesthesia. **Materials And Methods:** The study was conducted on thirty ASA-PS I and II adult patients undergoing elective lumbar spine surgery under general anesthesia.They either received ESPB or only multimodal analgesia.Those receiving ESPB were given 20ml of injection bupivacaine 0.25% and dexamethasone 8mg on each side following the landmark guided approach and were included in group A following data collection by consecutive sampling.The patients who didn't receive ESPB after data collection were allotted group B by consecutive sampling. Data was collected on intraoperative hemodynamic parameters, postoperative pain score (VAS) in first 24 h postoperatively, and requirement of first rescue analgesia. **Results:** ESPB was associated with significantly stable haemodynamics, reduced VAS (Visual analogue score) in the first 24 hours of postoperative period, provided adequate postoperative analgesia, and longer time interval to first dose of analgesic in comparison to the conventional analgesia. **Conclusions:** Erector spinae plane block (ESPB) can be considered safe and effective perioperative analgesic modality for lumbar spine surgery. It provides less opioid consumption and PONV, lower pain scores, and longer time to first analgesic request in patients undergoing lumbar surgery compared to general anesthesia alone.

KEYWORDS

Erector Spinae Plane Block (ESPB), Lumbar Spine Surgery, Perioperative Pain

INTRODUCTION

Post-operative pain is a common complaint following any surgical procedures which is associated with various autonomic, physiological and behavioral responses. Perioperative pain management facilitate patient's quick recovery to normal function following any surgical procedure and also reduces the incidence of adverse physiologic and psychological effects. In this study, both pharmacological agents and interventional techniques were utilized for pain control.

OBJECTIVE

To compare the analgesic efficacy of landmark guided erector spinae plane block(ESPB) combined with general anaesthesia versus conventional anesthetic technique in lumbar spine surgeries.

Lacunae In Existing Literature

- Observer bias
- Small sample size

METHODS AND MATERIALS

Place Of Study- Assam Medical College and Hospital, Dibrugarh
Type Of Study- Hospital-based observational study
Duration Of Study- One year
Study Population- Patients who underwent lumbar spine surgeries
Sample Size- 30 adult patients scheduled for elective lumbar spine surgeries by consecutive sampling
Ethical Clearance- Ethical clearance was taken from the Institutional Ethics committee(H) of Assam Medical College and Hospital before commencement of the study
Consent- Approval and informed written consent were taken from patients and family members/ legal guardians

Inclusion Criteria

- Patients of age ≥ 18 years and < 65 years of age of either sex
- ASA grading I & II according to American Society of Anesthesiologists Physical Status
- All patients planned for elective lumbar spine decompression /discectomy surgery under general anesthesia
- Patients/legal guardians who gave informed written consent for participation

Exclusion Criteria

- Patients with bleeding / coagulation disorders
- Patients with BMI >30 or <18
- Patients with infection at the injection site
- Patients who had allergy to local anesthetics
- Patients with major spine deformities like scoliosis
- Patients with pre-existing myopathy or neuropathy
- All patients suffering from significant comorbidities (e.g., significant cardiac, hepatic, renal, respiratory or central nervous system disorders) affecting daily activities.

METHODOLOGY

- Thirty ASA-PS l and ll adult patients who underwent elective lumbar spine surgery under general anesthesia were included in this study
- Written informed consent was obtained from patients/legal guardians
- Group A— All patients who received general anesthesia with ESPB (n = 15)
- Group B— Patients who received general anesthesia with conventional intravenous analgesia (Non-ESPB) (n = 15)
- All patients underwent thorough preoperative assessment and followed routine preoperative fasting guidelines. On arrival in the operation room, a multi-channel monitor was attached.
- An IV line was secured and Ringer's lactate solution was started
- Premedication- IV Inj.Glycopyrrolate 4mcg/kg, IV Inj. Ondansetron 0.15mg/kg, IV Inj.Fentanyl 2mcg/kg. Patients were preoxygenated with 100% oxygen for 3 minutes.
- Induction- IV lignocaine 1.5 mg/kg, IV Inj. propofol (2-2.5)mg/kg.
- Muscle relaxant- 1 mg/kg of Rocuronium IV (loading dose)
- Controlled ventilation was provided by face mask with 100% O_2. Endotracheal intubation achieved and IPPV were adjusted to maintain an end-tidal carbon dioxide partial pressure between 30 and 35 mmHg.
- Maintenance of depth of anesthesia by titrated dose of Sevoflurane with 50% oxygen and 50% nitrous oxide.
- Maintenance of relaxation- 0.2mg/kg of Rocuronium IV
- In group A (ESPB), after prone positioning and before surgery, the erector spinae plane block was performed bilaterally following the landmark based approach 3 cm lateral to the spinous process and one vertebral level above a predetermined marked surgical incision.
- Under aseptic precautions, the needle (22-gauge, 8–10 cm short bevelled needle or a Tuohy needle) was inserted in a cephalad-to-caudal direction until the tip lay in the interfascial plane below erector spinae muscle, the block was performed by injection of 20 ml of 0.25% bupivacaine with 8mg of dexamethasone.
- Both groups received IV Inj. Ketorolac 0.75 mg/kg and Inj. Paracetamol 15 mg/kg before surgical stimulus. IV Inj. Fentanyl 1mcg/kg was administered as rescue analgesia based on hemodynamic parameters.
- At the end of the surgery and after return of spontaneous respiratory efforts, residual neuromuscular blockade was reversed

by IV Inj. Sugammadex 2mg/kg. Tracheal extubation was carried out when the criteria for extubation were fulfilled. After extubation patient was oxygenated with 100% oxygen for 5 minutes.

- Data collection- Baseline characteristics, intraoperative hemodynamic parameters, postoperative pain score (Visual analogue score/VAS), total opioid consumption intraoperatively and in the first 24 h postoperatively, and time interval at which first rescue analgesic dose was required in the postoperative period based on reaching the score of 4 VAS.

Measured Outcomes

- Primary outcome was postoperative pain assessment using VAS score.
- Secondary outcomes were the total amount of opioid consumption intraoperatively and in the first 24 hours postoperatively, time to first dose of rescue analgesic, hemodynamic parameters (MAP, HR) and complications.
- The end point of the study was 24 hours post operatively.

Statistical Analysis

- The Statistical Package for Social Science (SPSS) version 22.0 was used to analyze the data.
- Quantitative data were expressed as range (minimum and maximum), mean, standard deviation (SD) or median (IQR) when indicated.
- The frequency and percentage of qualitative data were used.
- When comparing two means, independent-samples t-test of significance were used.
- To compare proportions between two qualitative parameters, the Chi-square (X2) test of significance was used.
- Mann–Whitney U test was used in non-parametric data for two-group comparisons.
- The confidence interval was set at 95%, and the acceptable margin of error was set at 5%. As a result, the p-Value was deemed significant as follows: p-Value <0.05— significant.

RESULTS AND OBSERVATIONS

All thirty patients completed the study.

1. DEMOGRAPHICS

There was no difference between the two groups with respect to demographic data (age, gender, BMI). (Table 1)

Table 1. Comparison Between The Two Studied Groups According To Demographic Data.

Demographic data	Group A n = 15	Group B n = 15	t-test / x_2- test of significance	p-Value
Age (years)	40.20 ± 10	42 ± 11.09	t= 0.467	0.644
Gender	M=11(73.3%) F=4(26.7%)	M=9(60%) F=6(40%)	x_2= 0.600	0.439
BMI	26.73± 1.91	26.97± 1.53	t = 0.370	0.714
ASA I, II	10 (67.67%), 5 (33.3%)	8(53.3%), 7(46.67%)	x_2= 0.6	0.4

2. HEMODYNAMICS

For group A (ESPB), the mean heart rate values were 79.20 ± 12.46 and 74.0 ± 8.79 beats/min after stimulus and first-time interval respectively, while for group B (Non-ESPB), the mean heart rate values were 88.07 ± 10.22, 81.00 ± 8.03 beats/min at the same time intervals. So, there were statistically significant differences between the two groups after stimulus and at the first time interval (p values 0.042, 0.031) respectively (Table 2 ; Figure 1)

Table 2. Comparison Between Groups According To Heart Rate (beats/min)

HR (beat/min)	Group A (ESPB) n = 15	Group B (Non-ESPB) n = 15	t-test	p-Value*
Before induction	84 ± 8.45	83.07 ± 9.33	0.533	0.598
After induction	86.27 ± 7.07	85.53 ± 10.83	0.220	0.828
After stimulus	79.20 ± 12.46	88.07 ± 10.22	2.131	0.042*
1st time interval	74 ± 8.79	81 ± 8.03	2.277	0.031*
2nd time interval	73.80 ±10.46	76.93 ± 8.03	0.92	0.365
At end of anesthesia	84.67 ± 8.70	85.07 ± 8.49	0.127	0.899
At eye opening	91.96 ± 10.66	91.73 ± 11.20	0.033	0.97

p-value < 0.05

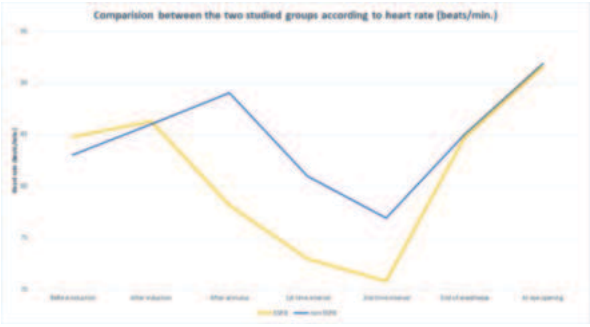

Figure 1.

For group A (ESPB), the mean arterial blood pressure values were 84.73 ± 7.12 mmHg after stimulus, while for group B (Non-ESPB), the mean arterial blood pressure values were 92.53 ± 11.56 mmHg at the same time interval. So, there was a statistically significant difference between the two groups after stimulus. (Table 3, Figure 2)

Table 3. Comparison Between Groups According To MAP.

MAP (mmHg)	Group A (ESPB) n = 15	Group B (Non-ESPB) n = 15	t-test (test of significance)	p-Value
Before induction	102.13 ± 9.59	103.20 ± 7.08	0.346	0.732
After induction	87.13 ± 12.58	91.13 ± 14.23	0.816	0.422
After stimulus	84.73 ± 7.12	92.53 ± 11.56	2.225*	0.034*
1st time interval	73.20 ± 10.43	75.07 ± 6.13	0.598	0.556
2nd time interval	75.20 ± 9.79	79.13 ± 8.80	1.157	0.257
At end of anesthesia	89.33 ± 8.68	95.93 ± 11.30	1.793	0.084
At eye opening	91.53 ± 7.45	105.93 ± 5.19	6.141*	<0.001*

p-value < 0.05

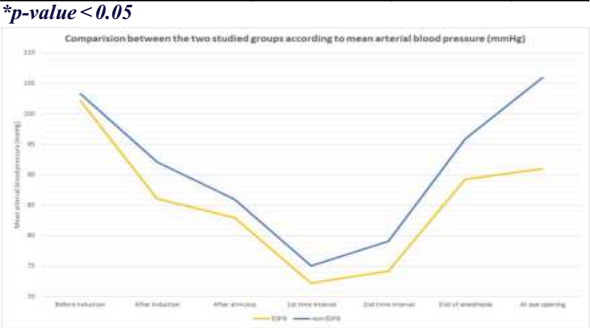

Figure. 2

3. PAIN CONTROL

- Both groups were compared as regards postoperative pain control using VAS score and total opioid consumption at regular intervals preoperative base line, at 2, 4 hours, 8 hours, 16 hours and 24 hours post-operative.
- At 4 hours, group A showed statistically significant decrease in VAS score <0.001.
- At baseline, 2, 8, 12 and 24 hours both groups showed no statistically significant difference in VAS score (Table 4)

Table 4. Comparison Between Groups According To VAS Score.

VAS (0–10)	Group A (ESPB) n = 15			Group B (Non-ESPB) n = 15			p-Value
	Range	Median	IQR	Range	Median	IQR	
Baseline & after 2 hrs	0–2	1	0-1	0-2	1	0-1	0.67

After 4 hrs	0–5	2	2–3	2–7	5	5–6	<0.001*
After 8 hrs	3–5	4	4–5	4–6	5	4–5	0.11
After 12 hrs	3-5	4	4-5	4-6	5	4-5	0.13
At 24 hrs	1–5	5	4–5	4–6	5	4–6	0.25

***p-Value <0.001**

Intraoperative fentanyl consumption was statistically lower in group A (ESPB) patients (two patients, 13.3%, 10.0 ± 28.03 µg) when compared to that in group B (Non-ESPB) (eight patients, 53.3%, 46.67 ± 48.06 µg) (Pfentanyl = 0.049) (Table 5).

- Postoperatively, total dose of fentanyl given in 24 hours was statistically lower in group A (ESPB) patients (166.7 ± 122.2 µg) than that in group B (Non-ESPB) (300.01± 103.5 µg) (p value 0.029) (Table 5).
- Group A (ESPB) had longer time interval to first analgesic requirements (min) than group B (Non-ESPB) based on reaching the score of 4 VAS which was statistically highly significant (p value < 0.001) (Table 5)

Table 5. Comparison Of Opioid Consumption Between The Two Groups

	Group A ESPB (n =15)	**Group B Non-ESPB (n = 15)**	**p-Value**
Intraoperative fentanyl consumption (µg)	10.0 ± 28.03 (2 patients; 13.3%)	46.67 ± 48.06 (8 patients; 53.3%)	0.049*
Total Fentanyl consumption (µg) in 24 hrs postoperatively	166.7 ± 122.2	300.01± 103.5	<0.029*
Time for request of first dose rescue analgesia (minutes)	468.2 ± 80	34.8 ± 44.1	<0.001*

4. Postoperative Nausea And Vomiting (PONV)

Although more cases in group B (Non-ESPB) complained of PONV, there was no statistically significant difference between both groups

Table 6. Comparison Of PONV

	Group A (ESPB) (n = 15)	**Group B (Non-ESPB) (n = 15)**	**p-Value**
PONV	1 (6.7%)	4 (26.67%)r	0.16

DISCUSSION

- The hemodynamic parameters are reliable clinical indicators for a balanced anesthetic technique and for adjusting the analgesic requirements. Unbalanced anesthesia leads to unacceptable hemodynamic changes by aggravating the sympathetically induced stress response during certain steps like intubation, noxious stimulus and extubation.
- ***Zhang et al.,*** compared ESP (erector spinae plane block) and general anesthesia, focusing solely on hemodynamic changes and opioid consumption. They discovered that the ESP group had significantly lower mean heart rates and mean arterial blood pressure (MABP) compared to the control group.[2]
- In the first and second time intervals, MABP showed no statistically significant values between the two groups, which may be explained by what ***Gousheh et al.***[3], documented; they believed that IV paracetamol takes about 30–60 min onset of action and when administered after the induction of anesthesia, it could improve VAS-based pain evaluation more quickly than the bupivacaine used in ESP.
- Fentanyl consumption was statistically lower in ESPB group than the control in our study.
- ***Josh et al,*** studied ESP in six patients who underwent lumbosacral spine surgery as case series and concluded that ESP had a crucial role in effective perioperative opioid-sparing analgesia.[4]
- ***Michael et al,*** performed ESP in a case report study of two patients who underwent corrective surgery for scoliosis and summarized that ESP could be safe and effective opioid-sparing analgesic strategy.[5]
- In our study, ESPB group had decreased opioid requirements and the needed increments at the end of the time frame evaluated which justify the reasonable time period of the bupivacaine and dexamethasone action.
- ***Zhang et al***, performed ESP in patients underwent lumbar spine surgery and found postoperative morphine consumption (P = 0.003) were lower in the intervention group than in the control group.[2]
- There was statistically significant difference between the two groups as regards the time to first analgesic requirements (min) based on reaching the score of 4 VAS (p value 0.001) in our study.
- ***Ahiskalioglo et al,*** reported first analgesic requirements range 6–14 h and the median was 8 h after performing ESP for hip surgeries.[6]

LIMITATION

- Due to small sample size, findings cannot be generalized to all patients.
- Chronic pain follow-up would have given us more informations about whether ESPB managed to avoid the development of chronic pain or not.
- Also, follow-up of the spread of local anesthetics was radiologically one of the study limitations.

CONCLUSION

- ESPB was associated with significantly stable haemodynamics,reduced VAS (Visual analogue score) in the first 24 hours of postoperative period, provided adequate postoperative analgesia, and longer time interval to first dose of analgesic in comparison to the conventional analgesia.
- Erector spinae plane block (ESPB) can be considered safe and effective perioperative analgesic modality for lumbar spine surgery.It provides less opioid consumption, lower pain scores, and longer time to first analgesic request in patients undergoing lumbar surgery compared to general anesthesia alone.

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